PROJECT REPORT
FOR THE
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

OCTOBER 2018

Prepared Under Contract With:
Walla Walla Basin Watershed Council
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Milton-Freewater, Oregon 97862

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OCTOBER 2018

RENEWS: 6-30-2020

ANDERSON PERRY & ASSOCIATES, INC.

Walla Walla, Washington
La Grande, Redmond, and Hermiston, Oregon

Job No. 7008-625

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Section 1.0 - Project Background

1.1 Introduction

This Project Report presents the design for a scalable Aquifer Storage and Recovery (ASR) Demonstration project in support of the Walla Walla Basin Watershed Council (WWBWC) Milton-Freewater Well No. 5 ASR Project.

The tasks of the Project Report are as follows:

- Task 1 – Develop complete project design for a new wellhead at Well No. 5. (Section 3.1).
- Task 2 – Design a diversion from the Walla Walla River to water treatment package system (Section 3.2).
- Task 3 – Water treatment system design (Section 3.3).
- Task 4 – Water rights transfer process (Section 3.4).

1.2 General Background and Reference Data

1.2.1 *Milton-Freewater Aquifer Storage and Recovery Project*

The Walla Walla Basin basalt groundwater system near the City of Milton-Freewater, Oregon (City) currently experiences annual declines of 3 to 5 feet. If this declining trend continues, the City may be forced to use their 7.24 cubic feet per second (cfs) water right from the Walla Walla River to supply water to their municipal water system. Withdrawals from the Walla Walla River could potentially impact surface water flows that support critical habitat for endangered species act (ESA) listed steelhead and bull trout fish species, as well as reintroduced spring Chinook salmon.

The overall vision of the Milton-Freewater Aquifer Storage and Recovery Project is to maintain robust and sustainable long-term water supplies in the Walla Walla Basin basalt aquifers. Aquifer storage and recovery (ASR) allows the City to store treated surface water in the basalt aquifer during winter months, and then maintain surface water flows by using their basalt wells to supply municipal demand.

The City is exploring options to develop an ASR project to store water below ground using their existing surface water rights. The stored groundwater would be recovered and used for municipal purposes and irrigation at the City's golf course during periods of low surface water flow.

1.2.2 *City of Milton-Freewater*

The City is located in Umatilla County in northeastern Oregon and has a population of approximately 7,050. The City maintains a public water system (OR41 00522) that receives water through seven deep basalt aquifer groundwater well sources.

Based on groundwater monitoring data, the Milton-Freewater area deep basalt aquifer is declining. In response to the decline, the Oregon Water Resources Department (OWRD) recently acted to form a Serious Water Management Problem Area (SWMPA) for the Walla Walla Basin. The formation of

the SWMPA curtails new basalt withdrawals and places monitoring requirements on all basalt water rights. If the basalt water continues to decline, further action could be taken by OWRD to limit existing basalt aquifer withdrawals.

The basalt water declines have not impacted the City's water system at this time, but the threat of continuing aquifer declines and potential OWRD regulation in the future are a concern. Therefore, the City is interested in investigating options to replenish the basalt aquifer by recharge with surface water or alluvial aquifer sources.

The City's water rights are described in Table 1-1.

TABLE 1-1
City of Milton-Freewater Water Rights

Water Source	Application Number	Permit Number	Certification Number (Full Beneficial Use)	Allowed Flow Volume (cfs/gpm)*	Priority Date	Allowed Use
Potable Water						
Well No. 1	U-109 G5389	U-102 G4924	12070	1.5/673 2.0/898	1/18/37 1/4/71	Domestic, Industrial, Commercial, Municipal
Well No. 2	U-159	U-150	15548	3.0/1,346	2/28/44	Municipal
Well No. 3	U-191	U-172	16998	3.5/1,571	1/10/46	Municipal
Well No. 5	U-809	U-718	23533	2.7/1,212	4/13/55	Municipal
Well No. 6	U-511	U-462	23519	3.5/1,571	7/16/52	Municipal
Well No. 8	G-2502	G-2312	41011	3.9/1,1750	12/13/62	Municipal
Well No. 9	G-13494	G-12582	20806	3.3/1,481	8/16/93	Municipal
Walla Walla River	-	D-12920	12920	7.24/3,245	1890	Domestic, Municipal
Non-potable Water						
Walla Walla River			89164	0.16/71	1885	Irrigation
Walla Walla River			89166	0.64/287	1875	Irrigation
Walla Walla River			89168	0.59/264	1880	Irrigation

** cfs = cubic feet per second*
gpm = gallons per minute

All water rights to the Walla Walla River would be utilized for a fully developed ASR system. Therefore, 8.63 cfs or 3,873 gallons per minute (gpm) is potentially available for ASR.

The demonstration test will be limited to 75 percent of the Well No. 5 production capacity equaling 750 gpm.

1.2.3 *Walla Walla Basin Watershed Council*

The WWBWC is a non-profit organization working to protect the resources of the Walla Walla Watershed in both Oregon and Washington.

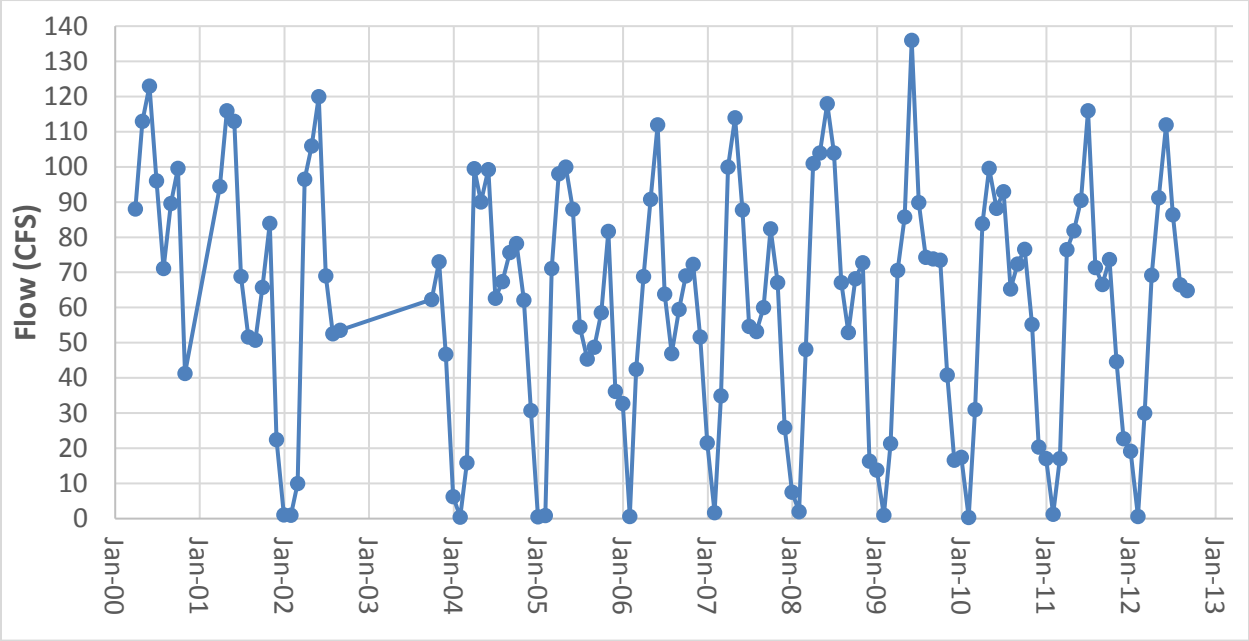
1.2.4 *Little Walla Walla River Description and Expected Flows*

The Little Walla Walla River (River) is a stream located in the Walla Walla Watershed originating at a diversion from the Walla Walla River located near Cemetery Bridge in the City limits. The diversion consists of an inflatable dam, concrete fishway, automated fish screens, and headgates. After the diversion, the River proceeds through residential, commercial, and light industrial properties in open ditches, culverts, and a piped section for approximately 1.5 miles. At approximately River Mile 1.5, the River is separated into three waterways, namely, the West Little Walla Walla (Ford Ditch), the East Little Walla Walla (Crockett Ditch), and the Hudson Bay District Improvement Company's main delivery canal. These three waterways provide water supply for agricultural use downstream.

In 2000, Walla Walla Basin irrigators and the U.S. Fish and Wildlife Service reached an agreement to maintain flow in the Walla Walla River. This agreement was necessitated due to the Walla Walla River identified as critical habitat for the recently listed bull trout and steelhead fish species on the Endangered Species List. Therefore, flow data since 2000 is the most representative for expected flow conditions in the River.

Annual maintenance on the Little Walla Walla diversion structure eliminates flow in the River for approximately a month between February and March. The flows in the Little Walla Walla River from 2000 to 2012 are presented in Graph 1-1.

GRAPH 1-1
Little Walla Walla River Average Monthly Flows From 2000 - 2012



1.3 Existing Conditions

The existing Well No. 5 well house is a 16- by 16-foot wood framed structure over the Well No. 5 wellhead. The well house contains a vertical line shaft turbine, electrical controls, 12-inch transmission piping, a 12-inch swing check valve, 4-inch pump-to-waste piping, a 4-inch control valve, 2-inch well pre-lube piping, electrical service panels, and chlorination equipment in a separate room.

According to City records, Well No. 5 currently produces approximately 1,000 gpm. See Appendix A for pump and well information for Well No. 5.

Section 2.0 - Aquifer Storage and Recover Feasibility Study

2.1 Aquifer Storage and Recovery Feasibility Study

The WWBWC, in cooperation with the City, applied for and received a funding from the Oregon Water Resourced Department Feasibility Study grant program to perform a feasibility study an aquifer storage and recovery (ASR) Demonstration project for the City.

In May 2018, the Milton-Freewater Aquifer Storage and Recovery Feasibility Study Phase I report was completed by EA Engineering, Science, and Technology, Inc., PBC, Northwest Groundwater Services, LLC, and Murraysmith. This report assessed the feasibility of using the City's infrastructure to enhance recharge in the basalt aquifer system beneath and near the City. Anderson Perry & Associates, Inc. (AP) relied on information gathered in this Feasibility Study to complete this report.

In reviewing the Feasibility Study, a number of follow-up items were identified. Supplementary information addressing the follow-up items is provided below:

2.1.1 *Supplementary Information*

1. **Hydrogeologic interpretation of existing basalt aquifer data.**

   See Section 2.4 for a description of the existing basalt aquifer.

2. **Figures of water treatment system options.**

   See Appendix B for a map of the water treatment system option locations identified in the Feasibility Study. A property map of the Well No. 5 site is also included.

3. **Potential for contaminants to be picked up by stormwater and directly discharged to the Little Walla Walla River through eight or more exiting outfalls throughout the City. The direct stormwater discharges are shown on the Milton-Freewater Phase 1 Underground Injection Control Stormwater Management Plan.**

   See Appendix C for a map showing direct stormwater discharge locations into the River, upstream of the Well No. 5 site.

4. **Operational Costs or Net Present Worth Analysis.**

   See Appendix D for a capital cost estimate and net present worth analysis for the two plausible treatment options identified in the Feasibility Study.

5. Discussion of operational requirement impacts of the various water treatment plant options.

See Section 3.4 for operational requirements for membrane filtration.

6. Certification requirements for water treatment facility operators for the various treatment options.

See Section 3.2 for a discussion on certification requirements for water treatment facility operators for various treatment options.

7. Discussion of using old Rogers Cannery wells for injection or monitoring.

The City has part interest in two wells formerly known as the Rogers Cannery wells (see Figure 1 in Appendix F). These wells were drilled in the 1940s and used to supply water for vegetable processing. The City obtained possession of the Roger's Cannery site and later sold the property to the Milton-Freewater Unified School District with an agreement that the wells could be used by the City.

The west well is located in what is now the Gib Olinger Elementary School playground and is not readily accessible for water production or ASR use. The well has a debris blockage where some pumping equipment was historically lost down the hole. However, this well could be useful as an aquifer monitoring point since there is no pumping equipment in the well.

The east well is located on the east side of the Walla Walla River immediately upstream of the Ninth Avenue - Cemetery Bridge. The east well has potential advantages for possible water injection as part of an ASR program including:

- As a deep basalt well this well is hydraulically connected to the Columbia River Basin Group.
- Located near the Walla Walla River fish screening facilities operated by the Hudson Bay Ditch Improvement Company. The fish screen facility and point of diversion supplies screened water for irrigation throughout the valley including the Little Walla Walla River.
- Not used as a current water production well.
- Located near agricultural lands.

8. Concept of water injection in Key and/or Rogers Cannery wells with recovery of water through existing City production wells.

The feasibility report did not evaluate concept of injecting water in the Key well or east Rogers Cannery well and stored water recovered from the existing City wells. The basalt aquifer is one large regional confined aquifer system with blocks formed by faults transecting the aquifer. It is expected that the basalt aquifer where the City's wells are located are hydraulically connected, even if there are several blocks formed by faults. With the hydraulic connectivity of the regional basalt aquifer, there is a potential for ASR to consist of injection and recovery wells. With this concept the injection wells would be the

Key well and east Rogers Cannery well while the recovery wells would be the existing City wells.

The advantage of this approach would be:

- Reduce the risk to the City's wells for plugging or some form of contamination.
- Close location of the injection wells to the surface water sources.
- Dedicated injection well equipment.
- Reduction of existing City well modifications.

2.1.2 *Water Treatment Alternatives and Selection*

Several water treatment alternatives were evaluated in the Feasibility Study. These options are summarized in Table 2-1.

TABLE 2-1
Surface Water Treatment Approach Options

Treatment Technique
Slow Sand Filtration
Conventional Rapid Sand Filtration
Packaged Treatment Units
Membrane Filtration
River Bank Filtration/Managed Aquifer Recharge (RBF/MAR)

Membrane filtration and river bank filtration/managed aquifer recharge (RBF/MAR) were identified as potential treatment options for the ASR project.

2.1.2.1 River Bank Filtration/Managed Aquifer Recharge Treatment Option

The RBF/MAR treatment process is described in the Feasibility Study. This treatment method entailed a number of follow-up elements to be considered feasible. The follow-up elements included:

1. Land availability and acquisition costs.

2. An environmental assessment of the site and characterization of soil and shallow groundwater conditions.

3. A monitoring system.

4. Design and construction costs for the intake or infiltration system, infiltration basin, alluvial recovery system, and conveyance to/from Key and Well No. 5 locations.

The City, in follow-up correspondence after the Feasibility Study, indicated the RBF/MAR treatment option was not desired for the demonstration project due to complexities in modifying existing water rights, acquiring property, and drilling a shallow alluvial test well. Therefore, this option is excluded from consideration for the demonstration project.

2.1.2.2 Membrane Filtration Treatment Option

The membrane filtration treatment process is described in the Feasibility Study. This option is recommended as the preferred option in the Feasibility Study because it presented the greatest opportunity for implementation in a demonstration project and provides flexibility in adaptation for full-scale multi-well ASR system.

Disinfection by chlorine or ultraviolet (UV) light is also recommended to treat for biological contaminants for the River. Water quality contaminants of concern are addressed in Table 2-2.

2.1.3 *Selected Alternative*

Membrane filtration with disinfection is the basis of design for this report. The design of this system is presented in Section 3.3 and Plan Sheet C-103.

2.1.4 *Little Walla Walla River Water Quality*

2.1.4.1 Oregon Water Quality Requirements

The Oregon Health Authority has the primary enforcement responsibility (primacy) for implementing the Federal Safe Drinking Water Act and State-level Oregon Drinking Water Quality Act in Oregon. Oregon Administrative Rule (OAR) 333-061-0030 specifies the maximum contaminant levels for public water systems. In summary, 78 primary contaminants and 16 secondary contaminants are regulated in Oregon public water systems. See Appendix E for a complete list of contaminants regulated in Oregon.

2.1.4.2 Little Walla Walla River Sampling and Testing

The WWBWC collected water samples from the Little Walla Walla River near Well No. 5 in March and April 2018, and procured the services of Anatek Labs, Inc. to test for a variety of contaminants. These sample results were provided to AP in June 2018. The March and April 2018 water quality samples were tested for 34 primary contaminants, 13 secondary contaminants, and 13 non-regulated water quality parameters. The test results identified turbidity, crytosporidium, giardia, and viruses as the contaminants of concern.

TABLE 2-2
Little Walla Walla River Contaminants of Primary Concern

Contaminant	Description*	Health Effects*
Turbidity	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (such as whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites, and some bacteria.	N/A
Cryptosporidium	Biological Pathogen	Gastrointestinal illness (such as diarrhea, vomiting, and cramps
Giardia	Biological Pathogen	Gastrointestinal illness (such as diarrhea, vomiting, and cramps)
Viruses	Biological Pathogens	Gastrointestinal illness (such as diarrhea, vomiting, and cramps)

** Source: U.S. Environmental Protection Agency, National Primary Drinking Water Regulations*

See Appendix E for the March and April 2018 water quality test results.

Section 3.0 - Aquifer Storage and Recovery Demonstration Project

A 3-month long demonstration project during November, December, and January is recommended. This section describes the wellhead pump test and the design for wellhead improvements, a diversion from the Little Walla Walla, and a package water treatment system.

See the Plan Sheet G-003 for a flow diagram and Plan Sheet C-101 for a site plan of the proposed improvements.

3.1 Develop Complete Project Design for New Wellhead at Well No. 5.

This section describes a wellhead pump test and an evaluation of changes required to the existing system to accommodate the ASR project and design of wellhead improvements.

3.1.1 *Wellhead Pump Test*

The following summarizes information obtained from aquifer testing completed at the City's Well No. 5:

- Well No. 5 typically operates for drinking water supply at a rate of approximately 1,000 gpm without issues with excessive drawdown.
- Aquifer testing completed over a 22-hour period at 943 gpm resulted in a total drawdown of 23 feet in Well No. 5, which represents a well specific capacity of 41 gallons per minute per foot (gpm/ft) and projected specific capacity at 60 days is estimated at 30 gpm/ft.
- City wells impart interference despite differences in well construction, with residual drawdown from operational pumping Wells No. 6 and 8 preceding the aquifer test observed at Wells 2 and 3, obscuring the ability to analyze aquifer characteristics at these wells from aquifer testing at Well 5.
- Aquifer testing analysis from the Key Well indicates an aquifer transmissivity ranging between approximately 250,000 gpd/ft to 92,000 gpd/ft and an aquifer storativity between 0.009 and 0.01.
- A negative aquifer boundary, suggesting the presence of a geologic structure or fault, appears to have been observed in the aquifer response observed in the Key Well during aquifer testing at Well No. 5. The effects of this boundary, if present, may negatively impact long-term drawdown, although anecdotal observations from City staff do not indicate operational impacts at Well No. 5.
- Water quality field parameters analyzed at the conclusion of aquifer testing at Well No. 5 indicate that previous field water quality parameters analyzed in March 2018 (Murraysmith and Northwest Groundwater Services, 2018), specifically pH and ORP, are inaccurate and may require reassessment in the context of ASR water quality mixing analysis.

In general, aquifer testing at the City's Well No. 5 indicate productive aquifer characteristics that are likely supportive of use for ASR.

See Appendix F for additional information of the wellhead pump test conducted by GSI Water Solutions, Inc.

3.1.2 *Wellhead Improvements*

The interior piping inside the Well No. 5 well house needs to be improved to support an ASR Demonstration project. Improvements include:

- Remove existing 4- and 12-inch ductile iron pipe.
- Install new 12-inch transmission piping, 8-inch ASR piping, 4-inch pump-to-waste piping. Also required is a new 12-inch swing check valve, 8-inch control valve, 8-inch butterfly valve, and reinstallation of the existing 4-inch control valve.
- Install two conduits in the well for level transducer instrumentation and manual level measurement.
- Install a 3R Valve in the well, including controls.

See the Plan Sheets G-004, C-101, C-104, and C-105 for additional information on the existing wellhead conditions and proposed wellhead improvements.

3.2 Design Diversion from Little Walla Walla River

This section describes the design of a structure needed to divert water from the Little Walla Walla River into the water treatment system demonstration trailer.

3.2.1 *Intake Screen*

The Little Walla Walla River is screened for juvenile fish at its diversion from the Walla Walla River. However, intake screening is desired to remove debris from entering the water system.

The intake screen is sized for a total flow of 1,500 gpm and includes a pressurized backwash spray to clear the screen of debris buildup. The screen will be placed in the River, secured to an existing concrete pad instream and connected with 1.5- and 12-inch hoses.

See Plan Sheet C-102 for further information on the intake screen.

3.2.2 *Infeed Pump Station*

An infeed pump station will provide the necessary pressure to the packaged water treatment system. The pump is sized at 50 horsepower with an operating point of 1,200 gpm at 115 feet of head. A variable frequency drive (VFD) control system will adjust the pump flow to approximately 990 gpm as directed by a programmable logic controller (PLC) located at the discharge of the packaged water treatment system.

See Plan Sheet C-102 for further information on the infeed pump screen.

3.3 Packaged Water Treatment System Design

This section describes the water treatment system selection process, preferred water treatment system, water operator certification requirements, connection between a skid-mounted water quality treatment unit, Well No. 5, and a waste discharge system.

3.3.1 *Ultrafiltration Membrane Filtration*

Turbidity at a level of approximately 5 Nephelometric Turbidity Units (NTU) is the sole contaminant of concern according to the March and April 2018 water quality testing of the River. Ultrafiltration (UF) membrane filtration is capable of reducing turbidity to less than 0.3 NTU if the raw water is less than 20 NTU. Table 3-1 presents the treatment capability of UF membrane filtration for turbidity.

TABLE 3-1
UF Membrane Filtration Treatment Capability*

	Raw Water Quality Requirement **	Treated Water Quality
Turbidity	<20 NTU	<0.3 NTU

** Source: Evoqua Water Technologies, Memcor CPII Membrane Filtration System.*
*** Little Walla Walla River turbidity is approximately 5 NTU during spring flows.*

For a demonstration test, a portable UF membrane filtration treatment system capable of producing 750 gpm is recommended.

3.3.2 *Disinfection*

Task 3 of the Feasibility Study identified two primary options for disinfecting water for this project: chlorine injection and ultraviolet (UV) light radiation. Both disinfection methods were recommended to achieve a chlorine residual and inactivate cryptosporidium and viruses.

For a demonstration test, a portable ultraviolet light treatment system membrane filtration unit capable of producing 750 gpm with a 4-log removal or inactivation of viruses is recommended.

3.3.3 *Treatment Design Criteria*

The existing Well No. 5 pump provides 1,000 gpm capacity during operation. Typically, ASR operations are designed to be 75 percent of well production. Therefore, the ASR supply quantity is 750 gpm. Table 3-2 summarizes the design criteria for the package water treatment system.

TABLE 3-2
Design Criteria for Package UF Membrane Filtration Treatment System

Criteria	Value
Raw Water Inflow	937 gpm
Filtrate Water Outflow	750 gpm
Backwash Waste	187 gpm

3.4 Water Operator Certification Requirements

The City will be required to operate and maintain the rented UF and UV equipment for approximately 11 weeks of the 3-month demonstration project.

It is recommended the City trains one or more operators to obtain a Water Treatment I Certification Level. Table 3-3 describes the Water Treatment I Certification requirement.

TABLE 3-3
Operator Classification Required for ASR Demonstration Project*

Item	Points
Treatment System Size	Population Served: 7,050 population/10,000 = 1 point Average Daily Flow: 1 MGD/1 MGD = 1 point Total Points = 2
Treatment System Water Source	Surface Water = 5 points
Disinfection	Ultraviolet (UV) = 2 points
Filtration Processes	Membrane Filtration/Microscreens = 5 points
Residuals Disposal	Disposal to Sanitary Sewer = 3 points
Facility Characteristics Instrumentation	The use of SCADA systems to provide data with complete process control = 5 points
Total Points	**22 (Water Treatment 1 Classification)**

** OAR 333-061-0220: Classification of Water Treatment Plants and Distribution Systems*

3.5 Capital Cost and Indirect Cost Estimates

The estimate for capital costs for the wellhead improvements and River diversion is approximately $394,100. Indirect costs for renting the packaged water treatment system and accessories, operator salary and benefits, electricity, and water sampling and testing are estimated to total approximately $394,500. Overall, the cost of the ASR demonstration project is estimated to total $788,600.

See Appendix G for detailed estimates of the capital and indirect costs.

Section 4.0 - Aquifer Storage and Recovery Permitting in Oregon

OWRD is the lead agency that permits and oversees ASR projects in the State of Oregon; however, OWRD consults with the Oregon Department of Environmental Quality (DEQ) and the Oregon Health Authority (OHA) Drinking Water Program on various aspects of ASR projects. To develop an ASR project, a water right authorizing the use of water for the project is required. ASR is an inherent (authorized) use of water under any existing water right in Oregon, meaning that any existing water right could be used as a source for an ASR project. However, the water right's use of water must be consistent use for which the recovered stored water will be used. All proposed ASR project proponents must also seek authorization from OWRD for an "ASR limited license" for ASR pilot testing.

See Appendix F for a technical memorandum by GSI Water Solutions, Inc. on ASR permitting in Oregon.

4.1 Water Rights Transfer Process

This section describes the water rights transfer process required for a ASR Demonstration project.

4.1.1 *Water Right for ASR Source Water*

Storing water under the ASR process would require a water right authorizing the ultimate use of the water and a limited license to authorize ASR testing. Based on discussion with City staff for this project, the stored water will be used for irrigation purposes. The City is proposing to use its water right Certificate 12920, which authorizes the use of up to 7.24 cubic feet per second (cfs) for domestic and municipal purposes. Since municipal use includes the use of water for irrigation purposes, Certificate 12920 could provide the needed water right authorization for an ASR project that would provide stored water for irrigation purposes.

4.1.2 *Limited License for ASR Testing*

The City would also need to obtain a limited license from OWRD to authorize ASR testing. To approve an ASR limited license, OWRD must determine that the ASR testing will not impair or be detrimental to the public interest, that testing will produce adequate information regarding resulting groundwater water quality and water quantity, and the proposed use will not expand the use under the original water right.

The primary objectives of ASR pilot testing are to 1) confirm the findings from the ASR feasibility study though data collection and observation and 2) allow incremental development of the ASR system over time up to the limits allowed by the ASR limited license. An ASR limited license is issued for a 5-year period and can be renewed for additional 5-year periods if prolonged testing is needed to fully develop the project (e.g., if multiple wells are proposed). Once testing has been completed, the applicant can apply to OWRD for an ASR permit.

4.1.3 *Protect Existing Irrigation Rights Instream through an Instream Transfer*

A third transaction would be required to protect the City's existing irrigation rights instream. According to the City, it currently uses water right Certificates 89164, 89166, and 89168 to irrigate the City golf course. These water rights authorize the use of up to 0.16 cfs, 0.64 cfs, and 0.59 cfs, respectively, from the Walla Walla River for irrigation purposes. These existing natural flow water rights could be protected instream (in the Walla Walla River) using an instream transfer. Instream transfers can be permanent or time-limited. The water rights could also be protected instream through an instream lease, which can protect water rights instream for up to 5 years. At the end of a time-limited transfer or an instream lease, the water right reverts back to its original place of use. A permanent transfer likely could not be reverted back. Under such a transfer or lease, the priority date of the water rights remains unchanged while the water is protected instream.

OWRD will review an application for an instream transfer to determine whether it will cause "injury" to existing water rights or enlargement of the right to be transferred. Under an instream transfer, the water protected instream could be protected throughout the irrigation season on a continuous basis, which is different than how water is typically used for irrigation. Although we would not expect OWRD to consider this "injury," downstream junior irrigators could receive less water after an instream transfer than when the rights were used for irrigation. The potential for this result and potential "harm" to downstream irrigators could be evaluated during the first years that the project is implemented.

Section 5.0 - Next Steps

5.1 List of Future Activities

A recommended list of future activities is provided below:

- Conduct full panel water quality sampling and testing in Winter 2018.
  - A complete water testing panel covering all regulated contaminants is not available at this time. Additional sampling and testing for all regulated water quality contaminants listed in OAR 333-061-0030 is highly recommended to verify if additional treatment is necessary.

- Apply for OWRD ASR limited license.
  - See Appendix H for the OWRD ASR Limited License application form.

- Conduct ASR Demonstration project.
  - Construct river intake structure and piping.
  - Rent UF treatment trailer and rent/purchase required accessories.
  - Rent ultraviolet disinfection skid.
  - Renovate interior well house piping to accommodate ASR Demonstration project.
  - Renovate existing electrical service to accommodate ASR Demonstration project.

Section 6.0 - References

Walla Walla Basin Watershed Council, *Little Walla Walla River Assessment and Initial Action Plan,* 2015. https://nrimp.dfw.state.or.us/web%20stores/data%20libraries/files/OWEB/OWEB_967_2_LittleWallaWalla_WatershedAssessment_03142011.pdf

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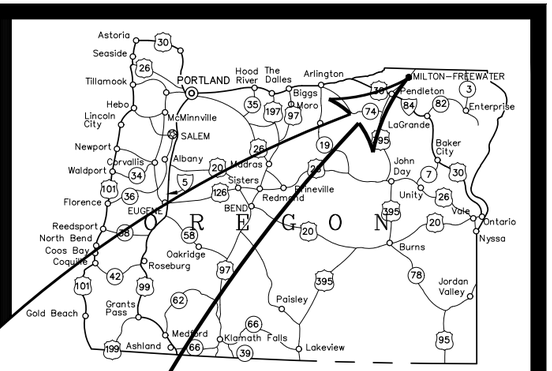
DRAWINGS AND TECHNICAL SPECIFICATIONS

WALLA WALLA BASIN WATERSHED COUNCIL

CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT
2018



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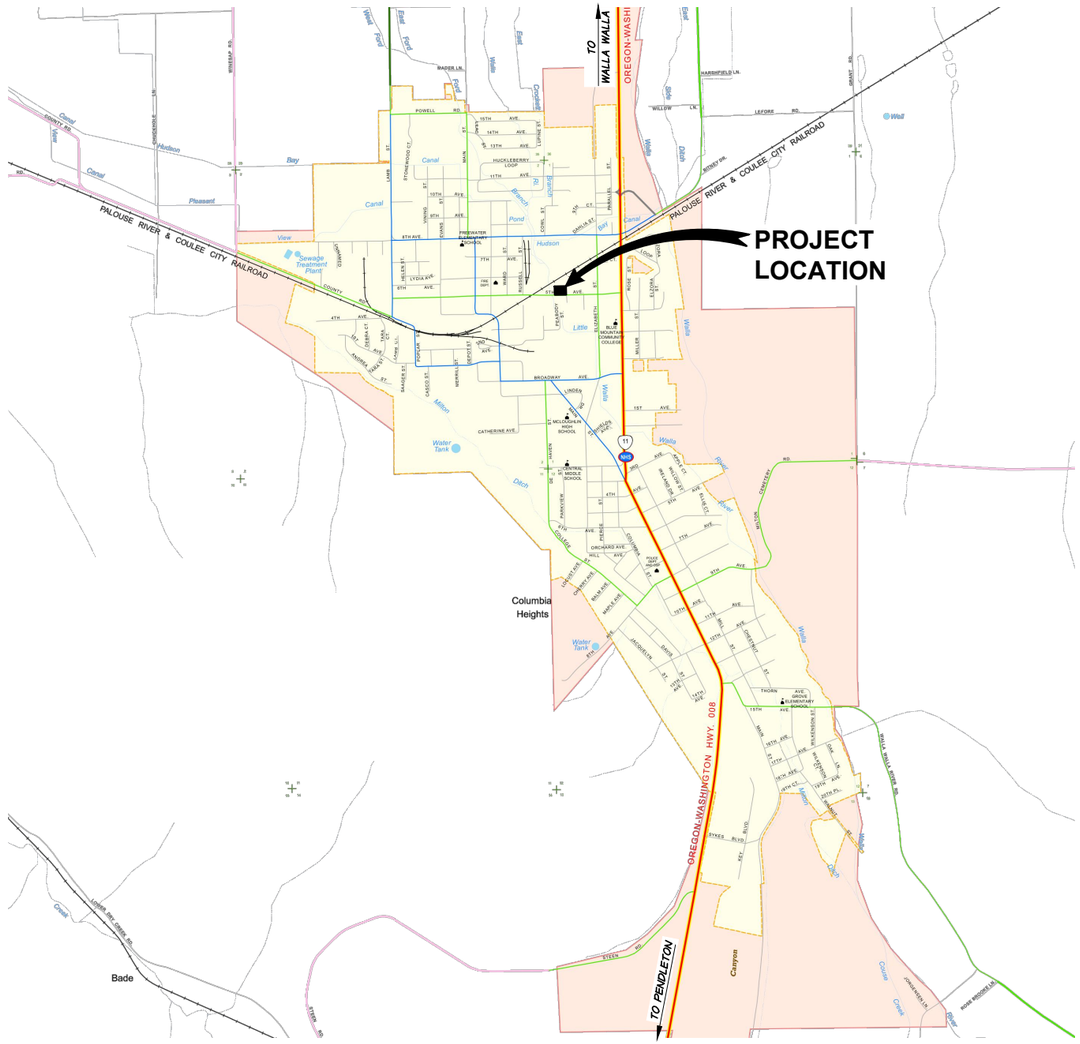

VICINITY MAP
NTS

811
Know what's **below.**
Call before you dig.

WALLA WALLA BASIN WATERSHED COUNCIL
Brian Wolcott - Executive Director
Marie Cobb - Senior Environmental Scientist

CITY OF MILTON-FREEWATER
Linda Hall - City Manager
Brian Steadman - Public Works Director
Steven Patten - Public Works Technician
Shane Wright - Water System Operator

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OREGON
NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

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engineering - surveying - natural resources
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LA GRANDE, OR. WALLA WALLA, WA. REDMOND, OR. HERMISTON, OR.

GENERAL NOTES

1. THE PLANS, SPECIFICATIONS, AND REFERENCED DOCUMENTS SHALL BE USED TO CONSTRUCT THE IMPROVEMENTS SHOWN. REFERENCED DOCUMENTS INCLUDE THE OREGON DEPARTMENT OF TRANSPORTATION (ODOT) STANDARD SPECIFICATIONS FOR CONSTRUCTION (2018 EDITION), ODOT STANDARD DRAWINGS, AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).

2. ALL EXISTING UTILITIES SHOWN ON THESE PLANS ARE SHOWN WITH AS MUCH ACCURACY AS POSSIBLE. IT SHOULD BE NOTED THAT SOME DISCREPANCIES AND OMISSIONS IN LOCATION, TYPE, AND SIZE WILL OCCUR AND THAT, IN GENERAL, ONLY MAIN UNDERGROUND UTILITIES ARE SHOWN EXCEPT FOR WATER AND SEWER SERVICES. UTILITIES SHOWN ARE FOR THE CONVENIENCE OF THE CONTRACTOR. THE CONTRACTOR SHALL FIELD LOCATE EXISTING UTILITIES, I.E. WATER, TELEPHONE, NATURAL GAS, SANITARY SEWER, STORM SEWER, ETC. AND ADJUST THE LOCATION OF THE NEW WATER LINES AS MAY BE NECESSARY TO PREVENT CONFLICTS WITH EXISTING WATER LINES OR OTHER UTILITIES. ALL ADJUSTMENTS SHALL BE REVIEWED AND APPROVED BY THE ENGINEER. THIS WORK SHALL BE PERFORMED PRIOR TO INSTALLING THE NEW WATER LINE TO ENSURE THE GRADE AND DEPTH OF NEW WATER LINE WILL NOT BE IN CONFLICT WITH THE EXISTING UTILITY AND TO ENSURE THAT THE MINIMUM DEPTH OF THE WATER LINE CAN BE MAINTAINED. THE CONTRACTOR SHALL PROVIDE FITTINGS AS REQUIRED TO ALLOW FOR A GRADE ADJUSTMENT OF THE NEW WATER LINE WHEN CONDITIONS REQUIRE. CONTRACTOR SHALL WORK CLOSELY WITH RESPECTIVE UTILITY COMPANIES FOR LOCATION AND COORDINATION NEEDS. (CALL - BEFORE - YOU - DIG 1-800-424-5555, UTILITIES NOTIFICATION CENTER).

2. THE CONTRACTOR SHALL DEVELOP A FORMAL WORK PLAN TO PROVIDE ADVANCE PUBLIC NOTIFICATION OF WATER UTILITY SERVICE INTERRUPTION CAUSED BY THE CONTRACTOR'S OPERATIONS. CONTRACTOR MUST MAINTAIN ACCESS FOR EMERGENCY VEHICLES AT ALL TIMES.

3. LOCATIONS OF REQUIRED TEES, CROSSES, VALVES, HYDRANTS, WATER METERS, ETC. SHOWN ON THE PLANS ARE APPROXIMATE ONLY. ACTUAL FIELD CONDITIONS WILL DETERMINE EXACT LOCATIONS.

4. THE WATER LINE DETAILS ON THESE SHEETS ARE SCHEMATIC IN NATURE. THE CONTRACTOR SHALL INSTALL THE LINES AS MAY BE REQUIRED IN THE FIELD AND AS APPROVED BY THE ENGINEER. THE CONTRACTOR MAY PROPOSE ALTERNATE COMBINATION OF FITTINGS.

PLAN LEGEND

WATER

- 10"W — EXISTING WATER LINE TYPE AND SIZE
- 10" RW — RAW WATER LINE AND SIZE
- EXISTING VALVE
- EXISTING WATER METER
- EDGE OF GRAVEL
- EDGE OF PAVEMENT

SEWER/STORM DRAIN

- 8"SS — EXISTING GRAVITY SEWER LINE AND SIZE
- IS — IS — EXISTING INDUSTRIAL SEWER LINE
- 24"CMP — EXISTING CULVERT AND SIZE
- NEW MANHOLE

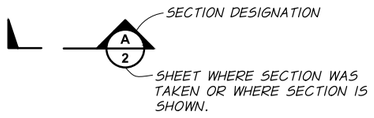
GENERAL

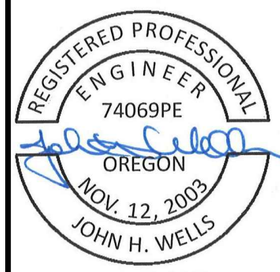
- EXISTING DITCH C/L AND FLOW
- NEW PERMANENT FENCELINE/GATE
- TEMPORARY CHAIN LINK FENCE
- EXISTING PAVED ROAD
- EXISTING BUILDING
- EXISTING DECIDUOUS TREE

SITE SURVEY

- 3160 — EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING PROPERTY PIN
- EXISTING UTILITY POLE (WITH GUY)
- EXISTING POWER POLE
- RIGHT-OF-WAY LINE OR PROPERTY LINE

DRAFTING





RENEWS: 6-30-2020

REVISION	BY	DATE

DESIGNED BY M. BLASY
DRAWN BY J. CHAPMAN
REVIEWED BY J. WELLS

JOB NUMBER 7008-625 DATE November 5, 2018
ACAD FILE: 7008-625-060-G002.DWG

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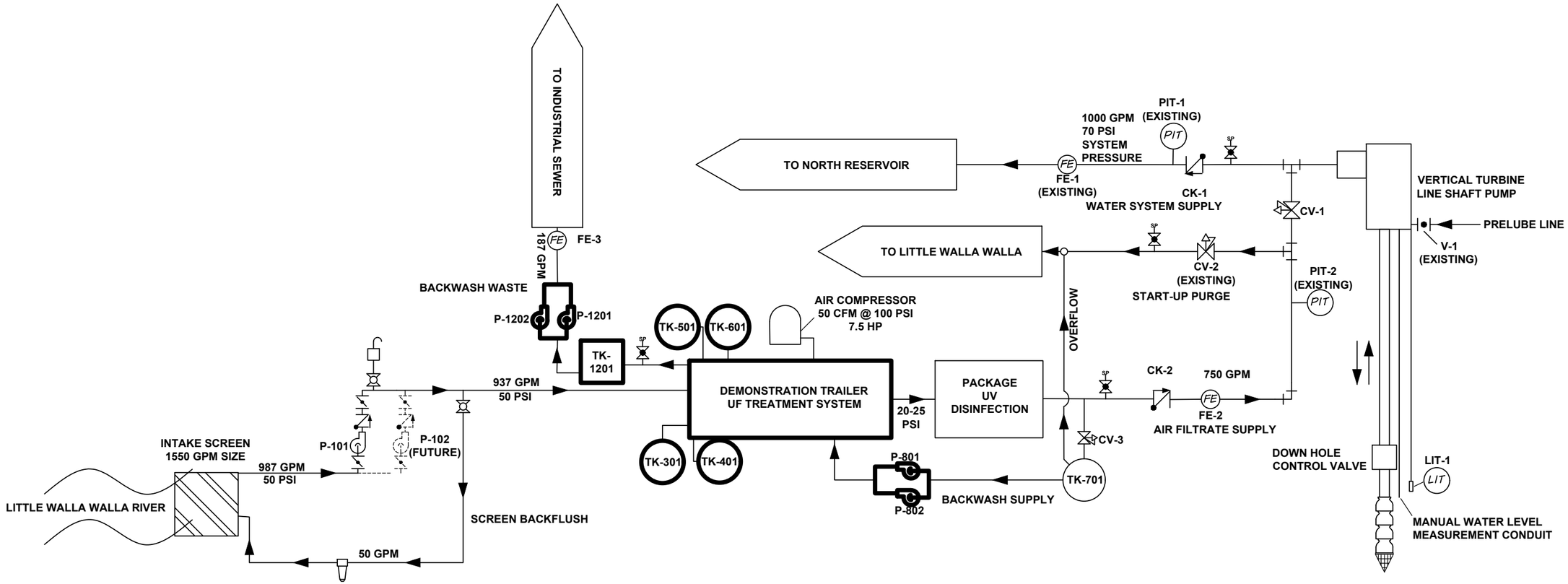
WALLA WALLA BASIN WATERSHED COUNCIL
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

GENERAL NOTES AND PLAN LEGEND

SHEET
G-002
2 OF 14



PROPOSED DEMONSTRATION FLOW DIAGRAM

NOTES:

1) CITY TO PROVIDE POWER TO:
   - A. INFEED PUMPS
   - B. AIR COMPRESSOR
   - C. UV SYSTEM
   - D. UF TRAILER/SYSTEM
2) THE UF TRAILER SHALL PROVIDE POWER FOR ALL AUXILIARY EQUIPMENT EXCEPT A, B, AND C UNDER NOTE 1 ABOVE.
3) DEMONSTRATION PROJECT INTAKE FLOW RATE=987 GPM FULL BUILD-OUT INTAKE FLOW RATE=1550 GPM
4) UF TRAILER/SYSTEM RENTAL COMPONENTS IN BOLD.

LEGEND

- TURBINE PUMP
- CENTRIFUGAL PUMP
- CHECK VALVE
- CONTROL VALVE
- FLOWMETER (FE)
- SAMPLING PORT (SP)
- BUTTERFLY VALVE
- BALL VALVE
- COMBINATION AIR/VAC RELEASE VALVE

SYSTEM COMPONENTS

ID	DESCRIPTION	SIZE	ELECTRICAL REQUIREMENTS
CONTROL VALVES			
CV-1	PRESSURE RELIEF/ ON & OFF, ANGLED	12" INLET, 12" OUTLET	120V AC
CV-2	PRESSURE RELIEF/ ON & OFF, ANGLED	4" INLET, 4" OUTLET	120V AC
CV-3	PRESSURE SUSTAINING/ ALTITUDE, GLOBE	4" INLET, 4" OUTLET	N/A
FLOW METERS			
FE-1	EXISTING WATER SUPPLY TO RESERVOIR	12" DIA	4-20 MA; PULSE COUNTER
FE-2	NEW DEMONSTRATION ASR WATER SUPPLY	8" DIA	4-20 MA; PULSE COUNTER
FE-3	NEW BACKWASH WASTE	4" DIA	4-20 MA; PULSE COUNTER
INSTRUMENTATION			
PIT-1	PRESSURE TRANSDUCER - RESERVOIR DISCHARGE	1/4"	24V DC
PIT-2	PRESSURE TRANSDUCER - RECHARGE SYSTEM	1/4"	24V DC
LIT-1	LEVEL TRANSDUCER - WELL WATER DEPTH	3/4"	24V DC
V-1	SOLENOID VALVE	1"	120V AC

SYSTEM COMPONENTS

ID	DESCRIPTION	SIZE	CAPACITY
INFEED SYSTEM			
P-101	INFEED PUMP 1, VFD	50 HP/1785 RPM	1200 GPM
P-102	INFEED PUMP 2 (FUTURE)	50 HP/1785 RPM	1200 GPM
FILTERED WATER STORAGE			
TK-701	FILTERED WATER STORAGE TANK	43'L X 10.5'W	21,000 GALLON
BACKWASH SYSTEM			
P-801	UF FILTRATE BACKWASH FEED PUMP 1	VFD, 25 HP/3600 RPM	550 GMP @ 30 PSI
P-802	UF FILTRATE BACKWASH FEED PUMP 2		
P-1201	UF BACKWASH WASTE PUMP 1	VFD, 7.5 HP/3600 RPM	187 GPM @ 34 PSI
P-1202	UF BASKWASH WASTE PUMP 2		
TK-1201	BACKWASH WASTE TANK	128"L X 84"W X 42"H	1,600 GALLON
TK-301	SODIUM HYPOCHLORITE STORAGE TANK		
TK-401	SULFURIC ACID STORAGE TANK		
TK-501	CITRIC ACID STORAGE TANK		
TK-601	COAGULANT STORAGE TANK		

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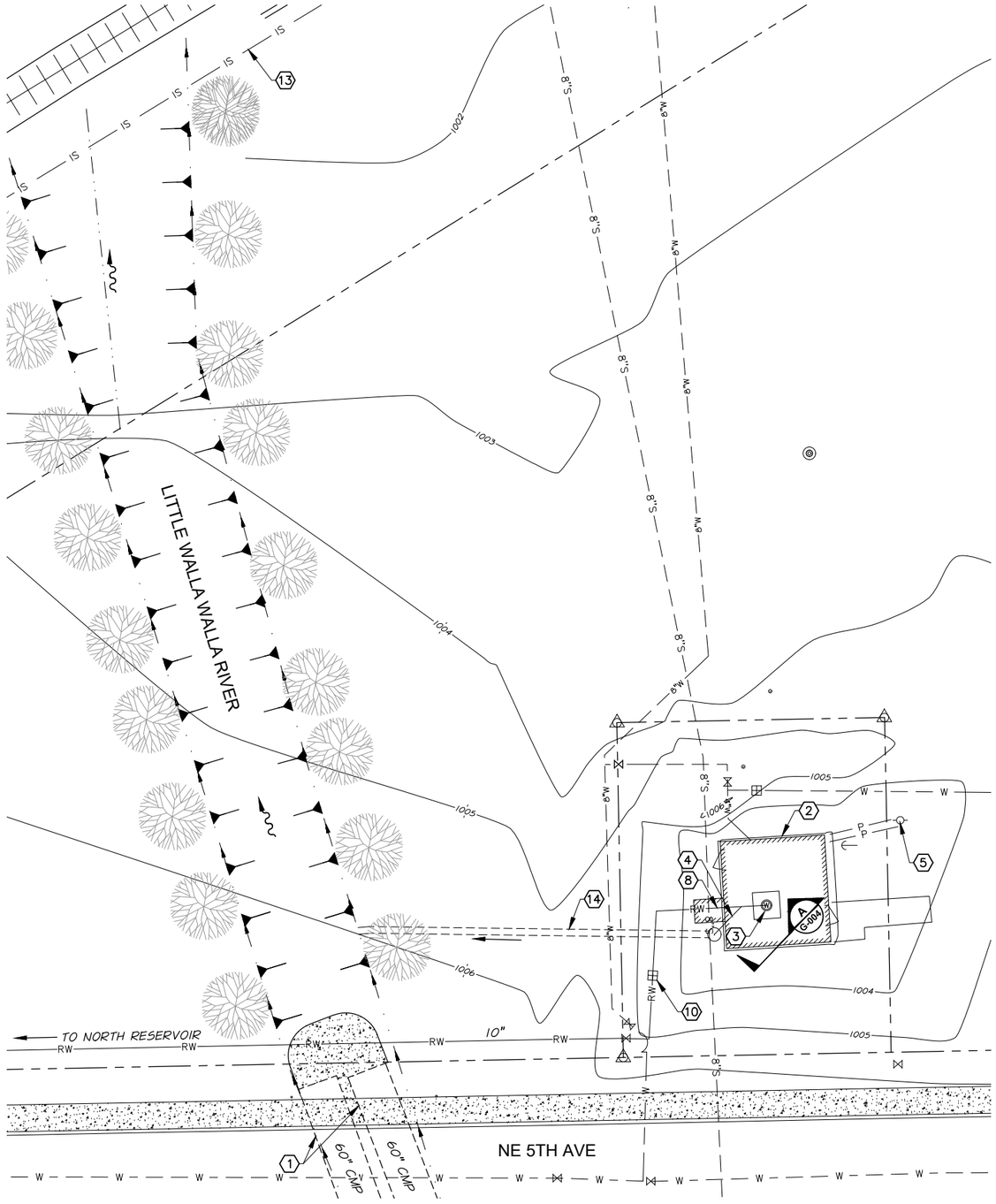
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

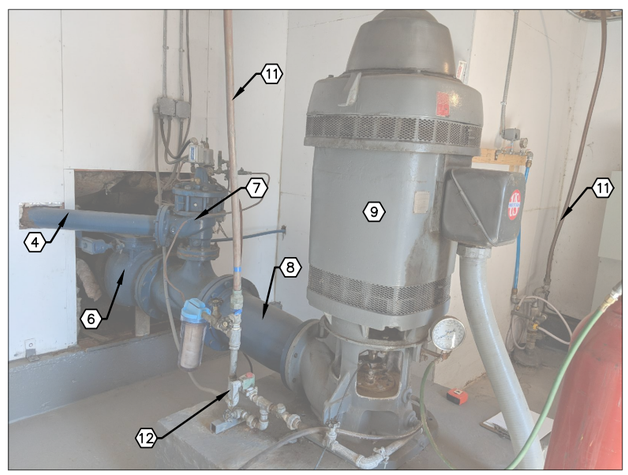
FLOW DIAGRAM

SHEET
G-003
3 OF 14

KEY NOTES:

1. 60" DIAMETER CULVERT
2. WELL NO. 5 WELL HOUSE
3. WELL NO. 5
4. 4" DIAMETER D.I. WELDED STEEL PUMP-TO-WASTE LINE
5. SITE POWER SUPPLY
6. EXISTING 12" SWING CHECK VALVE
7. EXISTING 4" PUMP-TO-WASTE CONTROL VALVE
8. 12" DIAMETER D.I. WELDED STEEL PIPE SPOOL DISCHARGE PIPE
9. EXISTING VERTICAL TURBINE LINE SHAFT PUMP
10. FLOW METER IN VAULT
11. 1" COPPER PRE-LUBE LINE
12. WELL PRE-LUBE SOLENOID VALVE
13. ASSUMED LOCATION OF EXISTING INDUSTRIAL SEWER. SIZE, CONDITION AND EXACT LOCATION ARE UNKNOWN. CITY TO VERIFY SIZE, MATERIAL, CONDITION, AND LOCATION PRIOR TO CONSTRUCTION.
14. EXISTING 12" CMP, LITTLE WALLA WALLA RIVER RETURN CULVERT.





A G-004 EXISTING WELL HOUSE PIPING
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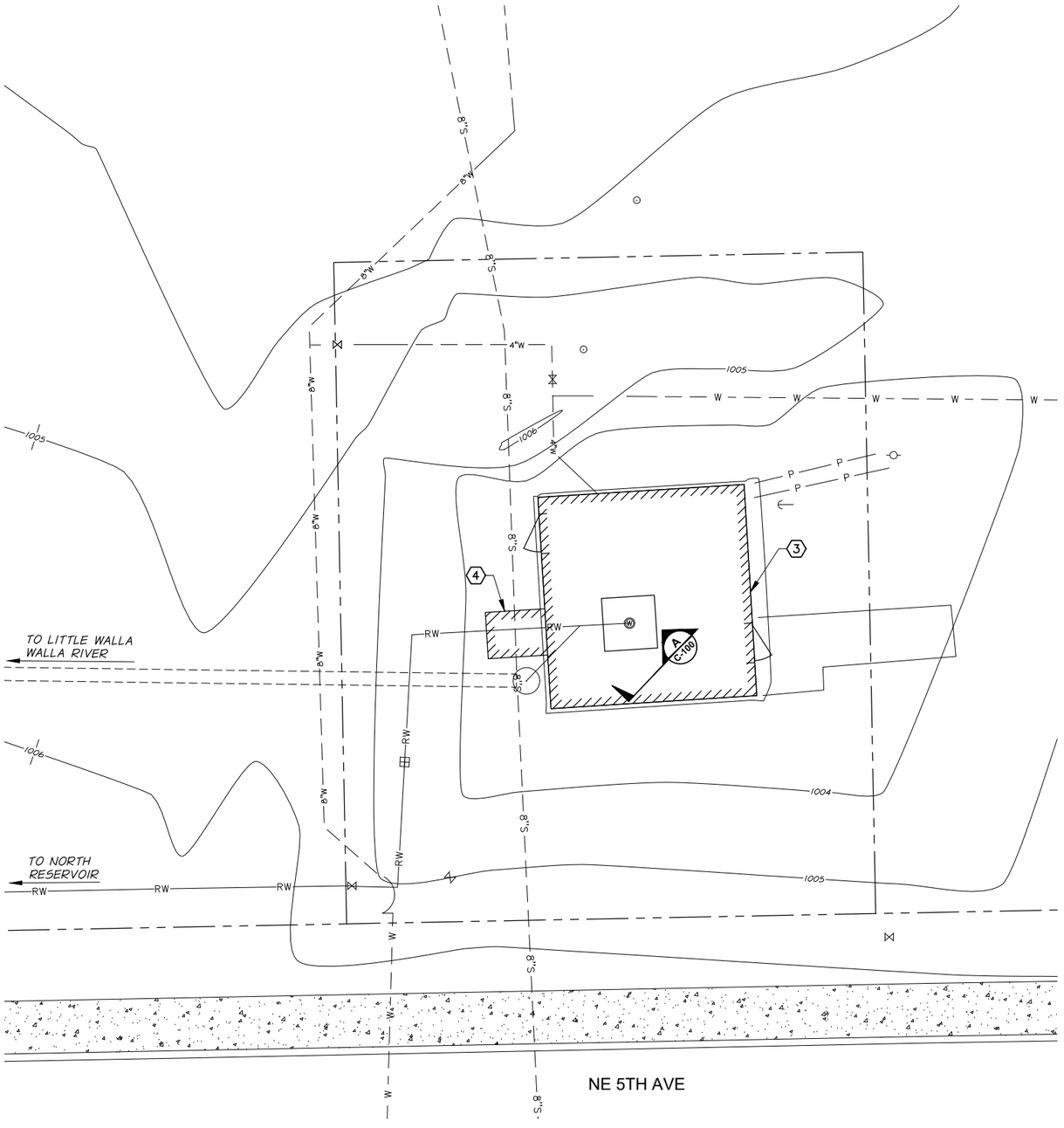
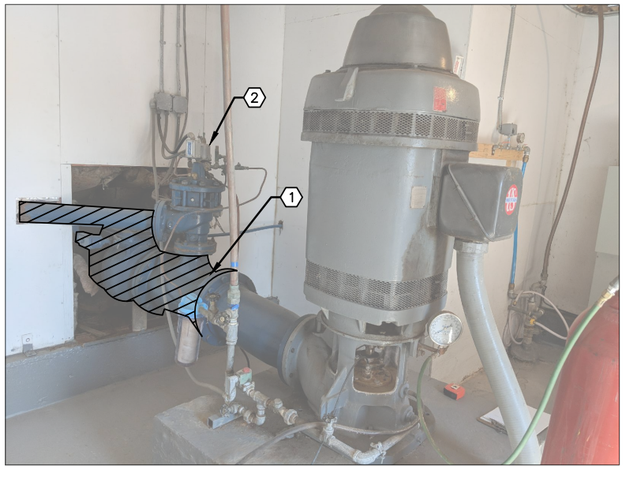
EXISTING SITE PLAN

SHEET
G-004
4 OF 14

KEY NOTES:

1. REMOVE EXISTING COMPONENTS. SEE COMPONENT DESCRIPTIONS ON G-004.
2. SALVAGE EXISTING CONTROL VALVE. TO BE USED AS CV-2.
3. SALVAGE AND RELOCATE EXISTING BUILDING ENCLOSURE PRIOR TO INSTALLING DOWN HOLE WELL VALVE AND WATER LEVEL INSTRUMENTATION. AFTER COMPLETION OF WELL IMPROVEMENTS, EXISTING BUILDING TO BE RE-INSTALLED TO EQUAL OR BETTER PRE-CONSTRUCTION CONDITION.
4. REMOVE EXISTING LEAN-TO STRUCTURE.





A C-100 **WELL HOUSE DEMOLITION**
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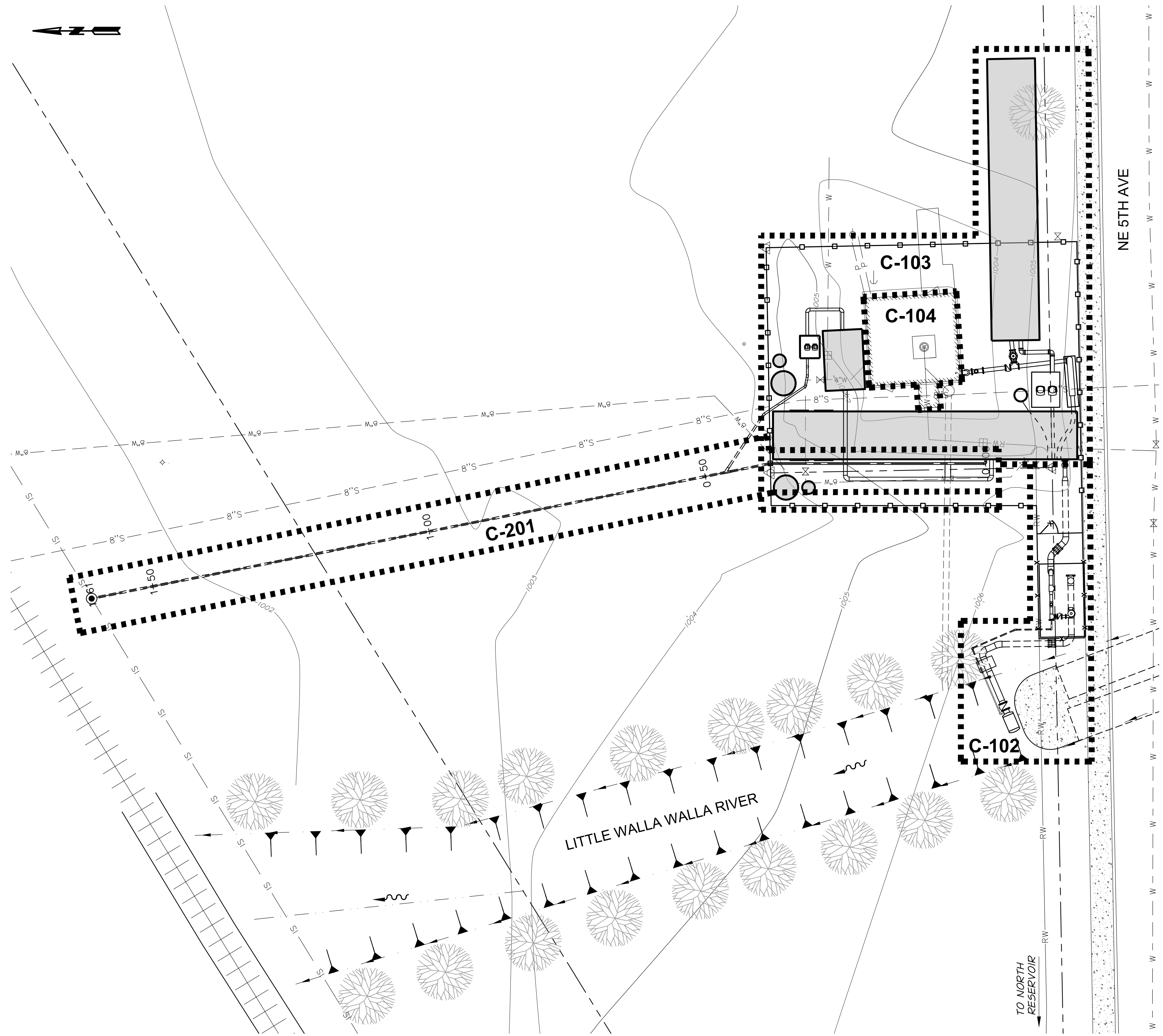
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

DEMOLITION PLAN

SHEET
C-100
5 OF 14



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CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

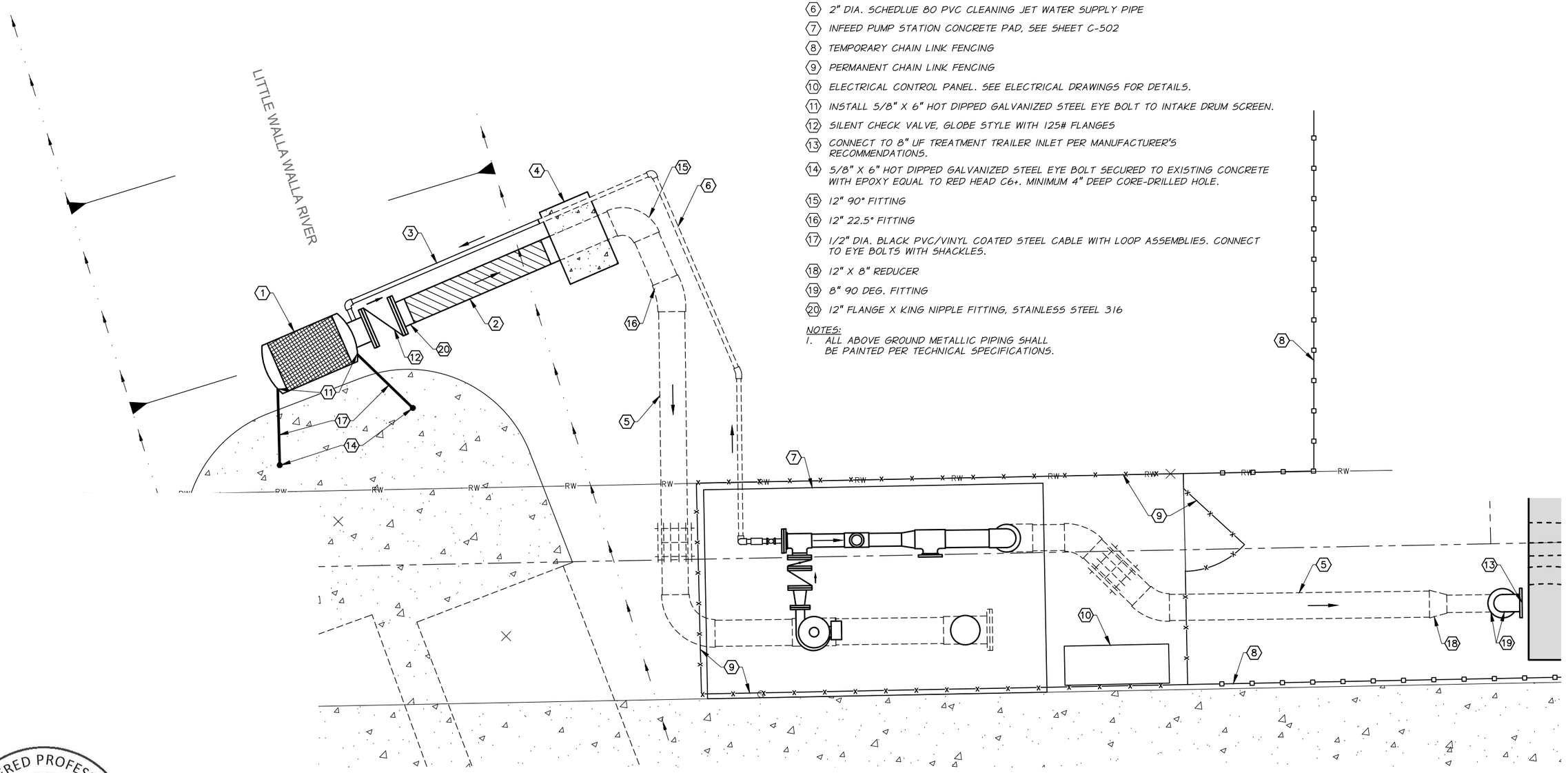
PROPOSED SITE PLAN

SHEET
C-101

KEY NOTES:

1. INTAKE DRUM SCREEN, SEE DETAIL SHEET C-501.
2. 12" DIA. CLEAR FLEXIBLE PVC CORRUGATED SUCTION HOSE
3. 1.5" DIA. BRAIDED EPDM RUBBER DISCHARGE HOSE
4. SUCTION INTAKE CONNECTIONS, SEE SHEET C-501 FOR DETAILS
5. 12" DIA. STEEL MANIFOLD WITH FITTINGS AS SHOWN
6. 2" DIA. SCHEDLUE 80 PVC CLEANING JET WATER SUPPLY PIPE
7. INFEED PUMP STATION CONCRETE PAD, SEE SHEET C-502
8. TEMPORARY CHAIN LINK FENCING
9. PERMANENT CHAIN LINK FENCING
10. ELECTRICAL CONTROL PANEL. SEE ELECTRICAL DRAWINGS FOR DETAILS.
11. INSTALL 5/8" X 6" HOT DIPPED GALVANIZED STEEL EYE BOLT TO INTAKE DRUM SCREEN.
12. SILENT CHECK VALVE, GLOBE STYLE WITH 125# FLANGES
13. CONNECT TO 8" UF TREATMENT TRAILER INLET PER MANUFACTURER'S RECOMMENDATIONS.
14. 5/8" X 6" HOT DIPPED GALVANIZED STEEL EYE BOLT SECURED TO EXISTING CONCRETE WITH EPOXY EQUAL TO RED HEAD C6+. MINIMUM 4" DEEP CORE-DRILLED HOLE.
15. 12" 90° FITTING
16. 12" 22.5° FITTING
17. 1/2" DIA. BLACK PVC/VINYL COATED STEEL CABLE WITH LOOP ASSEMBLIES. CONNECT TO EYE BOLTS WITH SHACKLES.
18. 12" X 8" REDUCER
19. 8" 90 DEG. FITTING
20. 12" FLANGE X KING NIPPLE FITTING, STAINLESS STEEL 316

NOTES:
1. ALL ABOVE GROUND METALLIC PIPING SHALL BE PAINTED PER TECHNICAL SPECIFICATIONS.



1 C-102 **RIVER INTAKE SITE PLAN**

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CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

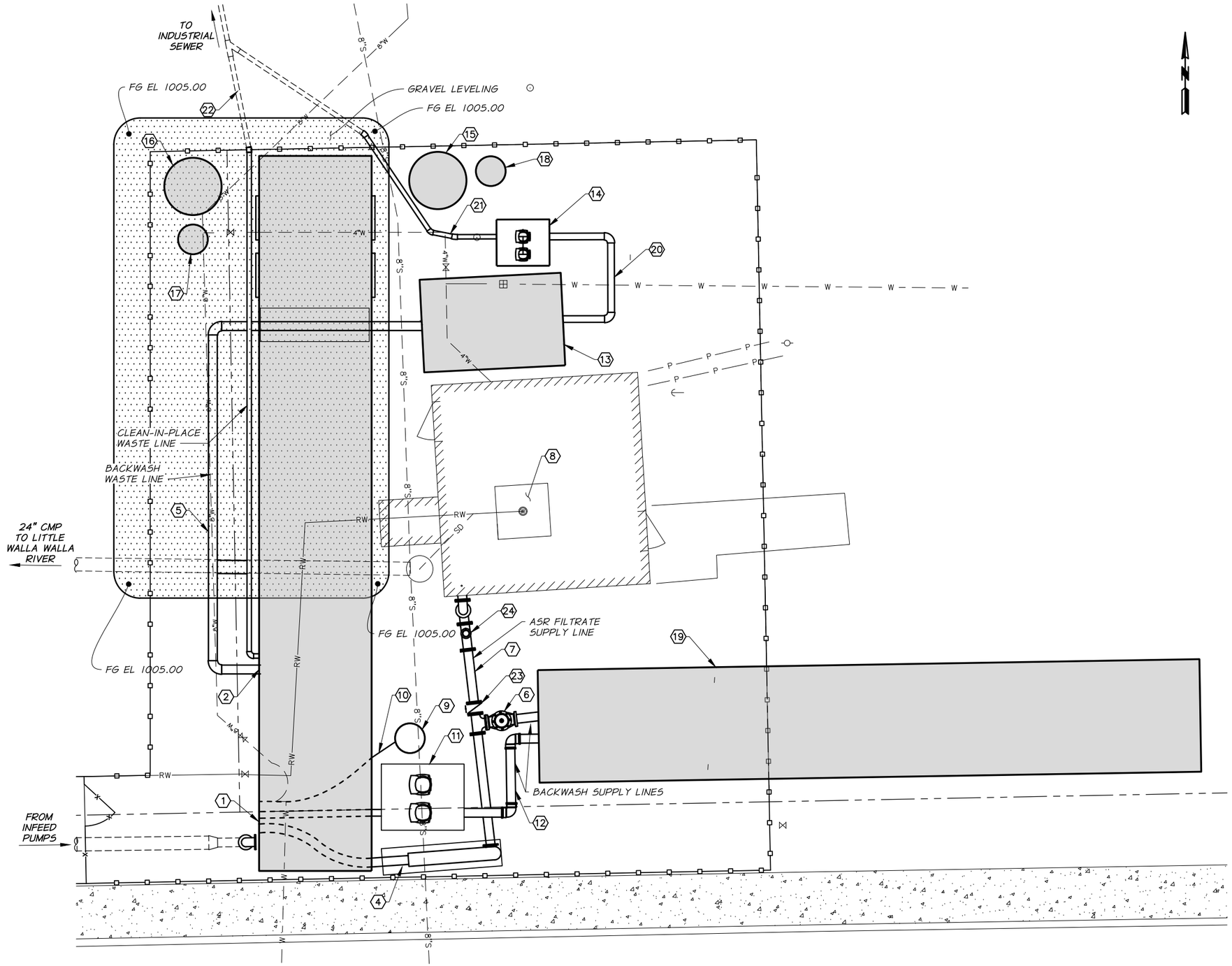
RIVER INTAKE SITE PLAN

SHEET C-102

KEY NOTES:

1. UF TREATMENT TRAILER RAW WATER INLET, FILTRATE OUTLET, BACKWASH SUPPLY INLET, AND AIR SUPPLY INLET.SEE GENERAL ARRANGEMENT TRAILER DRAWING.
2. UF TREATMENT TRAILER WASTE OUTLETS. SEE GENERAL ARRANGEMENT TRAILER DRAWING.
3. UF TREATMENT SYSTEM TRAILER.
4. UV DISINFECTION TREATMENT SKID.
5. 8" SCHEDULE 80 PVC BACKWASH WASTE PIPE.
6. ALTITUDE VALVE CV-3
7. FILTRATE LINE TO WELL NO. 5.
8. WELL HEAD IMPROVEMENTS, SEE SHEETS C-104 AND C-105.
9. AIR COMPRESSOR.
10. AIR LINE.
11. BACKWASH SUPPLY PUMPS AND SKID.
12. BACKWASH SUPPLY LINE.
13. BACKWASH WASTE STORAGE TANK (TK-1201).
14. BACKWASH WASTE STORAGE PUMPS AND SKID (P-1201 & P-1202).
15. SODIUM HYPOCHLORITE STORAGE TANK (TK-301).
16. COAGULANT STORAGE TANK (TK-501).
17. CITRIC ACID STORAGE TANK (TK-601).
18. SULFURIC ACID STORAGE DRUM (TK-401).
19. FILTERED WATER STORAGE TANK (TK-701).
20. 6" SCHEDULE 80 PVC BACKWASH WASTE PIPE.
21. 4" SCHEDULE 80 PVC WASTE PIPE.
22. 6" SDR 35 PVC WASTE PIPE.
23. 8" CHECK VALVE.
24. 8" FLOWMETER.
25. HEAT TAPE, 3W/FT 120 VOLT SELF REGULATING HEATING CABLE WITH THERMOPLASTIC ELASTOMER JACKET.

NOTES:
1. ALL ABOVE GROUND METALLIC PIPING SHALL BE PAINTED PER TECHNICAL SPECIFICATIONS.



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CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

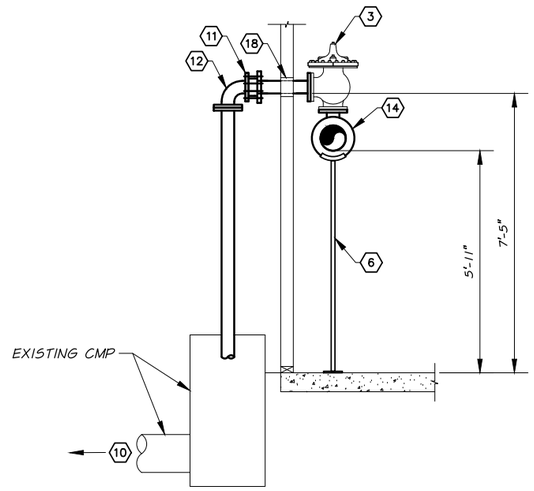
DEMONSTRATION TREATMENT TRAILER SITE PLAN

SHEET
C-103
8 OF 14

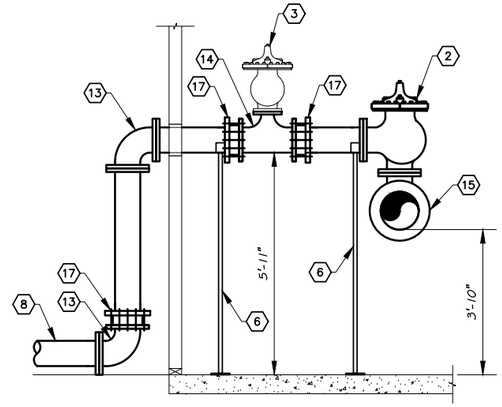
KEY NOTES

1. 12" SWING CHECK VALVE.
2. 8" CONTROL VALVE, ANGLED.
3. SALVAGED 4" CONTROL VALVE, ANGLED.
4. EXISTING WELL NO. 5 VERTICAL LINE SHAFT TURBINE PUMP.
5. RESERVED
6. PIPE SUPPORT, SEE SHEET C-502 FOR DETAILS.
7. WELL NO. 5.
8. ASR FILTRATE SUPPLY FROM UF TREATMENT TRAILER.
9. CONNECT TO EXISTING PIPE SERVING NORTHERN RESERVOIR. FIELD FABRICATE AS NECESSARY.
10. TO 12" DIA. STORM DRAIN AND LITTLE WALLA WALLA RIVER DISCHARGE.
11. 4" FLG COUPLING ADAPTOR.
12. 4" FLG 90° BEND.
13. 8" FLG 90 DEG. FITTING
14. 8"X4" FLG TEE.
15. 12"X8" FLG TEE.
16. 12" FLG 90℄ BEND.
17. 8" FLG COUPLING ADAPTOR.
18. INSTALL NEW PIPE WALL PENETRATION AND PROVIDE WEATHER TIGHT FINISH.
19. 12" MJ 90℄ BEND.
20. NEW ELECTRICAL CONTROL PANEL.
21. PRESSURE TRANSDUCER.
22. NEW EXTENDED ALL WEATHER ENCLOSURE.
23. EXISTING ELECTRICAL CONTROL PANEL.
24. DOWN HOLE WELL CONTROL VALVE HYDRAULIC LINES AND PRESSURE TRANSDUCER WIRING.
25. 12" FLG COUPLING ADAPTOR.

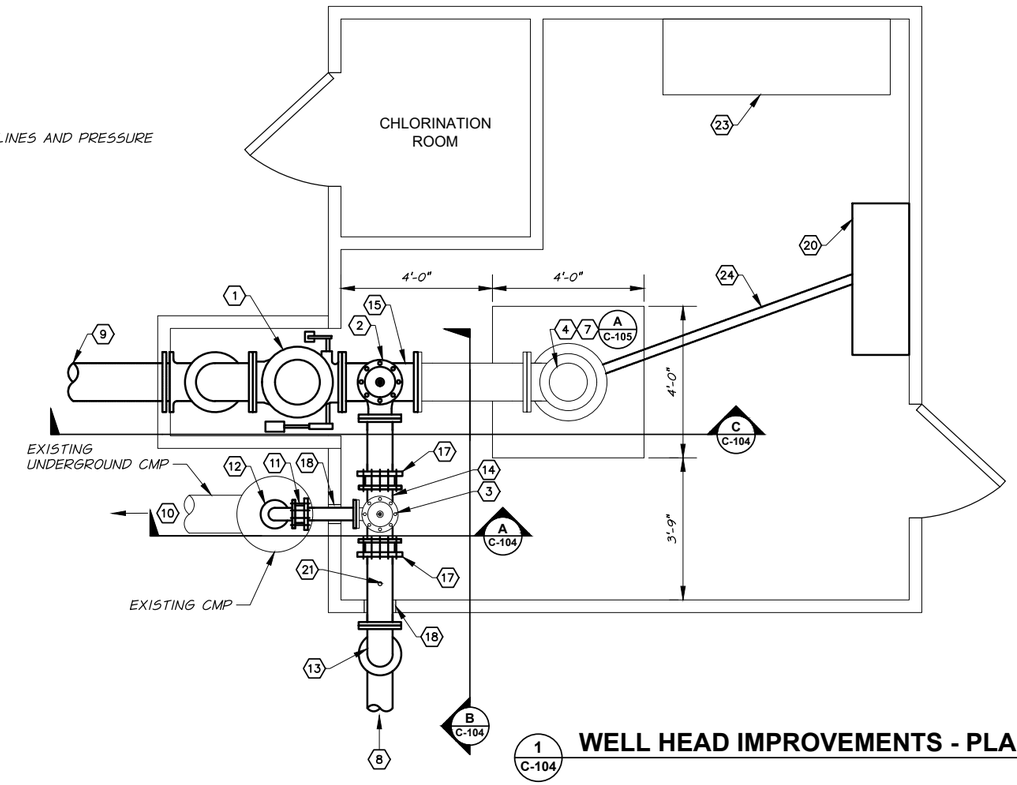
NOTES:
1. ALL ABOVE GROUND METALLIC PIPING SHALL BE PAINTED PER TECHNICAL SPECIFICATIONS.



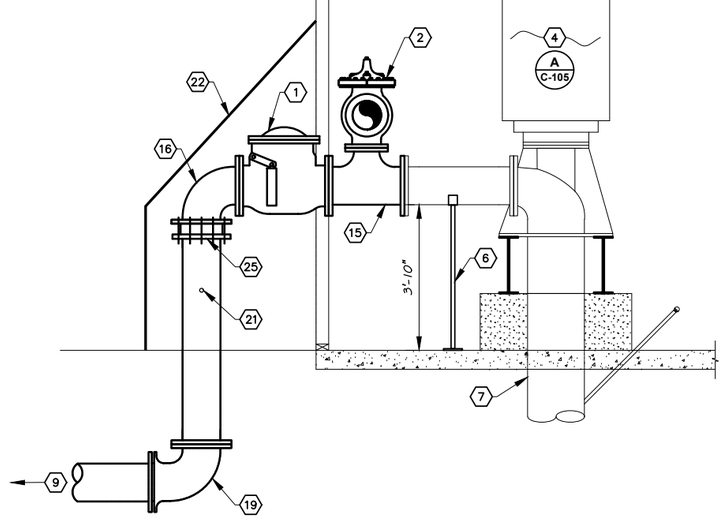
A C-104 **WELL HEAD IMPROVEMENTS - SECTION A**



B C-104 **WELL HEAD IMPROVEMENTS - SECTION B**



1 C-104 **WELL HEAD IMPROVEMENTS - PLAN**



C C-104 **WELL HEAD IMPROVEMENTS - SECTION C**

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NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

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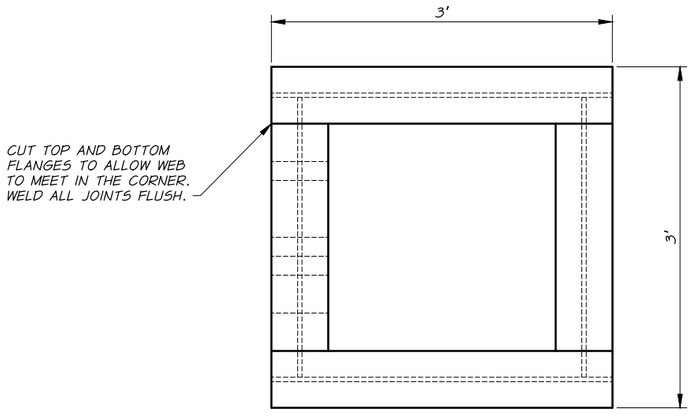
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

WELL HEAD IMPROVEMENTS I

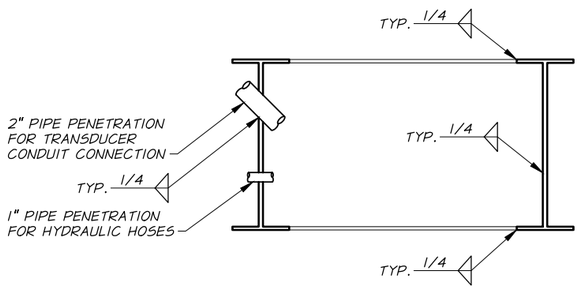
SHEET
C-104
9 OF 14

KEY NOTES

1. EXISTING TURBINE PUMP.
2. 18" PUMP BASE FABRICATED STRUCTURAL STEEL W18X40, EPOXY COATED.
3. TWO 1/4" DIA. HYDRAULIC LINES.
4. 1" DIA. AIR LINE.
5. EXISTING 1" ACCESS PORT.
6. REAM EXISTING PENETRATION.
7. 18" STEEL CASING.
8. 1 1/2" SCHEDULE 40 PVC TRANSDUCER CONDUIT.
9. EXISTING 8" COLUMN PIPE.
10. DOWNHOLE CONTROL VALVE.
11. LINESHAFT.
12. BOWL ASSEMBLY.



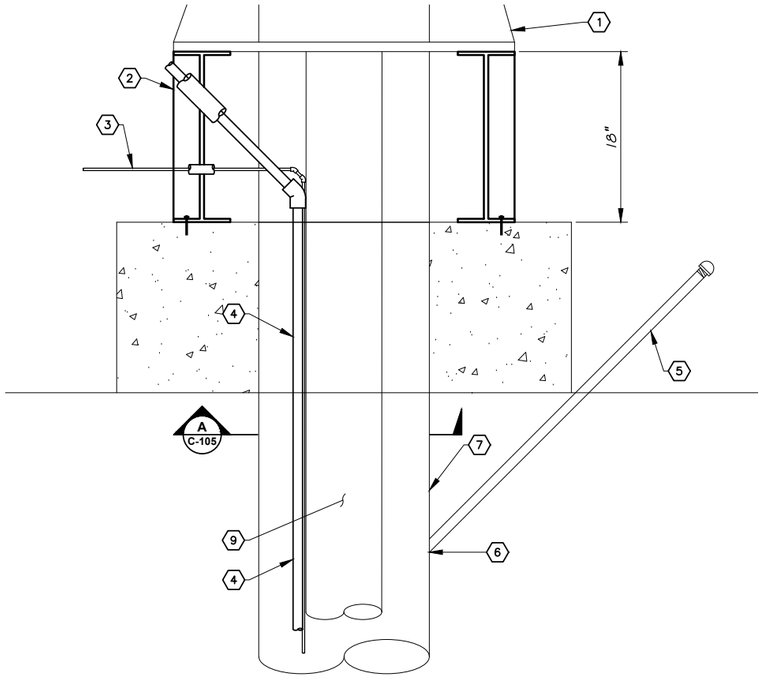
PLAN



SECTION

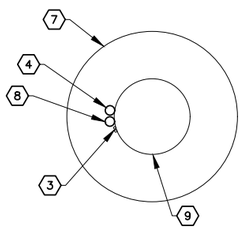
1 C-105 PUMP BASE DETAIL

3" 0 3" 6" 9"
SCALE IN FEET



2 C-105 WELL HEAD IMPROVEMENTS

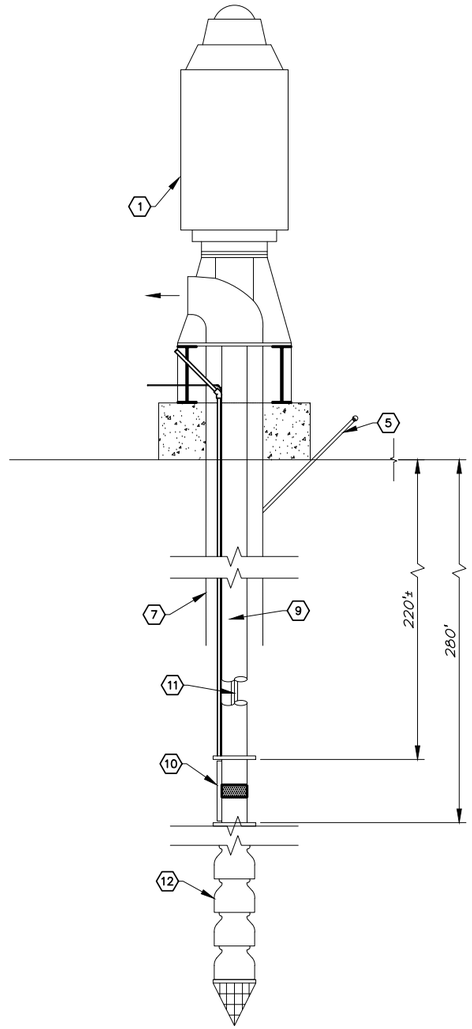
3" 0 3" 6" 9"
SCALE IN FEET



A C-105 WELL HEAD IMPROVEMENTS - SECTION A

3" 0 3" 6" 9"
SCALE IN FEET

NOTES:
1. HYDRAULIC HOSE, AIR LINE, AND PRESSURE TRANSDUCER CONDUITS SHALL BE SECURELY ATTACHED TO THE EXISTING COLUMN PIPE WITH STAINLESS STEEL BANDS AT A MAXIMUM SPACING OF 20 FEET.



3 C-105 DOWN HOLE CONTROL VALVE

2 0 2 4 8
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER
74069PE
OREGON
NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

REVISION	BY	DATE

DESIGNED BY M. BLASY
DRAWN BY J. CHAPMAN
REVIEWED BY J. WELLS

JOB NUMBER 7008-625 DATE November 5, 2018
ACAD FILE: 7008-625-060-C105.DWG

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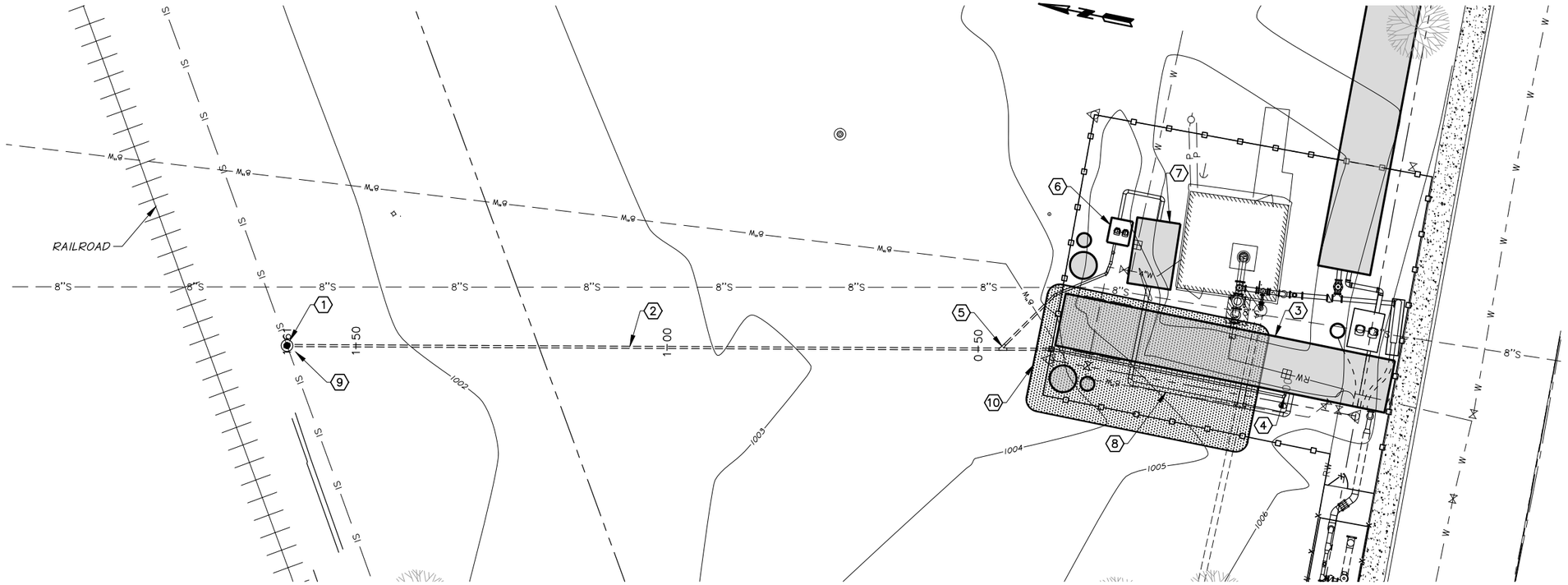
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

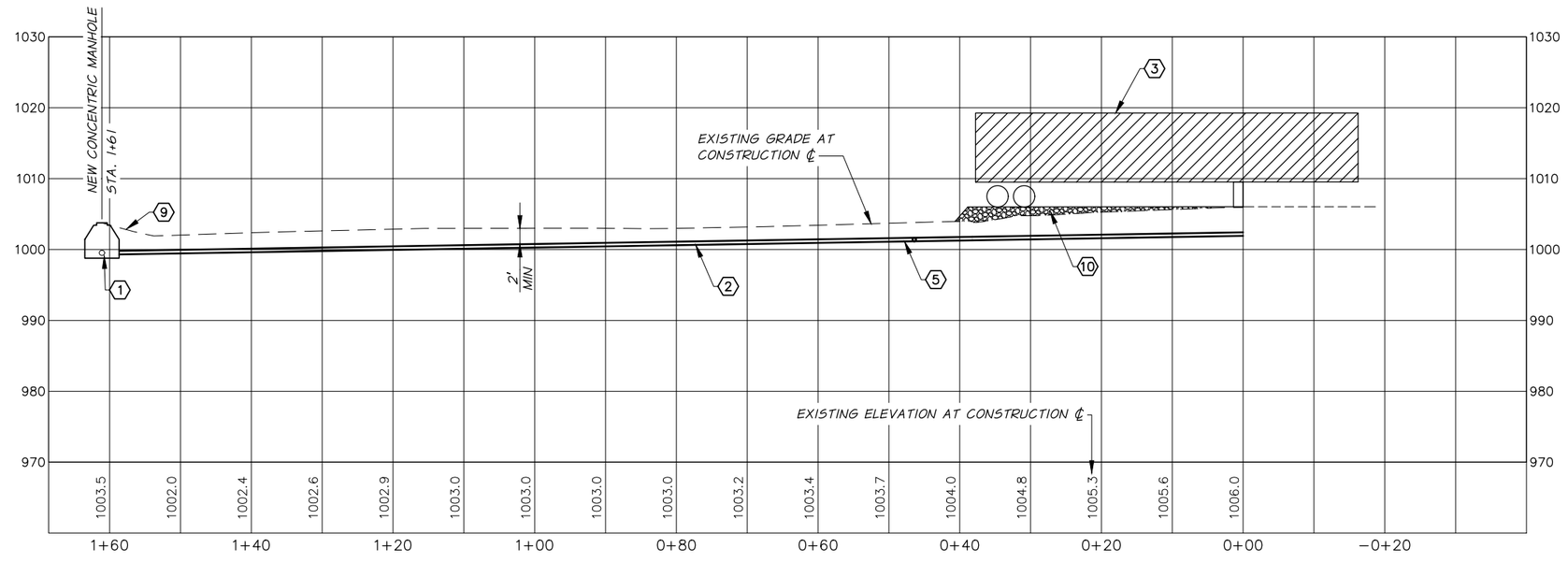
WELL HEAD IMPROVEMENTS II

SHEET
C-105
10 OF 14

KEY NOTES

1. CONNECT TO EXISTING 8" INDUSTRIAL SEWER LINE. EXACT LOCATION AND DEPTH UNKNOWN. VERIFY WITH CITY PRIOR TO START OF CONSTRUCTION.
2. 6" SDR 35 WASTE LINE.
3. UF TREATMENT TRAILER.
4. WASTE OUTLET.
5. BACKWASH WASTE CONNECTION.
6. BACKWASH WASTE PUMPS.
7. BACKWASH WASTE STORAGE TANK.
8. BACKWASH WASTE LINE.
9. NEW MANHOLE, SEE SHEET C-501 FOR DETAILS.
10. IMPORT 1"-0 AGGREGATE SUB-BASE PER ODOT 00640-10 FOR SITE LEVELING COURSE. COMPACT IN 6-INCH LAYERS.





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NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

REVISION	BY	DATE

DESIGNED BY M. BLASY
DRAWN BY J. CHAPMAN
REVIEWED BY J. WELLS

HORIZONTAL SCALE IN FEET: 10 0 10 20 30
VERTICAL SCALE IN FEET: 10 0 10 20 30

JOB NUMBER 7008-625 DATE November 5, 2018
ACAD FILE: 7008-625-060-C201.DWG

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CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

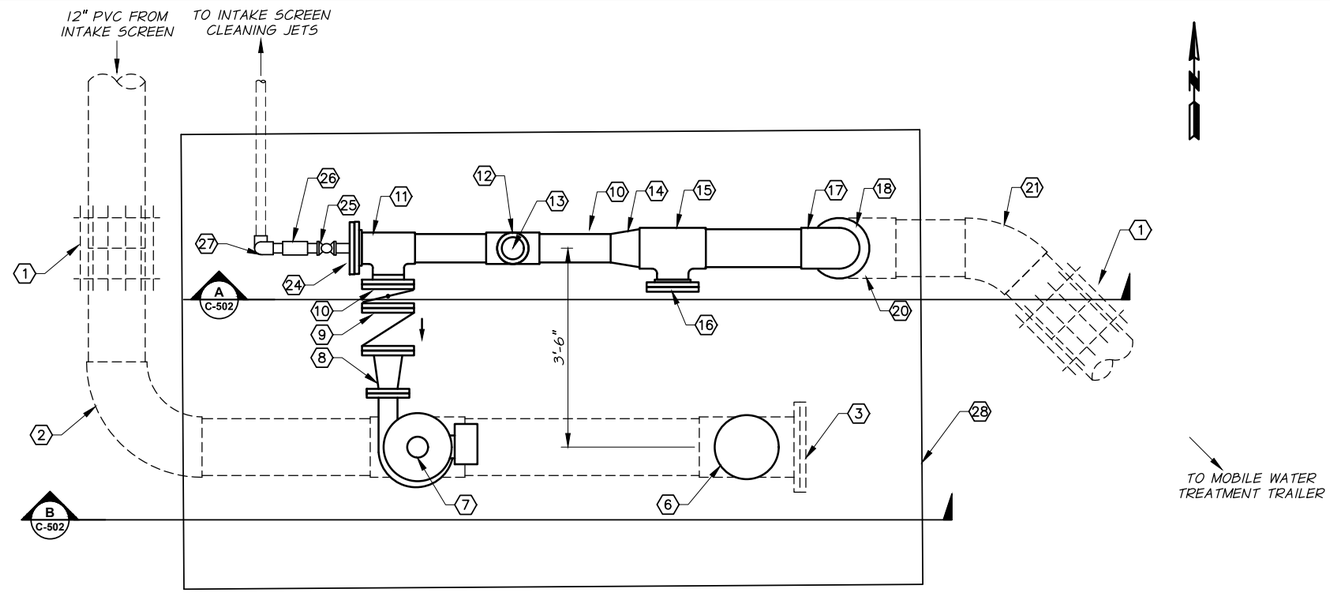
WASTE LINE PLAN AND PROFILE

SHEET
C-201
11 OF 14

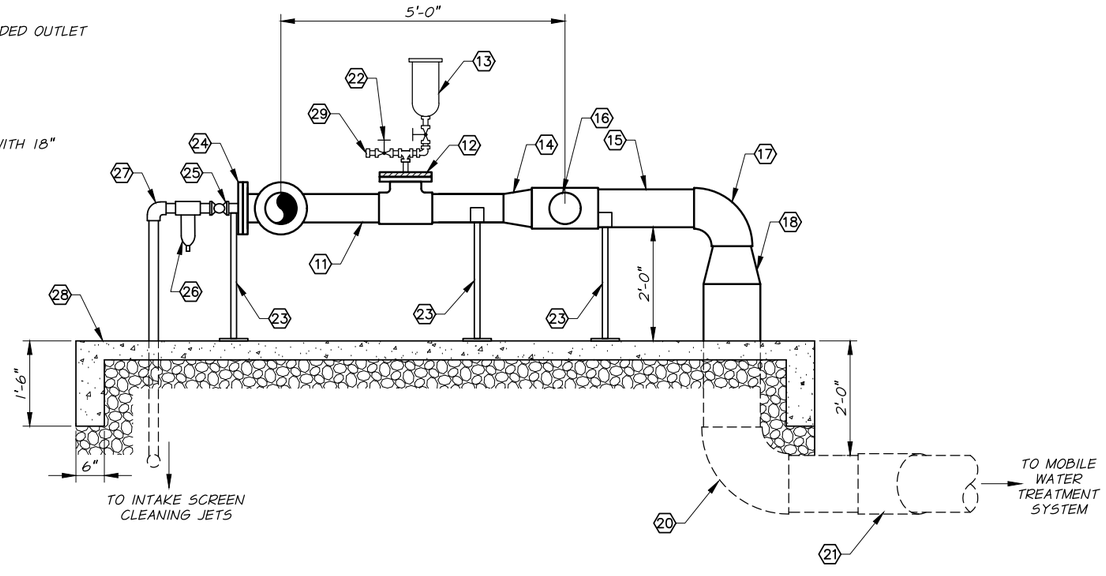
KEY NOTES

1. 12" PVC TO 12" STEEL COUPLING
2. 12" STANDARD WEIGHT STEEL MANIFOLD, EPOXY COATED WITH 90° BEND AND TWO 8" OUTLET TEES
3. 12" BLIND FLANGE
4. 6" RESTRAINED FLANGE COUPLING ADAPTER
5. 6" BUTTERFLY VALVE
6. 6" BLIND FLANGE
7. 40 HP VERTICAL MOUNTED CENTRIFUGAL PUMP, 6" SUCTION AND 4" DISCHARGE
8. 4"X6" REDUCER
9. 6" CHECK VALVE
10. 6" BUTTERFLY VALVE
11. 6" SCHEDULE 40 STEEL MANIFOLD, EPOXY COATED WITH TWO 6" OUTLET TEES
12. 6" TAPPED FLANGE WITH 1" THREADED OUTLET
13. 1" AIR RELEASE VALVE
14. 6"X8" REDUCER
15. STANDARD WEIGHT STEEL MANIFOLD, EPOXY COATED WITH ONE 6" OUTLET TEE, AND OTHER FITTINGS AS SHOWN
16. 6" BLIND FLANGE
17. 8" 90° BEND
18. 8"X12" REDUCER
19. RESERVED
20. 12" 90° BEND
21. 12" 45° BEND
22. 1" BALL VALVE
23. PIPE SUPPORT
24. 6" TAPPED FLANGE WITH 2" THREADED OUTLET
25. 2" 1/4 TURN BALL VALVE
26. 2" STRAINER
27. 2" 90° BEND
28. 13'L X 8'W X 4"D CONCRETE PAD WITH 18" FOOTING SUPPORTED ON 6" CSBC
29. 3/4" FEMALE NPT OUTLET

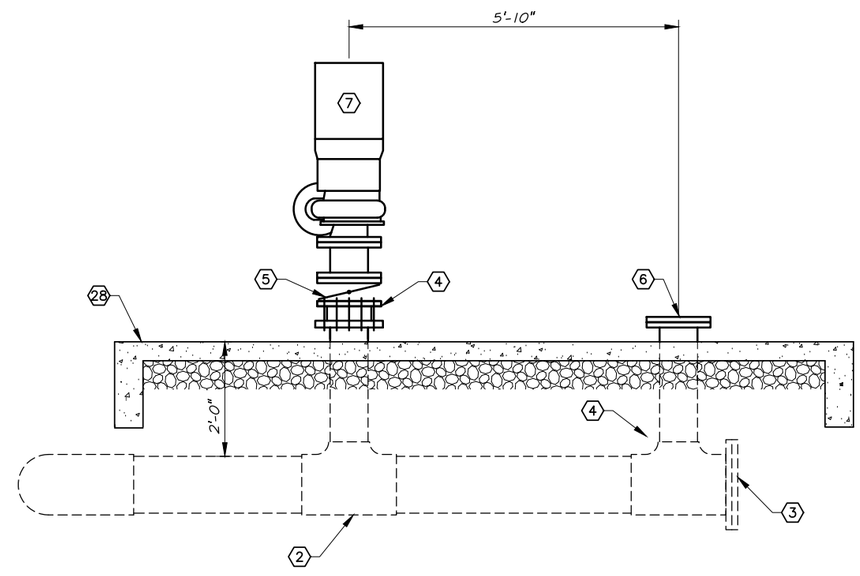
NOTES:
1. ALL ABOVE GROUND PIPE SHALL HAVE HEAT TAPE, 3W/FT 120 VOLT SELF REGULATING HEATING CABLE WITH THERMOPLASTIC ELASTOMER JACKET.



1 C-502 **INFEED PUMP STATION - PLAN**



A C-502 **DISCHARGE HEADER - SECTION A**



B C-502 **SUCTION HEADER - SECTION B**

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OREGON
NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

REVISION	BY	DATE

SCALE IN FEET: 1 0 1 2 3

DESIGNED BY M. BLASY	JOB NUMBER 7008-625
DRAWN BY J. CHAPMAN	DATE November 5, 2018
REVIEWED BY J. WELLS	ACAD FILE: 7008-625-060-C202.DWG

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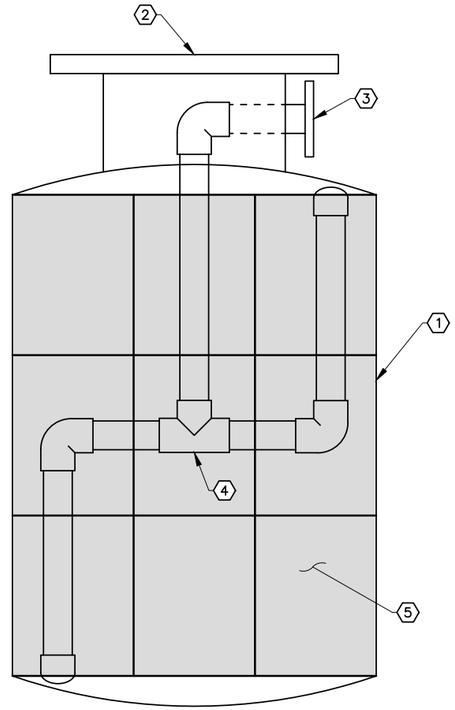
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

INFEED PUMP STATION PLAN AND SECTIONS

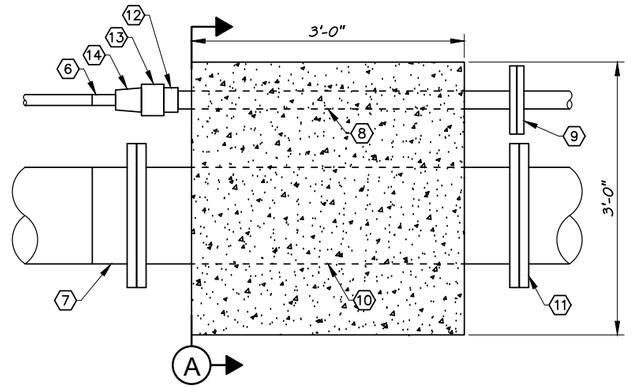
SHEET C-202
12 OF 14

KEY NOTES:

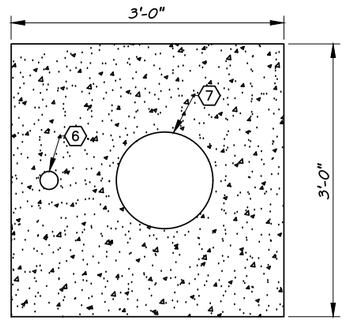
1. INTAKE SCREEN EQUAL TO EVOQUA VAF FILTRATION SYSTEMS SELF CLEANING INTAKE SUCTION SCREEN MODEL 15-1400.
2. 12" FLANGED OUTLET.
3. 1.5" SPRAY WATER SUPPLY INLET.
4. ROTATING SPRAY BARS WITH JET NOZZLES.
5. STAINLESS STEEL 18 MESH SCREEN.
6. 1.5" THREADED MALE X KING NIPPLE FITTING, STAINLESS STEEL
7. 12" FLANGE BY KING NIPPLE FITTING
8. 2" SCH 40 PVC EMBEDDED IN CONCRETE.
9. 2" FLANGED RPCA CONNECTION
10. 12" STEEL WITH FLG X FLG CONNECTIONS
11. 12" FLANGED RPCA CONNECTION.
12. 2" MALE CAMLOCK X THREADED FEMALE NPT, STAINLESS STEEL TYPE A
13. 2" FEMALE CAMLOCK X THREADED FEMALE NPT, STAINLESS STEEL TYPE B
14. 2" MALE X 1.5" FEMALE THREAD REDUCER BUSHING PIPE FITTING, STAINLESS STEEL, NPT



1 C-501 **INTAKE SCREEN**
NTS



PLAN



SECTION A

2 C-501 **SUCTION INTAKE CONNECTION**
NTS

REGISTERED PROFESSIONAL ENGINEER
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NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

REVISION	BY	DATE

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JOB NUMBER 7008-625 DATE November 5, 2018
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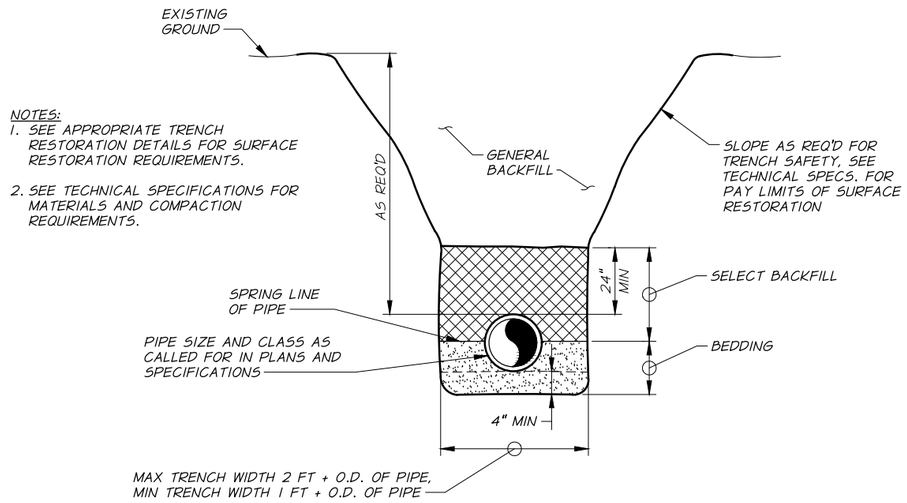
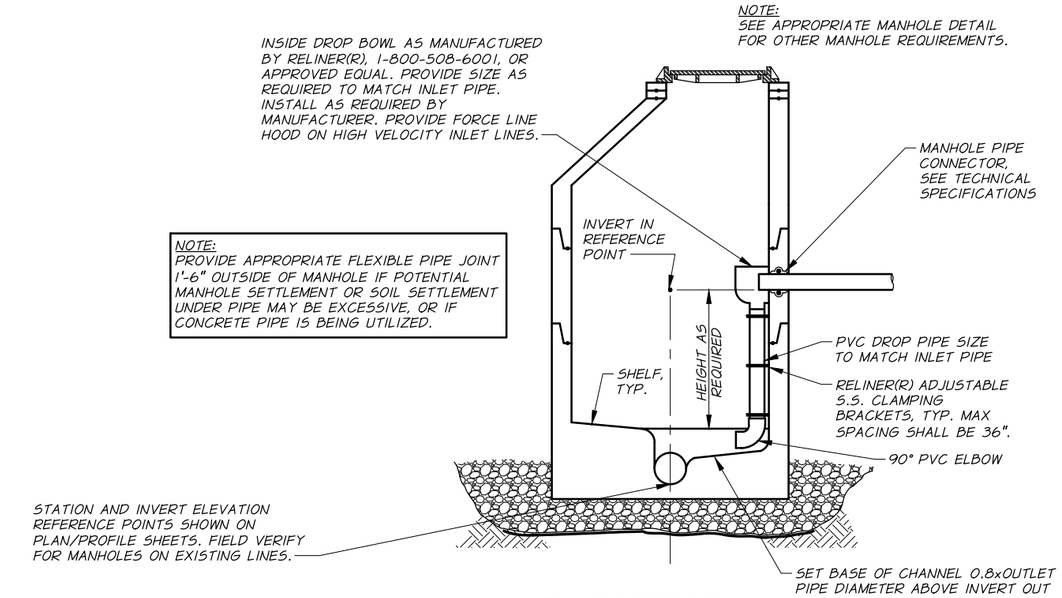
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

DETAILS I

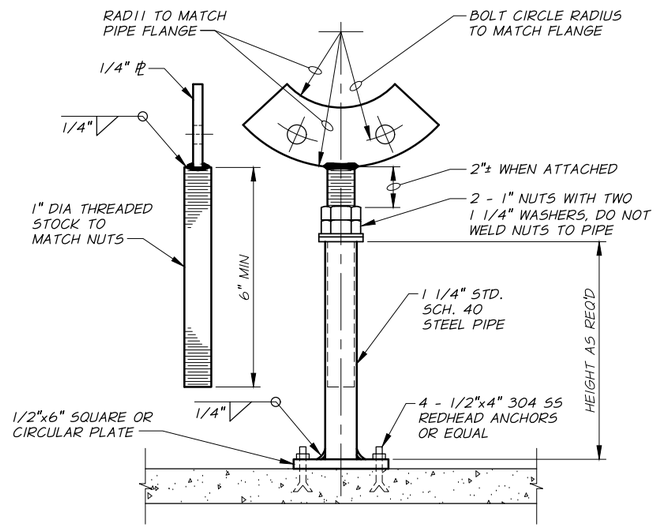
SHEET
C-501
13 OF 14



1 C-503 TRENCH DETAIL
NTS



2 C-503 MANHOLE
NTS



3 C-503 PIPE SUPPORT DETAIL
NTS

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NOV. 12, 2003
JOHN H. WELLS
RENEWS: 6-30-2020

REVISION	BY	DATE

DESIGNED BY M. BLASY
DRAWN BY J. CHAPMAN
REVIEWED BY J. WELLS

JOB NUMBER 7008-625 DATE November 5, 2018
ACAD FILE: 7008-625-060-C502.DWG

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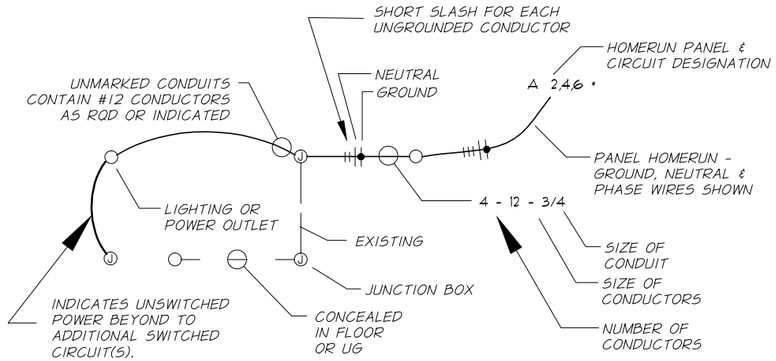
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

DETAILS II

SHEET
C-502
14 OF 14

A	AMPERES
AC	ALTERNATING CURRENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AVAILABLE INTERRUPT CURRENT
ATS	AUTOMATIC TRANSFER SWITCH
BLDG	BUILDING
C	CONDUIT
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CLG	CEILING
CONC	CONCRETE
CTL	CONTROL
CU	COPPER
DC	DIRECT CURRENT
DEMO	DEMOLISH OR REMOVE
DET	DETAIL REFERENCE
EA	EACH
FO	FIBER OPTIC
G	GROUND
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
GRC	GALVANIZED RIGID CONDUIT
J/JB	JUNCTION BOX
KA	1,000 A
KVA	1,000 VA
KW	KILOWATT
KWH	KILOWATT HOUR
M	MAGNETIC CONTRACTOR COIL
mA	MILLI AMP
MA	MOTOR ACTUATOR
MCC	MOTOR CONTROL CENTER
MFGR	MANUFACTURER
MT	MOUNT
MTD	MOUNTED
N	NEUTRAL
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	OVER CURRENT
OH	OVER HEAD
OL	OVERLOAD
OS	OUTSIDE
PLC	PROGRAMMABLE LOGIC CONTROLLER
RECPT	RECEPTACLE
RM	ROOM
RMC	RIGID METAL CONDUIT
RQD	REQUIRED
SH	SHEET REFERENCE
SHC	SODIUM HYPOCHLORITE
SPD	SURGE PROTECTION DEVICE
SS	STAINLESS STEEL
SURF	SURFACE
SW	SWITCH
TBD	TO BE DETERMINED
TSP	TWISTED SHIELDED PAIR
TYP	TYPICAL
UG	UNDER GROUND
V	VOLT
VA	VOLT AMPERE
VAC	SEE V & A ABOVE
VFD	VARIABLE SPEED DRIVE
W/	WITH
WP	WEATHER PROOF

ABBREVIATIONS



* INDICATES MULTIPLE HOME RUN CONNECTIONS TO THIS PNL LOCATION.

CIRCUIT SYMBOL DETAIL

DETAIL REFERENCE

2 / E14 — DETAIL REFERENCE NUMBER / SHEET NUMBER

(TYPICALLY APPLIES TO LIKE ITEMS)

- (M) MOTOR
- (CR) RELAY OR CONTACTOR COIL
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- HOA HAND - OFF - AUTO SWITCH
- RTM RUN TIME METER
- TRIANGLE REMOTELY LOCATED DEVICE
- (D) LED INDICATOR LIGHT - AS INDICATED
- TERMINAL STRIP CONNECTION
- COMPONENT TERMINAL CONNECTION
- 1 KEYED NOTE REFERENCE
- (J) JUNCTION BOX
- PANELBOARD. SEE SCHEDULE FOR TYPE.
- DUPLEX CONVENIENCE OUTLET. 120 VAC
- DOUBLE DUPLEX (4) RECEPTACLE.
- S SWITCH, TYPE AS INDICATED
- (T) THERMOSTAT SWITCH
- A LIGHTING FIXTURE- SEE SCHEDULE. LETTER REFERENCES FIXTURE SCHEDULE
- C WALL MOUNTED EXTERIOR LIGHT. LETTER REFERENCES FIXTURE SCHEDULE
- LED EXIT SIGN - SHADING DEPICTS FACE LETTER REFERENCES FIXTURE SCHEDULE
- EXHAUST FAN
- 30 DISCONNECT. TYPE AS SPECIFIED

ELECTRICAL LEGEND

SCOPE OF WORK

1. INSTALLATION OF DOWN HOLE 3R VALVE & WELL WATER DEPTH SENSOR LIT-1 WILL REQUIRE PUMP STATION ROOF REMOVAL. PROVIDE ELECTRICAL & INSTRUMENTATION SYSTEM DEMOLITION & RECONNECTION IN SUPPORT OF THIS WORK.

2. ELECTRICAL AS BUILT DRAWINGS WERE NOT AVAILABLE FOR EXISTING PUMP MOTOR CONTROL CKT & CLAY VALVE CV-2. THE CONTRACTOR MAY BE REQUIRED TO PROVIDE DESIGN BUILD INTERFACES FOR THESE ITEMS TO ACOMPLISH INTENDED OPERATION.

3. PROVIDE LABOR & MATERIALS AS INDICATED ON THE DRAWINGS & SCHEDULE SITE WORK SUCH AS UNDERGROUND INSTALLATION OF ELECTRICAL & CONTROL SYSTEM RACEWAYS PRIOR TO PLACEMENT OF DEMO TRAILER & ASSOCIATED TANKS & SKIDS.

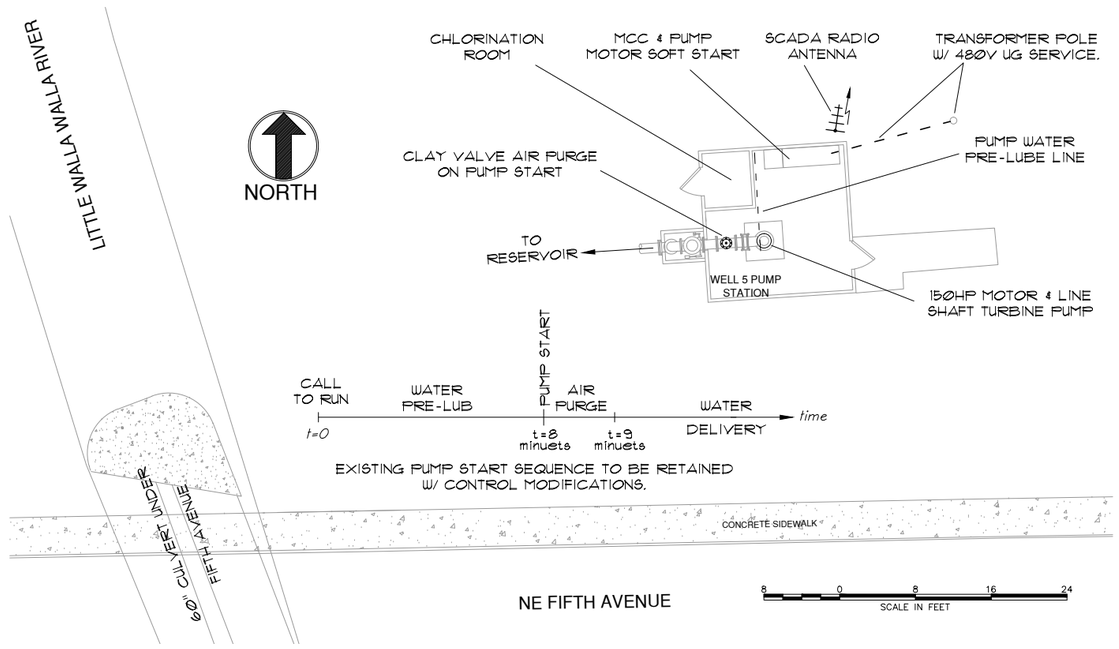
4. THE CONTRACTOR SHALL SECURE & PAY FOR PERMITS & ALL FEES NECESSARY FOR THE EXECUTION. INSPECTION & COMPLETION OF THE ELECTRICAL WORK DESCRIBED HEREIN. ALL ELECTRICAL WORK SHALL BE IN COMPLIANCE WITH THE LATEST GOVERNING ELECTRICAL CODE(S) HAVING JURISDICTION AT THE TIME THE WORK IS INSTALLED.

5. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE CONTROL SYSTEM INTEGRATOR TO PROVIDE ITEMS SUCH AS BOXES, CONDUITS & WIRING INDICATED ON THE DRAWINGS & NECESSARY FOR SYSTEM OPERATION. VERIFY REQUIREMENTS OF THESE SYSTEMS & PROVIDE ELECTRICAL ITEMS AS RQD.

6. VERIFY MANUFACTURERS RECOMMENDED TYPE & SIZE OF OVERCURRENT PROTECTION DEVICE FOR ALL EQUIPMENT.

7. PROVIDE LABOR & MATERIALS FOR CONTROL & INSTRUMENTATION SYSTEM AS INDICATED ON THE DRAWINGS. PROVIDE PLC & HMI PROGRAMMING FOR SYSTEM OPERATION & MONITORING AS INDICATED HEREIN.

8. THE ELECTRICAL & CONTROL SYSTEM INSTALLATION SHALL BE COMPLETE & FULLY OPERATIONAL AT THE COMPLETION OF THE WORK. THE CONTRACTOR SHALL FURNISH A ONE (1) YEAR WRITTEN GUARANTEE ON MATERIALS & WORKMANSHIP FROM THE DATE OF ACCEPTANCE.



1 EXISTING ELECTRICAL SITE PLAN

1/8" = 1' - Ø" (AT FULL SHEET SIZE)

REGISTERED PROFESSIONAL ENGINEER
60814PE
OREGON
MAY 17, 1999
JACK TERRY
EXP.: JUNE 30, 2020
DATE SEALED: 10/31/2018

REVISION	BY	DATE

THIS DRAWING HAS BEEN REDUCED 50%. ADJUST SCALE ACCORDINGLY. BARSCALE SHOWN IS ACCURATE.

DESIGNED BY	J. TERRY
DRAWN BY	J. TERRY
REVIEWED BY	J. WELLS
JOB NUMBER	7008-625
DATE	October 31, 2018
ACAD FILE:	

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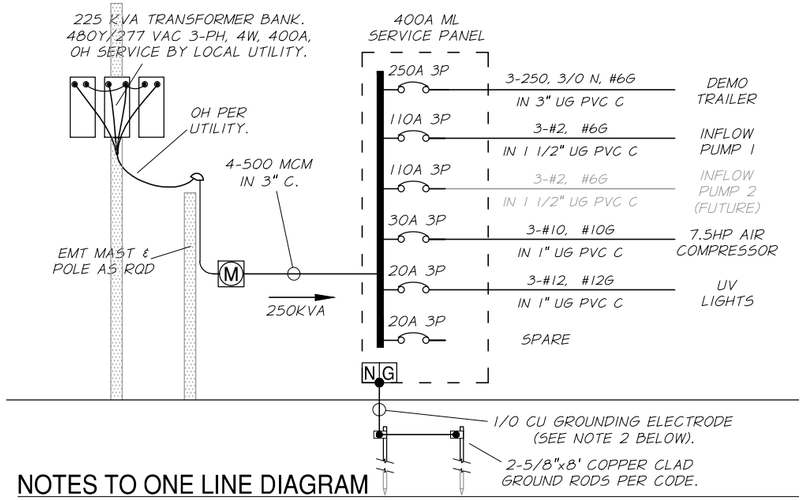
engineering surveying natural resources

WALLA WALLA BASIN WATERSHED COUNCIL
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

EXISTING ELECTRICAL SITE PLAN

SHEET **E1**



NOTES TO ONE LINE DIAGRAM

1. SERVICE PANEL: TOP INCOMING, NEMA 3R, 72"x20"x6.5", 480V, 3-PH, 4W, 400 AMP, MAIN LUG, ALUMINUM BUSS, SURFACE MTD. AIC RATING AS RQD. EATON CATALOG # P3D400LT18AH3R OR EQUAL.

2. GROUNDING ELECTRODE CONDUCTOR SHALL BE ONE CONTINUOUS LENGTH WITHOUT A SPLICE OR JOINT, UNLESS SPLICED BY AN IRREVERSIBLE COMPRESSION CONNECTOR LISTED FOR THE PURPOSE OR BY EXOTHERMIC WELDING. PROVIDE TWO SERVICE & TWO GENERATOR GROUND RODS.

3. UNLESS OTHERWISE NOTED, ALL WIRING SHALL BE COPPER TYPE THHN OR THWN OPERATED AT 75°C MAXIMUM. PROVIDE TERMINALS FOR FEEDERS AND BRANCH CIRCUITS WHICH ARE SUITABLE FOR THIS OPERATION.

4. PROVIDE BONDING AND GROUNDING IN COMPLIANCE WITH ARTICLE 250 OF THE NATIONAL ELECTRIC CODE.

5. OBTAIN THE AVAILABLE FAULT CURRENT FROM ELECTRIC UTILITY AT THE SERVICE TRANSFORMER SECONDARY & CALCULATE THE FAULT CURRENT AT THE SERVICE PANEL & SUBSEQUENT DISTRIBUTION PANELS. PROVIDE SERVICE EQUIPMENT, DISTRIBUTION PANELS & CIRCUIT BREAKERS RATED TO WITHSTAND THE AVAILABLE FAULT CURRENT AT EACH POINT IN THE POWER DISTRIBUTION SYSTEM. SUBMIT CALCULATIONS & WITHSTAND RATINGS TO ENGINEER FOR REVIEW & APPROVAL.

1 ONE LINE DIAGRAM

GENERAL NOTES (ALL SHEETS)

1. UNDER GROUND WIRING METHOD SHALL BE SCH 40 PVC C BURIED 18" BELOW THE SURFACE PER CODE UNLESS OTHERWISE NOTED. PROVIDE TRENCHING & BACKFILL AS RQD.

2. ABOVE GROUND WIRING METHOD SHALL BE SCH 40 PVC C SURFACE MTD & SUPPORTED PER CODE UNLESS OTHERWISE NOTED. PROVIDE WP METALLIC OR NONMETALLIC BOXES WHERE EXPOSED TO THE WEATHER.

3. WIRING METHOD INSIDE THE PUMP STATION SHALL BE SCH 40 PVC C SURFACE MTD & SUPPORTED PER CODE UNLESS OTHERWISE NOTED. PROVIDE METALLIC OR NONMETALLIC BOXES AS RQD.

4. EXCEPT AS NOTED CONDUIT RUNS WITHIN THE BUILDING SHALL BE FASTENED DIRECTLY TO WALL OR CEILING - TIGHT TO SURFACES & PARALLEL TO BUILDING LINES. LAYOUT SURFACE MTD RUNS TO AVOID CONDUITS CROSSING. PROVIDE SADDLE & BOX OFFSET BENDS AS RQD. CONDUIT SIZES INDICATED ARE MINIMUM & MAY BE INCREASED AT CONTRACTORS' OPTION BASED ON CODE OR JOB CONDITIONS.

5. UNDER GROUND (UG) WIRING OR WIRING EXPOSED TO THE WEATHER SHALL BE LISTED FOR USE IN WET LOCATIONS.

KEYED NOTES (THIS SH)

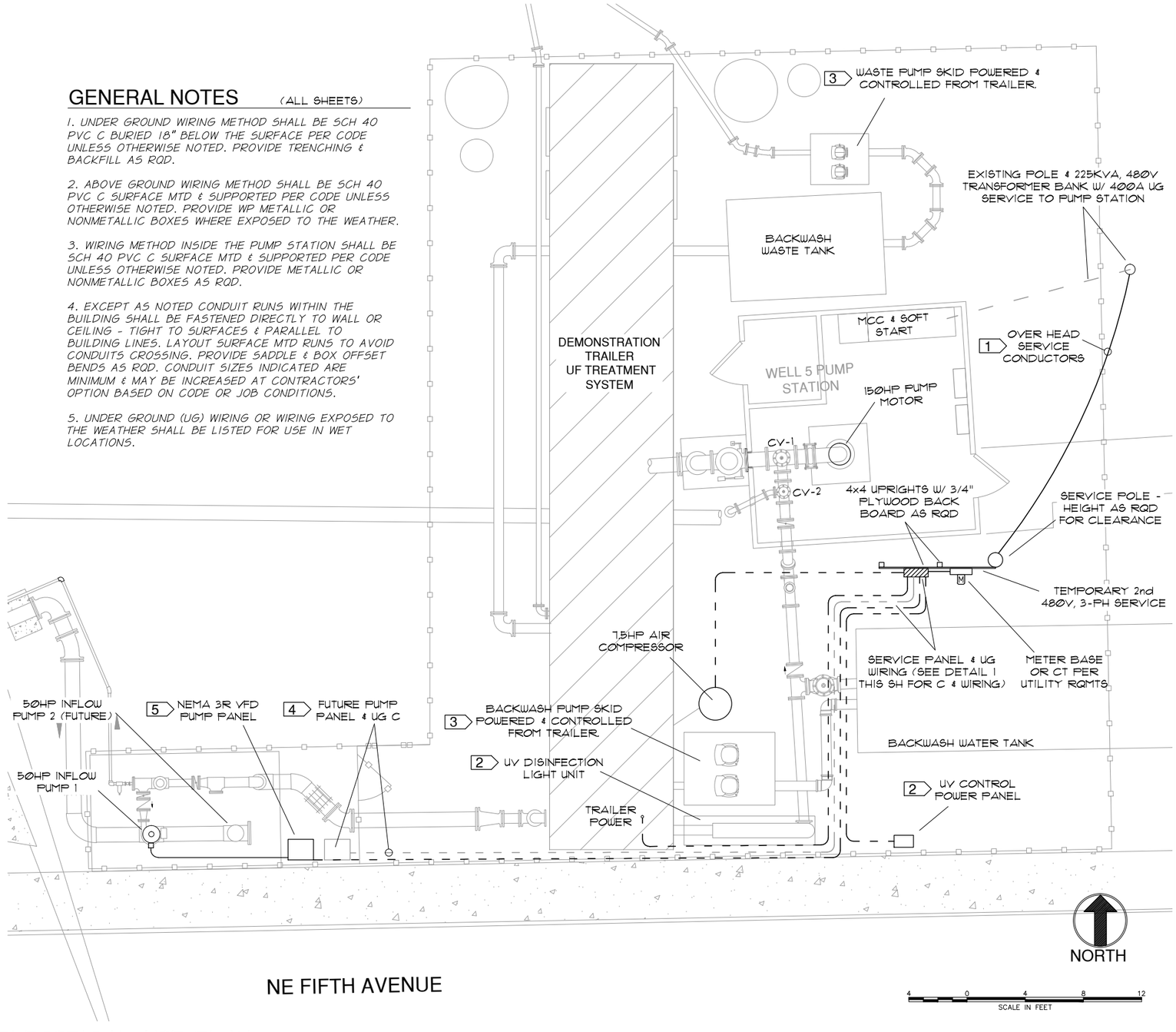
1. CONTRACTOR SHALL PROVIDE ALL COORDINATION & SCHEDULING W/ ELECTRIC UTILITY FOR INSTALLATION OF SECOND SERVICE. UTILITY CHARGES FOR INSTALLATION WILL BE PAID BY THE CITY DIRECTLY TO THE UTILITY.

2. UV SYSTEM TO BE PROVIDED W/ 25' PRE-WIRED CABLE CONNECTING PANEL TO UV LIGHT UNIT & 480V TO 240V TRANSFORMER. MT PANEL AT 66" AFG ON VERTICAL STRUT UPRIGHT ASSEMBLY SET IN CONCRETE BASE.

3. WIRING FOR DEMO TRAILER COMPONENTS NOT SHOWN. PROVIDE THESE CONNECTIONS AS RQD PER TRAILER MANUFACTURER INSTRUCTIONS.

4. PROVIDE UG C ONLY FOR FUTURE INFLOW PUMP 2.

5. NEMA 3R ENCLOSED VFD DRIVE PANEL. EGS 6-PULSE VFD W/ 5% DUAL DC LINK CHOKE, 50HP, 480V, 3-PH INPUT. CIRCUIT BREAKER DISCONNECT, 100KAIC RATED, 22mm HOA & INDICATOR LIGHTS, BX ENCLOSURE, VARNISHED BOARDS, ETHERNET/IP CONTROL INTERFACE. EATON CATALOG # EGS0654A3200C0000 OR EQUAL. MT PANEL AT 66" AFG ON VERTICAL STRUT UPRIGHT ASSEMBLY SET IN CONCRETE BASE.



2 ELECTRICAL SITE PLAN

1/4" = 1' - 0" (AT FULL SHEET SIZE)

REGISTERED PROFESSIONAL ENGINEER
60814PE
OREGON
MAY 17, 1999
JACK TERRY
EXP.: JUNE 30, 2020
DATE SEALED: 10/31/2018

REVISION	BY	DATE

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DESIGNED BY J. TERRY
DRAWN BY J. TERRY
REVIEWED BY J. WELLS

JOB NUMBER 7008-625 DATE October 31, 2018
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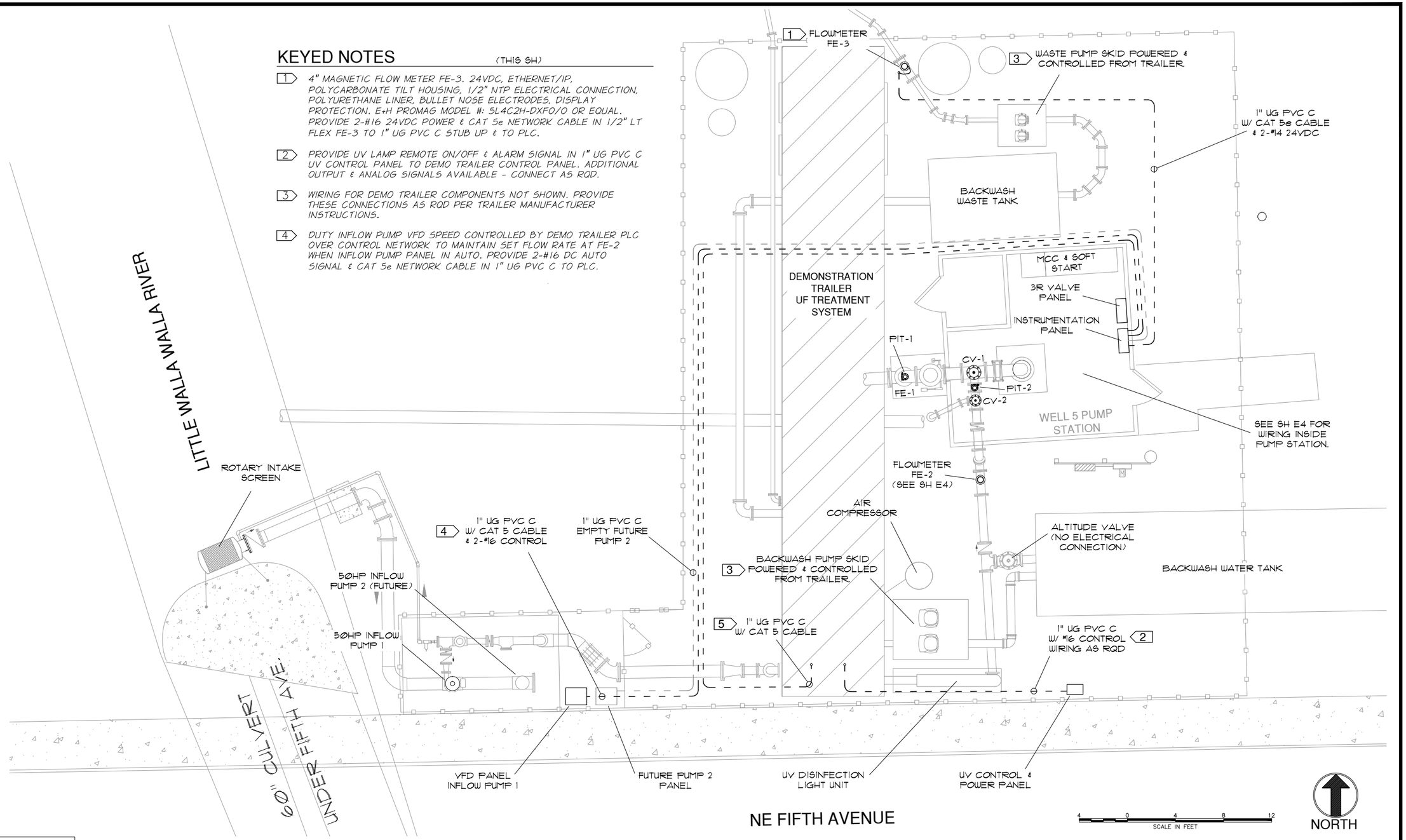
WALLA WALLA BASIN WATERSHED COUNCIL
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

ELECTRICAL SITE PLAN

SHEET
E2

KEYED NOTES (THIS SH)

1. 4" MAGNETIC FLOW METER FE-3. 24VDC, ETHERNET/IP, POLYCARBONATE TILT HOUSING, 1/2" NTP ELECTRICAL CONNECTION, POLYURETHANE LINER, BULLET NOSE ELECTRODES, DISPLAY PROTECTION. E+H PROMAG MODEL #: 5L4C2H-DXF0/0 OR EQUAL. PROVIDE 2-#16 24VDC POWER & CAT 5e NETWORK CABLE IN 1/2" LT FLEX FE-3 TO 1" UG PVC C STUB UP & TO PLC.
2. PROVIDE UV LAMP REMOTE ON/OFF & ALARM SIGNAL IN 1" UG PVC C UV CONTROL PANEL TO DEMO TRAILER CONTROL PANEL. ADDITIONAL OUTPUT & ANALOG SIGNALS AVAILABLE - CONNECT AS RQD.
3. WIRING FOR DEMO TRAILER COMPONENTS NOT SHOWN. PROVIDE THESE CONNECTIONS AS RQD PER TRAILER MANUFACTURER INSTRUCTIONS.
4. DUTY INFLOW PUMP VFD SPEED CONTROLLED BY DEMO TRAILER PLC OVER CONTROL NETWORK TO MAINTAIN SET FLOW RATE AT FE-2 WHEN INFLOW PUMP PANEL IN AUTO. PROVIDE 2-#16 DC AUTO SIGNAL & CAT 5e NETWORK CABLE IN 1" UG PVC C TO PLC.



1 INSTRUMENTATION & CONTROL SITE PLAN

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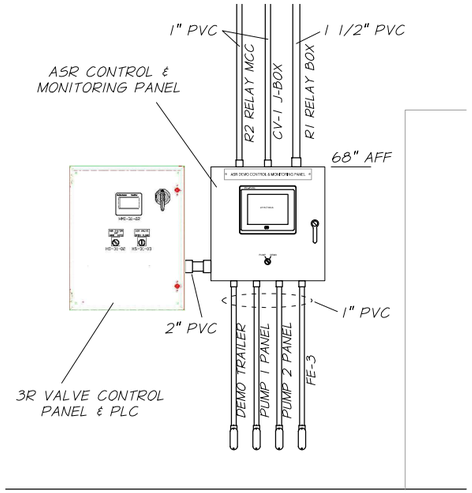
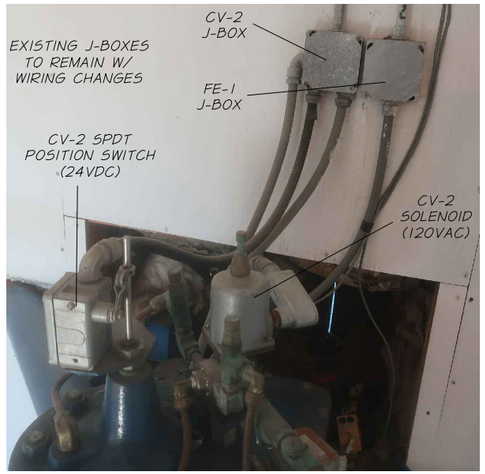
INSTRUMENTATION & CONTROL SITE PLAN

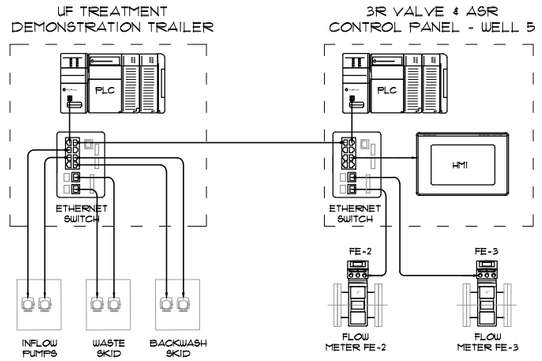
SHEET
E3



1 PANEL ELEVATION



3 EXISTING CLAY VALVE CV-2



2 NETWORK CONTROL DIAGRAM

KEYED NOTES (THIS SH)

1. PROVIDE 3-#16 24V SPDT POSITION SWITCH & 2-#14 120V SOLENOID IN LT FLEX CV-1 TO J-BOX THEN 1" C TO ASR CONTROL PANEL & PLC. NEW CLAY VALVE CV-1 CONTROLLED BY PLC IN PUMP & DEMO MODES. OPEN/CLOSE VIA 120V SOLENOID (S) - POSITION (P) VIA 24V SPDT SWITCH.

2. EXISTING MECHANICAL FLOW METER FE-1 24V PULSE OUTPUT CONNECTS TO EXISTING MCC TELEMETRY PANEL. PROVIDE 2-#16 IN LT FLEX FE-1 TO CV-2 J-BOX THEN TO 1 1/2" OH C TO ASR CONTROL PANEL & PLC.

3. NEW PRESSURE TRANSDUCERS PIT-1 & 2. OUTPUT 4-20mA HART, LCD DISPLAY, PUSH BUTTON, ELECTRICAL CONNECTION VIA 1/2" NTP, SENSOR RANGE 0-150 PSI, PROCESS CONNECTION 1/2" MNTP. E+H MODEL #: PMC51-64X00/01 OR EQUAL. PROVIDE SHIELDED TWISTED PAIR 4-20mA CABLE LOOP EACH SENSOR IN LT FLEX TO R1 RELAY BOX THEN 1 1/2" OH C TO ASR CONTROL PANEL & PLC.

4. EXISTING CLAY VALVE CV-2 TO BE W/ SAME FUNCTIONALITY IN PUMP MODE. IN DEMO MODE PLC WILL ENERGIZE 24VDC RELAY R1 IN ENCLOSURE WHERE CONTACTS WILL BE WIRED TO PROVIDE PLC CONTROL OF CV-2 SOLENOID. PROVIDE 2-#16 24V COIL, 3-#16 SPDT POSITION SWITCH & 2-#14 120V SOLENOID IN FLEX CV-2 TO RELAY J-BOX THEN 1 1/2" C TO ASR CONTROL PANEL & PLC. SEE X ON EX FOR CONTROL DIAGRAM.

5. PROVIDE SUITABLE ENCLOSURE FOR RELAY R1 & AGGREGATION OF CONDUITS & WIRING FROM FE-1 & 2, PIT-1 & 2, FE-2, CV-2 & LIT-1 TO ASR PANEL & PLC VIA 1 1/2" OH C.

6. 8" MAGNETIC FLOW METER FE-2. 24VDC, ETHERNET/IP, POLYCARBONATE TILT HOUSING, 1/2" NTP ELECTRICAL CONNECTION, POLYURETHANE LINER, BULLET NOSE ELECTRODES, DISPLAY PROTECTION. E+H PROMAG MODEL #: 5L4C2H-DXF0/0 OR EQUAL. PROVIDE 2-#16 24VDC POWER & CAT 5e NETWORK CABLE VIA SHORT 1/2" LT FLEX FE-2 TO 1" PVC C THEN TO R1 RELAY BOX & 1 1/2" OH C TO ASR PANEL & PLC.

7. DEMO MODE PUMP INHIBIT. WIRE RELAY R2 SINGLE OR MULTIPOLE CONTACTS IN PUMP CONTROL CKT TO INHIBIT PUMP OPERATION IN ALL HOA MODES WHEN RELAY R2 COIL IS ENERGIZED BY PLC. PROVIDE 2-#16 FROM COIL TO 1" OH C TO ASR PANEL & PLC.

8. PROVIDE 1" C W/ 20A, 120V #12 CKTS AS REQ'D FROM 120/240 VAC PANEL IN MCC TO 3R VALVE CONTROL PANEL & ASR CONTROL PANEL.

9. SUBMERSIBLE LEVEL TRANSMITTER LIT-1. 0-175' WATER, 250' POLYURETHANE MOLDED, VENTED INTERGRAL CABLE, 0.69" DIA X 7.1" LENGTH, STAINLESS STEEL HOUSING, 2 WIRE 4-20mA, 10-35 VDC. PMC ENGINEERING VL-4-3-1-3-250 OR EQUAL. INSTALL TRANSDUCER IN WELL AT PUMP LEVEL IN 1" PROTECTIVE PVC PIPE. ROUTE CABLE FROM WELL PLATE IN 1/2" LT FLEX TO R1 RELAY J-BOX & SPLICE TO TSP THEN VIA 1 1/2" OH C TO ASR PANEL & PLC.

CONTROL NARRATIVE - PUMP MODE

PRECONDITIONS:
A. MCC HOA IN AUTO W/ RESERVOIR CALLING FOR WATER OR HOA IN HAND POSITION.
B. ASR CONTROL PANEL PUMP/DEMO SWITCH IN PUMP MODE (RELAY R1 & R2 DEENERGIZED)
C. CLAY VALVE START POSITION: CV-1 OPEN (120V ON SOLENOID), CV-2 OPEN (0V ON SOLENOID)

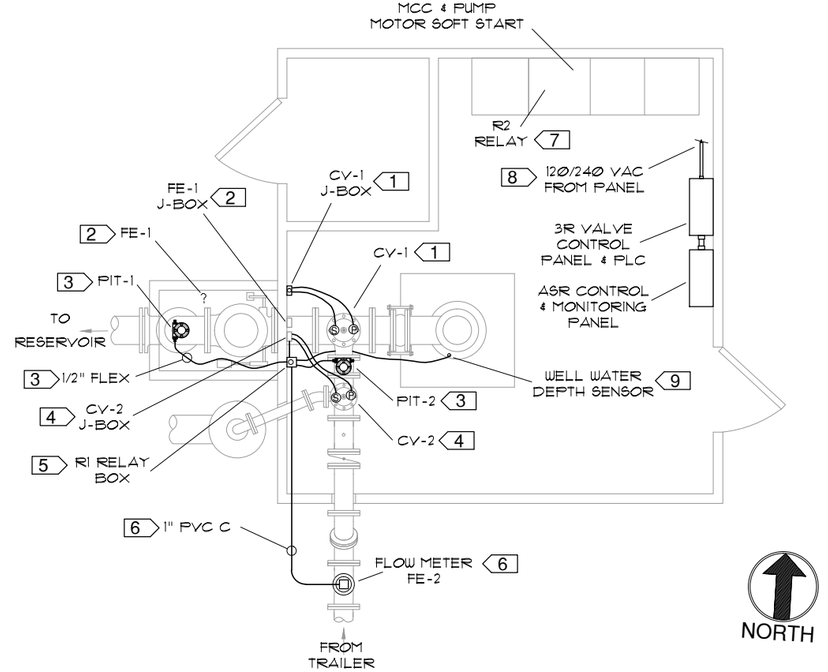
OPERATION:
1. SELECTING PUMP MODE (PUMP/DEMO SWITCH) SHALL INITIATE FOLLOWING PLC ACTIONS:
   DEENERGIZE RELAYS R1 & R2 (TRANSFERS CV-2 CONTROL TO MCC, REMOVE PUMP RUN INHIBIT).
   CLOSE THE DOWN HOLE 3R VALVE.
   OPEN CV-1 (APPLY 120VAC TO CV-1 SOLENOID)
2. WATER PRELUBE STARTS & RUNS FOR A PRESET TIME (8 MINUTES)
3. AFTER PRELUBE PUMP STARTS & RUNS FOR PRESET AIR PURGE TIME (1 MINUTE)
4. AFTER PURGE CV-2 WILL CLOSE (120V ON SOLENOID), CV-1 REMAINS OPEN.

SEE DETAIL 1 SHEET E1 FOR STARTUP & RUN SEQUENCE UNDER MCC LEGACY CONTROL.

CONTROL NARRATIVE - DEMO MODE

PRECONDITIONS:
A. ASR CONTROL PANEL PUMP/DEMO SWITCH IN DEMO MODE (RELAYS R1 & R2 ENERGIZED).
B. CLAY VALVE START POSITION: CV-1 CLOSED (0V ON SOLENOID), CV-2 OPEN (0V ON SOLENOID)

OPERATION:
1. SELECTING DEMO MODE (PUMP/DEMO SWITCH) SHALL INITIATE FOLLOWING PLC ACTIONS:
   ENERGIZE RELAYS R1 & R2 (TRANSFERS CV-2 CONTROL TO PLC, INHIBITS PUMP RUN).
   OPEN THE DOWN HOLE 3R VALVE.
   SEND PERMISSIVE SIGNAL TO TO UF TRAILER PLC TO START WATER FLOW
   WATER PURGE CYCLE BEGINS & RUNS UNTIL FE-2 REGISTERS FLOW OF XXX GALLONS.
2. AFTER PURGE CV-1 WILL OPEN (120V ON SOLENOID), CV-2 WILL CLOSE (120V ON SOLENOID)
3. AT SHUTDOWN (HMI) CV-1 & CV-2 WILL RETURN TO THEIR START POSITIONS.



4 WELL 5 PUMP STATION CONTROL PLAN

3/8" = 1' - 0" (AT FULL SHEET SIZE)

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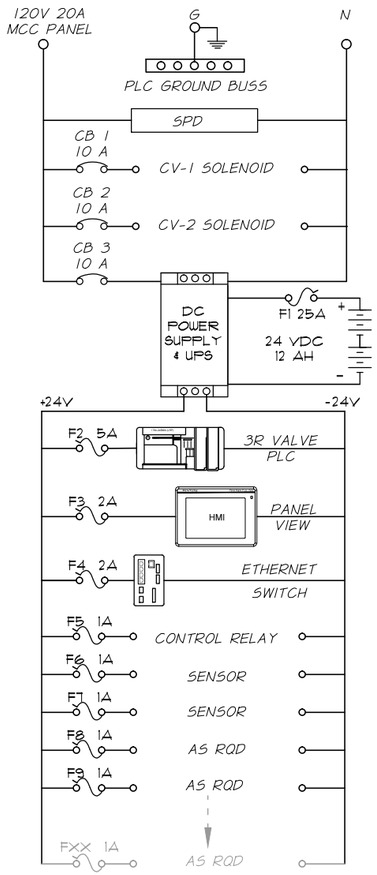
PUMP STATION CONTROL PLAN

SHEET
E4



NOTES TO CONTROL POWER DIAGRAM:

1. PROVIDE 3R VALVE PLC, ASR HMI & ASSOCIATED NETWORK W/ 24VDC FROM UNINTURPTABLE SUPPLY.

2. 24 VDC CONNECTIONS SHALL BE FUSED EITHER BY INDIVIDUAL OR RELATED COMMON CONNECTIONS.

3. VERIFY CAPACITY OF 120/240 TRANSFORMER IN MCC TO SUPPLY ADDED LOAD.

1 AC & DC CONTROL POWER

GENERAL NOTES

1. PROVIDE SURGE SUPPRESSION FOR INDUCTIVE LOADS SUCH AS CONTACTORS & CONTROL RELAYS PER ALLEN-BRADLEY PUBLICATION 1770-4.1 - FEBRUARY 1998. OR EQULIVANT.

2. PROVIDE FUSING FOR EACH 1769 COMPACT I/O DIGITAL OR ANALOG CONNECTION LEAVING THE PLC PANEL. FUSE PROTECTION SHALL BE IN DIN RAIL MODULES EITHER SINGLE OR MULTIPLE W/ BLOWN FUSE LED INDICATOR. FUSE RATING 250 MA MAXIMUM, FAST BLOW.

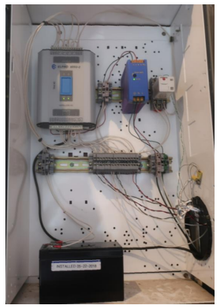
3. ANALOG 4-20 MA INPUTS & OUTPUTS SHALL BE RUN IN INDIVIDUALLY SHIELDED CONDUCTORS W/ SHIELD GROUNDED AT ONE POINT WITHIN THE PLC ENCLOSURE.

4. PLC CONTROL OF EACH VFD DRIVE SHALL BE VIA ETHERNET WHEN THE DRIVE HOA SWITCH IS IN THE AUTO POSITION. PLC & HMI DRIVE MONITORING SHALL FUNCTION WHEN THE HOA IS IN THE AUTO OR MANUAL POSITION. PROVIDE A "SOFTWARE" HOA FUNCTION ON THE HMI FOR OPERATOR CONTROL WHEN THE HOA IS IN THE AUTO POSITION. HAND OPERATION AT THE DRIVE SHALL BE INDEPENDENT OF THE PLC OR HMI.

5. PROVIDE FUSE ISOLATED DC VOLTAGE BY INDIVIDUAL FUNCTION SUCH AS SENSOR, VFD, ETC.

6. PROVIDE TWISTED & SHIELDED CONDUCTORS FOR ANALOG SIGNALS. DRY LOCATIONS: BELDEN 9501 #24, 8761 #22 OR 5340F1 #18. OR EQUAL. WET LOCATIONS: BELDEN 83702 #16 OR EQUAL.

7. CIRCUITS DIAGRAMS ILLUSTRATE DESIGN INTENT & FUNCTION. AS SUCH THEY ARE GENERAL IN NATURE. THE CONTRACTOR IS RESPONSIBLE FOR ELECTRICAL & CONTROL SYSTEM DESIGN IN ACCORDANCE WITH THE INFORMATION PROVIDED IN THE DRAWINGS & TECHNICAL SPECIFICATIONS. SUBMITTAL OF COMPLETE & DETAILED DESIGN DOCUMENTATION IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS IS REQUIRED.



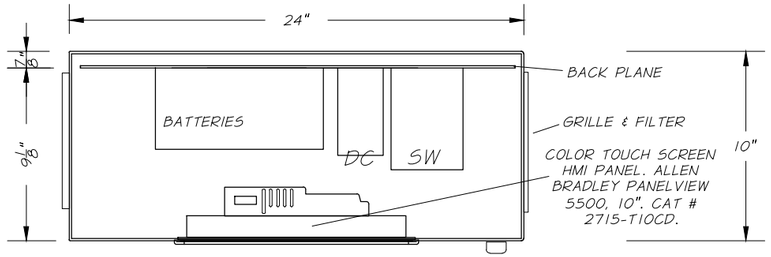
POWER OUTAGE:

1. ALARM SIGNAL ON FAULT OR POWER OUTAGE SHALL BE PROVIDED BY PLC TO EXISTING BATTERY BACKED CITY SCADA TELEMETRY RADIO LOCATED IN MCC (SEE LEFT).

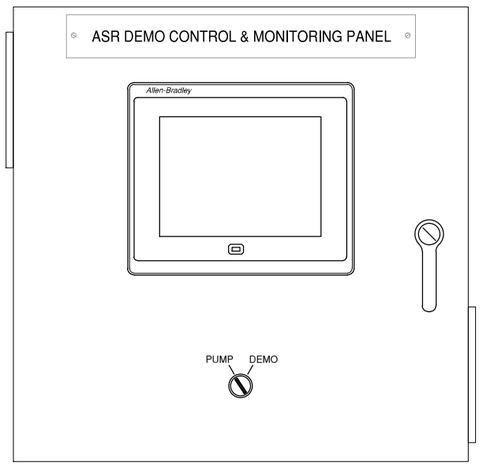
2. ASR PLC & HMI SHALL BE POWERED FROM 24V DC SUPPLY W/ BATTERY BACKUP AS INDICATED.

3. POWER OUTAGE WHILE OPERATING IN DEMO MODE SHALL REQUIRE OPERATOR INTERVENTION & MANUAL RESET TO RESTART.

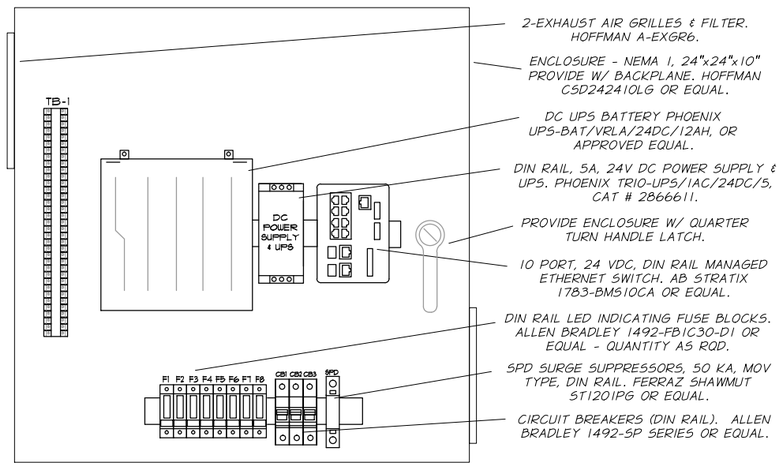
2 EXISTING TELEMETRY



ENCLOSURE DEPTH LAYOUT



OPERATOR VIEW



COMPONENT VIEW

3 ASR CONTROL & MONITORING PANEL

NTS

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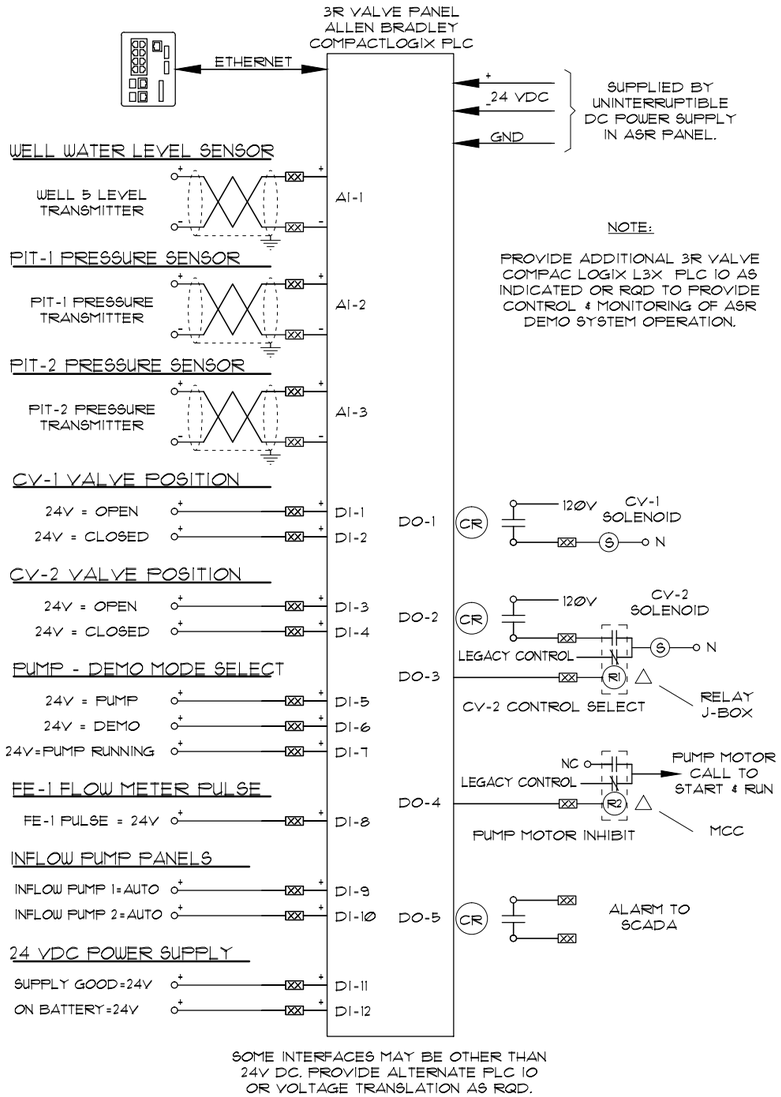
SHEET
E5



1 PLC CONNECTION DIAGRAM

PROGRAMMING - GENERAL

1. THE HUMAN MACHINE INTERFACE (HMI) SCREENS SHALL BE DESIGNED & PROGRAMMED TO PROVIDE A GRAPHICAL REPRESENTATION OF THE SYSTEM COMPONENTS, THEIR INTERCONNECTIONS & STATUS PROVIDING THE OPERATOR WITH AN OVERVIEW OF THE WATER SYSTEM OPERATIONAL STATE. THE INTEGRATOR SHALL BE RESPONSIBLE FOR THE DESIGN & LAYOUT OF HMI SCREENS IN A MANNER MEETING THE INTENT OF THE SCREEN DESIGN & FUNCTIONALITY INCLUDING THE FOLLOWING:

- PROVIDE REAL TIME OPERATOR STATUS OF STATION OPERATION
- APPROPRIATE USE OF ANIMATED GRAPHICS TO INDICATE CURRENT STATUS
- PROVIDE INTUITIVE MULTI-SCREEN NAVIGATION TO & FROM INFORMATION SCREENS
- COLLECT & DISPLAY DATA SUCH AS FLOW TOTALS REQUIRED BY THE OPERATOR
- PROVIDE MEANS FOR OPERATOR MANUAL COMPONENT OPERATION
- PROVIDE ALARM NOTIFICATION & ACKNOWLEDGMENT
- PROVIDE TREND SCREENS OF OPERATIONAL HISTORY

2. HMI SCREENS SHALL BEGIN WITH THE HOME OR TOP LEVEL SCREENS FOR PUMP & DEMO MODES OF OPERATION. COLORS SHALL BE USED IN A CONSISTENT MANNER TO INDICATE STATUS & OPERATION OF THE VARIOUS COMPONENTS OF THE SYSTEM SUCH AS PUMPS RUNNING, OFF OR OUT OF SERVICE. DEFINE THESE COLORS & THEIR CORRESPONDING SIGNIFICANCE ON A LEGEND SCREEN & USE THEM IN A CONSISTENT MANNER ON ALL SCREENS THROUGHOUT THE PROJECT. ANIMATIONS SHALL BE USED WHERE APPROPRIATE TO INDICATE CURRENT STATUS OF ITEMS SUCH AS WATER LEVEL, FLOW AND PRESSURE. PRESENCE OR ABSENCE OF NEW ALARMS OR EVENTS SHALL ALSO BE INDICATED ON THIS SCREEN.

3. TOUCH SCREEN NAVIGATION CAPABILITY OF THE DISPLAY SHALL BE USED TO PROVIDE MORE DETAILED INFORMATION FOR EACH ITEM USING SECOND & THIRD LEVEL SUB SCREENS AS REQUIRED WHICH THE OPERATOR CALLS BY TOUCHING THE ITEM OF INTEREST. WHERE SUB SCREENS MAY NOT PERTAIN TO A PARTICULAR ITEM SUCH AS A SCREEN LISTING ALARMS OR DAILY FLOW TOTALS PROVIDE A MENU STRUCTURE TO THESE ITEMS AND BACK TO THE HOME SCREEN.

4. THE DESIGN INTENT FOR THE HOME SCREEN IS TO PROVIDE THE OPERATOR AN OVERVIEW OF THE SYSTEM IN GRAPHICAL FORM. SUITABLE COLORS, GRAPHICS & ANIMATION SHALL BE PROVIDED ON THE HOME SCREEN IN ORDER TO CONVEY THE STATE OF THE WATER SYSTEM TO THE OPERATOR AT A GLANCE. PROVIDE COLOR SCREEN & COMPONENT MOCKUPS OF PROPOSED HMI LAYOUT TO THE ENGINEER FOR APPROVAL EARLY IN THE PROGRAMMING PROCESS.

5. THE SYSTEM SHALL REVERT TO THE HOME SCREEN DISPLAY AFTER AN APPROPRIATE PERIOD OF OPERATOR INACTIVITY & POWER DOWN TO A SCREEN SAVER DURING LONG PERIODS OF INACTIVITY.

PROGRAMMING - PUMP MODE

1. PUMP MODE HOME SCREEN SHALL REPRESENT RELEVANT SYSTEM COMPONENTS IN GRAPHIC FORM CLOSELY RELATED TO THEIR PHYSICAL APPEARANCE. PROVIDE PLC & HMI PROGRAMMING FOR THE USE OF ANIMATION, COLOR & REAL TIME PERFORMANCE DATA REPRESENTING THEIR CURRENT STATE. THESE SHALL INCLUDE THE PUMP, WELL WATER LEVEL (LIT-1), FLOWMETER FE-1, CLAY VALVES CV-1 & CV-2, PRESSURE TRANSMITTERS PIT-1 & PIT-2 AS WELL AS POSITION OF THE 3R VALVE.

2. PROVIDE PLC & HMI PROGRAMMING TO INDICATE ON THE MAIN SCREEN OR SUBSCREEN TOTAL FLOW TO THE RESERVOIR. PROVIDE A SET OF TREND SCREENS FOR THE PAST 48 HOURS THAT INCLUDE WELL RUN EVENTS, PIT-1 PRESSURE PROFILE, WELL WATER LEVEL & FLOW TOTALS FOR THE PAST DAY, SEVEN DAYS & MONTH.

3. PROVIDE PROGRAMMING AS RQD TO INDICATE THE CURRENT STATE OF THE PUMP ON THE MAIN SCREEN SUCH AS OFF, WATER PRELUBE IN PROCESS, PURGE IN PROCESS OR RUNNING. INDICATE THE CURRENT POSITION OF CLAY VALVES CV-1 & CV-2. PROVIDE A SUBSCREEN FOR EACH VALVE SO THAT THEY CAN BE MANUALLY OPENED OR CLOSED FROM THE HMI.

PROGRAMMING - DEMO MODE

1. DEMO MODE HOME SCREEN LIKE THE PUMP HOME SCREEN WILL REPRESENT RELEVANT SYSTEM COMPONENTS CLOSELY RESEMBLING THEIR PHYSICAL APPEARANCE. THE HOME SCREEN SHALL BE A PICTURE OF THE PROCESS ANIMATED TO INDICATE THE REAL TIME STATE. PROVIDE PLC & HMI PROGRAMMING FOR THE USE OF ANIMATION, COLOR & REAL TIME PERFORMANCE DATA. THESE SHALL INCLUDE THE WELL WATER LEVEL (LIT-1), FLOWMETERS FE-1, FE-2 & FE-3, CLAY VALVES CV-1 & CV-2, PRESSURE TRANSMITTERS PIT-1 & PIT-2 & POSITION OF THE 3R VALVE.

2. IN ADDITION TO (1) ABOVE THE DEMO HOME SCREEN SHALL DIPECT THE REMAINING SYSTEM COMPONENTS ASSOCIATED WITH THE DEMO TRAILER & THEIR STATUS. THESE INCLUDE BACKWASH PUMPS, WASTE PUMPS, INFLOW PUMPS & UV DISINFECTION STATUS.

3. PROVIDE PLC & HMI PROGRAMMING TO INDICATE ON THE MAIN SCREEN OR SUBSCREEN TOTAL ASR FLOW INTO THE WELL FOR THE PAST DAY, SEVEN DAYS & MONTH. PROVIDE A SET OF TREND SCREENS FOR THE PAST 48 HOURS THAT INCLUDE BACKWASH, PUMP TO WASTE & OTHER RELAVENT EVENTS. PROVIDE 48 HOUR TREND DISPLAY FOR FE-2 & FE-3 FLOW RATE. PROVIDE REAL TIME PIT-1 PRESSURE PROFILE, WELL WATER LEVEL & FLOW TOTALS FOR THE PAST DAY, SEVEN DAYS & MONTH.

4. PROVIDE PROGRAMMING AS RQD TO INDICATE THE CURRENT POSITION OF CLAY VALVES CV-1 & CV-2. PROVIDE A SUBSCREEN FOR EACH VALVE SO THAT THEY CAN BE MANUALLY OPENED OR CLOSED FROM THE HMI.

5. PROVIDE PROGRAMMING TO ACKNOLEDGE PRESENCE OF ALTITUDE VALVE CONTROLLING FILL OF THE BACKWASH WATER TANK. WHEN THIS TANK REQUIRES WATER THERE WILL BE DIMINIDHED FLOW AT FE-2 UNTIL THE TANK HAS FILLED. REDUCED FLOW AT FE-2 SHOULD RESULT IN THE DUTY INFLOW PUMP OPERATING AT LINE (IE FULL) SPEED. THIS EVENT SHALL BE DETECTED OVER THE CONTROL NETWORK TO DISPLAY & INDICATE THE BACKWASH TANK IS FILLING.

6. PROVIDE PLC & HMI PROGRAMMING TO INDICATE STATUS OF PUMPS IN THE SYSTEM SUCH AS THE DUTY BACKWASH PUMP, WASTE PUMP & INFLOW PUMP. THIS INFORMATION SHALL BE OBTAINED OVER THE CONTROL NETWORK FROM THE DEMO TRAILER PLC.

PROGRAMMING - ALARMS

1. OPERATOR ALARMS RECOGNIZED BY THE PLC SHALL BE LOGGED BY THE HMI OR PLC AS THEY OCCUR. EACH ALARM SHALL CARRY A SHORT ASSOCIATED EMBEDDED WORD DESCRIPTION, INCLUDE A TIME STAMP AND BE LISTED IN CHRONOLOGICAL ORDER STARTING WITH THE MOST RECENT.

2. ALARMS SHALL INDICATE AN IMMEDIATE OR URGENT SITUATION REQUIRING OPERATOR INTERVENTION. PRESENCE OF AN ACTIVE ALARM SHALL BE INDICATED ON THE HMI HOME SCREENS USING A FLASHING MESSAGE TO ATTRACT ATTENTION. ON APPROPRIATE SUB SCREENS PROVIDE A LISTING OF THE MOST RECENT 50 ALARMS CHRONOLOGICALLY. PROVIDE MEANS FOR ACKNOWLEDGING ALARMS INCLUDING A TIME STAMP FOR SUCH ACTIONS. INDICATE STATUS OF PAST ALARMS SUCH AS ACTIVE, ACKNOWLEDGED OR CLEARED. ONCE AN ALARM IS ACKNOWLEDGED IT SHALL REMAIN ON THE LIST UNTIL REPLACED. THE OPERATOR SHALL BE ABLE TO MANAGE, VIEW & ACKNOWLEDGE ALARMS ON THE HMI WHILE PRESENT AT THE PUMP STATION.

3. ALARMS SHALL INCLUDE BUT NOT NECESSARILY BE LIMITED THOSE IDENTIFIED HEREIN & SUMMARIZED BELOW:

1. WASTE PUMP CALLED TO RUN WITH NO OR LOW FLOW
2. BACKWASH PUMP CALLED TO RUN WITH NO OR LOW FLOW
3. HIGH OR LOW WELL WATER LEVEL (2-ALARMS)
4. UTILITY POWER OUTAGE
5. 3R VALVE POSITION INDICATION MISSING OR ERROR
6. UV SYSTEM FAIL
7. DC UPS FAIL
8. CLAY VALVE CV-1 NOT RESPONDING
9. CLAY VALVE CV-2 NOT RESPONDING

EACH ALARM SHALL BE OPERATOR SELECTABLE ON OR OFF.

REGISTERED PROFESSIONAL ENGINEER
60814PE
OREGON
MAY 17, 1999
JACK TERRY
EXP.: JUNE 30, 2020
DATE SEALED: 10/31/2018

REVISION	BY	DATE

DESIGNED BY J. TERRY
DRAWN BY J. TERRY
REVIEWED BY J. WELLS

JOB NUMBER 7008-625 DATE October 31, 2018
ACAD FILE:

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engineering surveying natural resources

WALLA WALLA BASIN WATERSHED COUNCIL
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

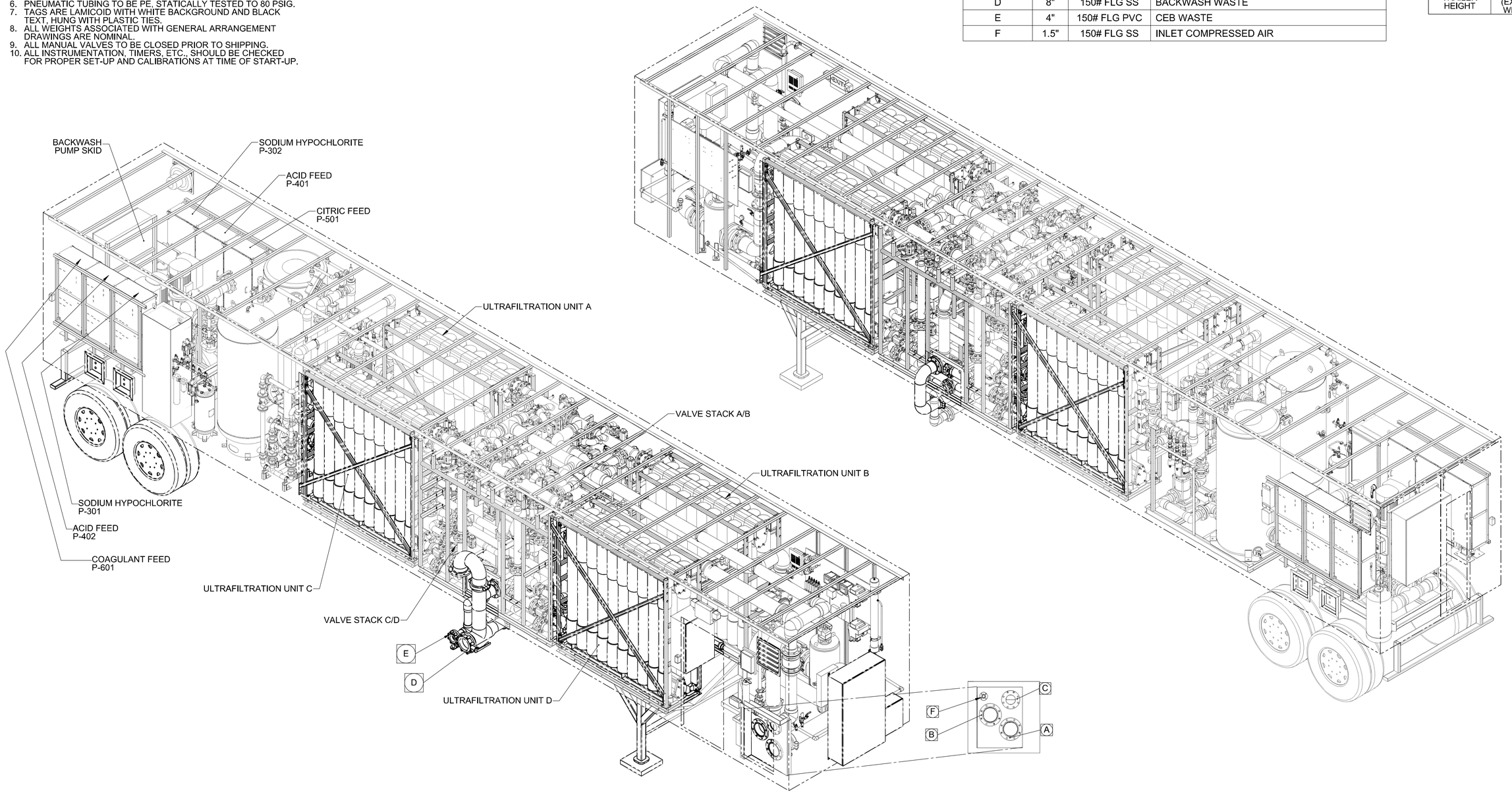
PLC CONNECTION DIAGRAM

SHEET
E6

NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL DIMENSIONS ARE IN INCHES. ALL TOLERANCES ARE +/- 1/2".
2. BOLT HOLE PATTERN OF FLANGES TO STRADDLE PRINCIPLE CENTERLINE OF PIPE.
3. ALL GASKETS TO BE EPDM.
4. ALL CONDUIT TO BE PVC.
5. ALL MOUNTING HARDWARE TO BE STAINLESS STEEL..
6. PNEUMATIC TUBING TO BE PE, STATICALLY TESTED TO 80 PSIG.
7. TAGS ARE LAMICOID WITH WHITE BACKGROUND AND BLACK TEXT, HUNG WITH PLASTIC TIES.
8. ALL WEIGHTS ASSOCIATED WITH GENERAL ARRANGEMENT DRAWINGS ARE NOMINAL.
9. ALL MANUAL VALVES TO BE CLOSED PRIOR TO SHIPPING.
10. ALL INSTRUMENTATION, TIMERS, ETC., SHOULD BE CHECKED FOR PROPER SET-UP AND CALIBRATIONS AT TIME OF START-UP.

CONNECTION POINTS			
CONNECTION	SIZE	TYPE	DESCRIPTION
A	8"	150# FLG SS	INLET, FEED WATER
B	8"	150# FLG SS	OUTLET, FILTERED WATER TO STORAGE
C	6"	150# FLG PVC	INLET, FROM BACKWASH PUMP SKID
D	8"	150# FLG SS	BACKWASH WASTE
E	4"	150# FLG PVC	CEB WASTE
F	1.5"	150# FLG SS	INLET COMPRESSED AIR

GENERAL ARRANGEMENT SPECIFICATIONS	
TRAILER LENGTH	54' - 03"
TRAILER WIDTH	102 3/8"
TRAILER HEIGHT	108-1/2" (EXCLUDE WHEELS)



THIRD ANGLE PROJECTION

STD: BORDER-0106-22X34D

INTL REF:INTR_REF_NO

PRINT NOT TO SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATED CONNECTION BOX LOCATIONS	1/4/2018	JAB	DRA	DRA	
0	ISSUE FOR CONSTRUCTION	6/9/17	JAB	DRA	DRA	

		DATE
DESIGNER	JAB	1/27/17
CHECKER	DRA	1/27/17
ENGINEER	DRA	1/27/17
MANAGER	SL	1/27/17
SCALE:	1:30	

TITLE: GENERAL ARRANGEMENT
TRAILER, UF SKID (MEMCOR)

CLIENT: EVOQUA WATER TECHNOLOGIES
COLORADO SPRINGS, CO

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	SAP NUMBER	DRAWING	SHEET	REV
2034/UFM000	W3T387911	0100	1 OF 7	1

FLOWS & LINES

- NEW MAJOR WATER FLOW LINES, AND REVISION CLOUDS
- NEW MINOR WATER FLOW LINES, NEW CHEMICAL FLOW LINES, NEW MAIN EQUIMENT, NEW CONCRETE BARRIERS
- NEW AIR FLOW LINES, NEW SECONDARY EQUIPMENT,
- NEW VALVES, NEW INSTRUMENTATION SYMBOLS, NEW FITTINGS, NEW INSTRUMENTATION LINES
- FUTURE FLOW LINES & EQUIPMENT
- EXISTING FLOW LINES & EQUIPMENT
- PACKAGE UNIT/SKID LIMITS
- PNEUMATIC LINES
- DATALINK
- DCS–PLC
- HYDRAULIC WATER LINES
- CAPILLARY
- EQUIPMENT DETAILS (HATCHING, INTERIOR COMPONENTS, ETC.)
- BY CUSTOMER

LINE CONTINUATIONS — INDICATES A LINE GOING TO OR COMING FROM BATTERY LIMITS (CONTRACT LIMITS)

LINE CONTINUATIONS (5 | A 2) — INDICATES CONTINUATION OF LINE IS ON SHEET NUMBER 5 (SAME DRAWING NUMBER) IN ZONE A–2.

SHT 5 SIGNAL CONTINUATIONS — INDICATES CONTINUATION OF A SIGNAL IS ON SHEET NUMBER 5.

LINE CONTINUATIONS — INDICATES A LINE GOING TO OR COMING FROM BATTERY LIMITS (CONTRACT LIMITS)

MATERIAL DESIGNATION CHANGE OVER: CPVC | PVC

LINE IDENTIFIER: 3" PVC — PIPING MATERIAL, NOMINAL LINE SIZE

ACTUATOR SYMBOLS

- CYLINDER
- DIAPHRAGM
- DOUBLE DIAPHRAGM
- ELECTRO–PNEUMATIC
- MOTOR
- POSITIONER
- RELIEF
- SOLENOID
- MANUAL ACTUATOR
- FAIL CLOSED
- FAIL OPEN
- LIMIT STOP

VALVE SYMBOLS

- 3–WAY
- 4–WAY
- AIR RELEASE
- AIR RELIEF (SP=___ PSIG, PSV)
- BALL
- BUTTERFLY
- BLOCK & BLEED
- CHECK
- DIAPHRAGM
- GATE
- GLOBE
- KNIFE
- NEEDLE
- PLUG
- PRESSURE REDUCING
- RELIEF
- VACUUM BREAKER (STYLE 1)
- CONSERVATION
- Y – DIAPHRAGM

PIPING ACCESSORIES

- DIAPHRAGM SEAL
- DRAIN
- EDUCTOR/EJECTOR (ED)
- EXPANSION JOINT (EXP)
- FLANGE
- FLEXIBLE HOSE (H)
- HOSE CONNECTION
- INSULATION
- INSULATED PIPE WITH ELECTRIC HEAT TRACE (E)
- INSULATED PIPE WITH STEAM HEAT TRACE (S)
- ORIFICE
- PIGTAIL
- PULSATION DAMPENER (R)
- PUMP
- METERING PUMP
- QUICK DISCONNECT
- REDUCER (CONCENTRIC)
- REDUCER (ECCENTRIC)
- RUPTURE DISK
- SANITARY COUPLING
- SIGHT FLOW INDICATOR (X)
- SIGHT FLOW STRAINER (S)
- SPRAYBALL
- STATIC MIXER (M)
- STEAM TRAP (T, ST)
- STRAINER (S)
- VIC COUPLING

INSTRUMENTATION, ELECTRICAL AND RELATED ITEMS

- MAGNETIC FLOW METER
- SONIC FLOW METER
- TURBINE FLOW METER
- VORTEX FLOW METER
- PADDLEWHEEL FLOW METER
- ROTAMETER
- PILOT LIGHT
- VARIABLE FREQUENCY DRIVE (VFD)
- CALIBRATION COLUMN
- ULTRASONIC SENSOR

	PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR (IE: LOCAL PANEL MOUNTED)	FIELD MOUNTED (IE: PIPE MOUNTED)	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR (IE: REMOTE PANEL MOUNTED)	LOCATION NORMALLY INACCESSIBLE TO OPERATOR (IE: MOUNTED INSIDE PANEL)	BY OTHERS**
DISCRETE INSTRUMENTS	1 IP1*	2	3	4	5
SHARED DISPLAY, SHARED CONTROL	6	7	8	9	10
COMPUTER FUNCTION	11	12	13	14	15
PROGRAMMABLE LOGIC CONTROL	16	17	18	19	20

* ABBREVIATIONS OF THE USER'S CHOICE SUCH AS IP1 (INSTRUMENT PANEL #1), IC2 (INSTRUMENT CONSOLE #2), CC3 (COMPUTER CONSOLE #3), ETC., MAY BE USED WHEN IT IS NECESSARY TO SPECIFY, INSTRUMENT OR FUNCTION LOCATION.
** PRIMARY LOCATION SYMBOL FOR EACH INSTRUMENT TYPE IS SHOWN AS AN EXAMPLE OF "BY OTHERS"
*** AI,AO,DI,DO

INSTRUMENT TAG NUMBERS

TIC–SCH10–01 – INSTRUMENT IDENTIFICATION OR TAG NUMBER
- LOOP NUMBER
- MATERIAL IDENTIFIER
- FUNCTIONAL IDENTIFICATION

WHERE:
(LEGEND BASED ON ISA STANDARD S 5.1)

ISA INSTRUMENT IDENTIFICATION TABLE

	FIRST LETTER		SUCCEEDING LETTERS	
	PROCESS VARIABLE	MODIFIER (IF NEEDED)	READOUT OR COMPUTER FUNCTION	MODIFIER (IF NEEDED)
A	ANALYSIS		ALARM	
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE		CONTROL	
D	USER'S CHOICE	DIFFERENTIAL		
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)	
F	FLOW RATE	RATIO (FRACTION)		
G	USER'S CHOICE		GLASS, VIEWING DEVICE	
H	HAND			HIGH
I	CURRENT (ELECTRICAL)		INDICATE	
J	POWER	SCAN		
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE	CONTROL STATION	
L	LEVEL		LIGHT	LOW
M	USER'S CHOICE	MOMENTARY		MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)	
P	PRESSURE, VACUUM		POINT (TEST CONNECTION)	
Q	QUANTITY	INTEGRATE, TOTALIZE		
R	RADIATION		RECORD	
S	SPEED, FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECH. ANALYSIS		VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL	
X	UNCLASSIFIED	X–AXIS	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y–AXIS	RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z–AXIS	DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

ABBREVIATIONS

B	–	BLOWER OR AIR HANDLING
CDI	–	CONTINUOUS DEIONIZATION CELL PACK
CFM	–	CUBIC FEET PER MINUTE
CS	–	CARBON STEEL
CW	–	CITY WATER (POTABLE)
DA	–	STEAM DEAERATOR
DIA	–	DIAMETER
DWG	–	DRAWING
EPSS	–	ELECTRO POLISHED STAINLESS STEEL
F	–	FILTER VESSEL (CARTRIDGE, MEDIA, CARBON, PRECOAT, AIR)
FC	–	FAIL CLOSED
FDD	–	FORCED DRAFT DECARBONATOR VESSEL
FO	–	FAIL OPEN
FRP	–	FIBERGLASS REINFORCED PLASTIC
GAL	–	GALLONS
GPD	–	GALLONS PER DAY
GPH	–	GALLONS PER HOUR
GPM	–	GALLONS PER MINUTE
HG	–	INCHES OF MERCURY
HOA	–	HAND/OFF/AUTO
HP	–	HORSEPOWER
HDPE	–	HIGH DENSITY XXX XXX
HX	–	HEAT EXCHANGER
IA	–	INSTRUMENT AIR
ID	–	INSIDE DIAMETER
IX	–	ION EXCHANGER
M	–	MIXER (AGITATOR, AERATOR)
MD	–	MEMBRANE DEGASIFIER CONTACTOR
MMF	–	MULTI–MEDIA FILTER
MOC	–	MATERIAL OF CONSTRUCTION
MW	–	MANWAY
NO	–	NORMALLY OPEN
NC	–	NORMALLY CLOSED
NF	–	NANOFILTER
OD	–	OUTSIDE DIAMETER
OZ	–	OZONE GENERATOR
P	–	PUMP
PE	–	POLYETHYLENE
PP	–	POLYPROPYLENE
PSIA	–	POUNDS PER SQUARE INCH – ABSOLUTE
PSID	–	POUNDS PER SQUARE INCH – DIFFERENTIAL
PSIG	–	POUNDS PER SQUARE INCH – GAUGE
PVC	–	POLY VINLY CHLORIDE
PVDF	–	POLYVINYLIDENE FLUORIDE
PW	–	PLANT WATER
RO	–	REVERSE OSMOSIS
RPM	–	REVOLUTIONS PER MINUTE
SB	–	SPRAYBALL
SCFM	–	STANDARD CUBIC FEET PER MINUTE
SCH	–	SCHEDULE
SG	–	SPECIFIC GRAVITY
SP	–	SETPOINT
SS	–	STAINLESS STEEL
SSH	–	STRAIGHT SIDE HEIGHT
SST	–	STAINLESS STEEL TUBE
SW	–	SEAL WATER
T	–	TANK (LIQUID OR CHEMICAL STORAGE, NEUTRALIZATION)
TDH	–	TOTAL DYNAMIC HEAD (FEET OF FLUID)
TYP	–	TYPICAL
UF	–	ULTRAFILTER MODULE
UV	–	ULTRAVIOLET LIGHT (STERILIZER, TOC OR O3 REMOVAL)
VAC	–	VACUUM
VD	–	VACUUM DEGASIFIER VESSEL
VFD	–	VARIABLE FREQUENCY DRIVE
WC	–	WATER COLUMN

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
4	ENGINEERING CHANGES	4/20/18	DRA	KW	JT	
3	ENGINEERING CHANGES	2/22/18	DRA	KW	JT	
2	ENGINEERING CHANGES	5/10/17	DRA	JMP	ZW	
1	ENGINEERING CHANGES	1/17/17	DRA	JMP	ZW	
0	RELEASE FOR CONSTRUCTION	12/9/16	DRA	JMP	ZW	

DESIGNER	DRA 12/1/16
CHECKER	JMP 12/1/16
ENGINEER	DRA 12/1/16
MANAGER	ZW 12/1/16
FILE:	2034/UFM000–9100_0
SCALE:	NONE

TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
LEGEND SHEET ONE
UF TRAILER – MEMCOR UF

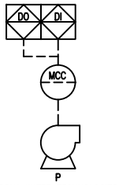
CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719–570–9600

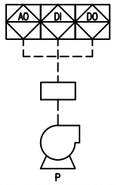
PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	1 OF 18	4

STD: BORDER–0106–24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

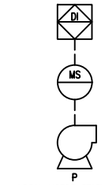
PUMP DIAGRAM NOTES:
1. HAND–OFF–AUTO (H–O–A) COULD BE REPLACED BY HAND–OFF (H–O).
2. MOTOR CONTROL CENTER (MCC), MOTOR STARTER (MS), VARIABLE FREQUENCY DRIVE (VFD) OR DISCONNECT SWITCH (DS) COULD BE BY CUSTOMER OR EVOQUA WATER TECHNOLOGIES.
3. ZS INDICATES VOLUME ADJUSTMENT, EITHER FREQUENCY OR STROKE LENGTH. EXAMPLE INDICATES ADJUSTMENT FROM THE PLC.
4. THE POSITIVE DISPLACEMENT PUMP CAN HAVE THE SAME COMBINATIONS AS SHOWN FOR THE CENTRIFUGAL PUMP.



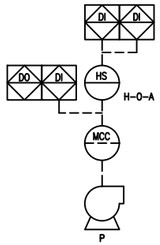
EVOQUA WATER TECHNOLOGIES SUPPLIED STARTER OR VFD TO PLC



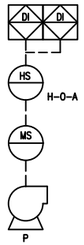
EVOQUA WATER TECHNOLOGIES SUPPLIED VFD



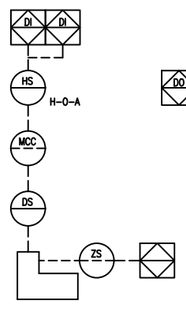
LOCAL MOTOR STARTER TO PLCS



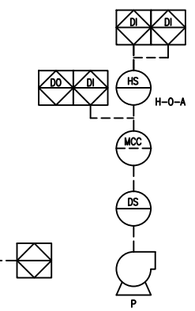
EVOQUA WATER TECHNOLOGIES SUPPLIED STARTER OR VFD TO SELECTOR SWITCH THEN PLC



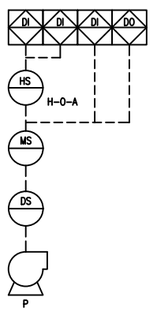
LOCAL MOTOR STARTER TO SELECTOR SWITCH THEN PLC



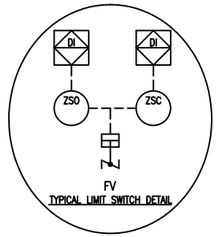
POSITIVE DISPLACEMENT PUMP WITH EVOQUA SUPPLIED DISCONNECT SWITCH AND STARTER OR VFD TO SELECTOR SWITCH THEN PLC.



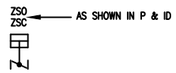
EVOQUA WATER TECHNOLOGIES SUPPLIED DISCONNECT SWITCH AND STARTER OR VFD TO SELECTOR SWITCH



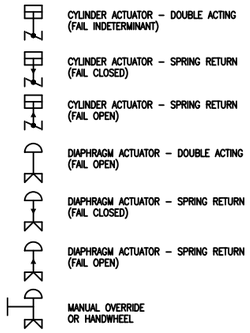
LOCAL MOTOR STARTER TO DICONNECT SWITCH TO SELECTOR SWITCH THEN PLC

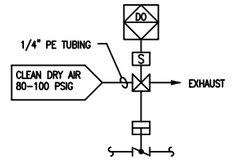


TYPICAL LIMIT SWITCH DETAIL

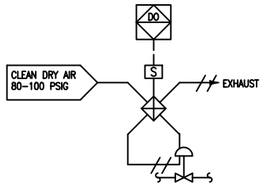


AUTO VALVE ACTUATORS

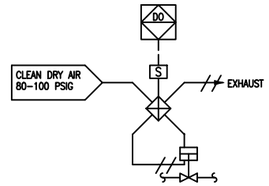




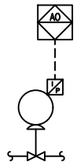
TYPICAL AIR ACTUATED VALVE CONTROL DETAIL (AIR SUPPLY NOT SHOWN ON SYSTEM P&ID)



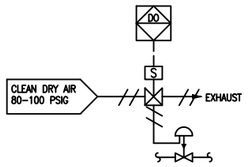
TYPICAL VALVE SCHEMATIC FOR ALL VALVES W/AIR TO AIR DIAPHRAGM ACTUATOR



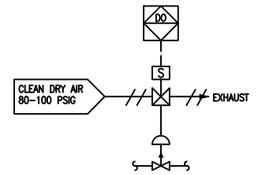
TYPICAL VALVE SCHEMATIC FOR ALL VALVES W/AIR TO AIR CYLINDER ACTUATOR



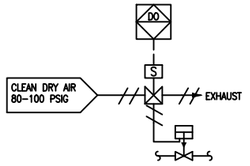
TYPICAL PROPORTIONAL CONTROL VALVE



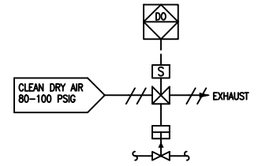
TYPICAL VALVE SCHEMATIC FOR ALL VALVES W/SPRING TO CLOSE DIAPHRAGM ACTUATOR



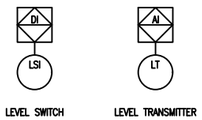
TYPICAL VALVE SCHEMATIC FOR ALL VALVES W/SPRING TO OPEN DIAPHRAGM ACTUATOR



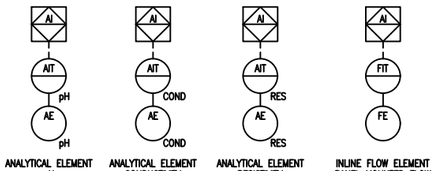
TYPICAL VALVE SCHEMATIC FOR ALL VALVES W/SPRING TO CLOSE CYLINDER ACTUATOR



TYPICAL VALVE SCHEMATIC FOR ALL VALVES W/SPRING TO OPEN CYLINDER ACTUATOR



LEVEL SWITCH
LEVEL TRANSMITTER



ANALYTICAL ELEMENT pH
ANALYTICAL ELEMENT CONDUCTIVITY
ANALYTICAL ELEMENT RESISTIVITY
INLINE FLOW ELEMENT PANEL MOUNTED FLOW METER W/ANALOG INPUT

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 20054/UFM000-9100_0
SCALE: NONE

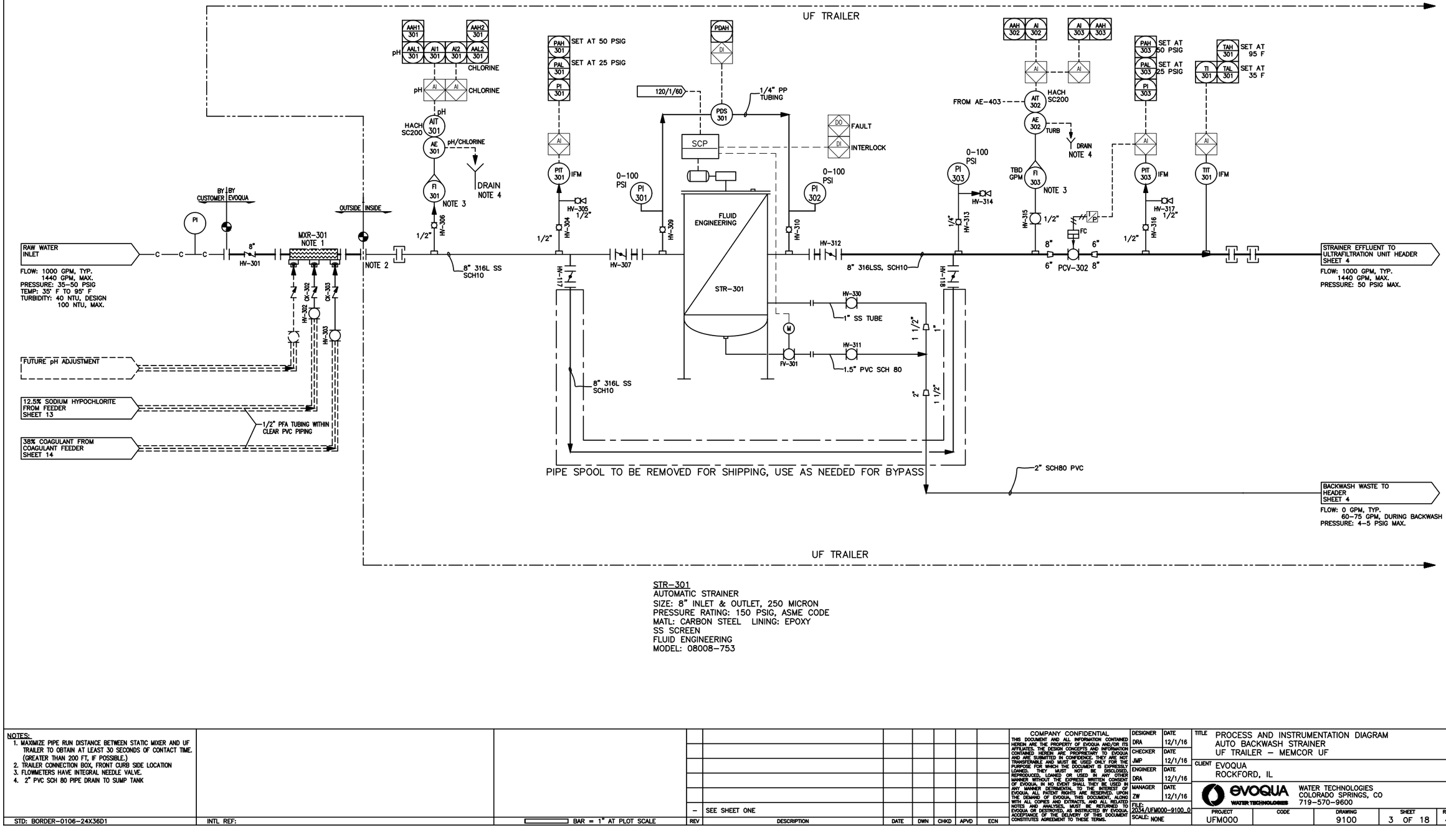
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
LEGEND SHEET TWO
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719–570–9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	2 OF 18	4

STD: BORDER–0106–24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



STR–301
AUTOMATIC STRAINER
SIZE: 8" INLET & OUTLET, 250 MICRON
PRESSURE RATING: 150 PSIG, ASME CODE
MATL: CARBON STEEL LINING: EPOXY
SS SCREEN
FLUID ENGINEERING
MODEL: 08008–753

NOTES:
1. MAXIMIZE PIPE RUN DISTANCE BETWEEN STATIC MIXER AND UF TRAILER TO OBTAIN AT LEAST 30 SECONDS OF CONTACT TIME. (GREATER THAN 200 FT, IF POSSIBLE.)
2. TRAILER CONNECTION BOX, FRONT CURB SIDE LOCATION
3. FLOWMETERS HAVE INTEGRAL NEEDLE VALVE.
4. 2" PVC SCH 80 PIPE DRAIN TO SUMP TANK

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

		DATE
DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 2034/UFM000–9100_0
SCALE: NONE

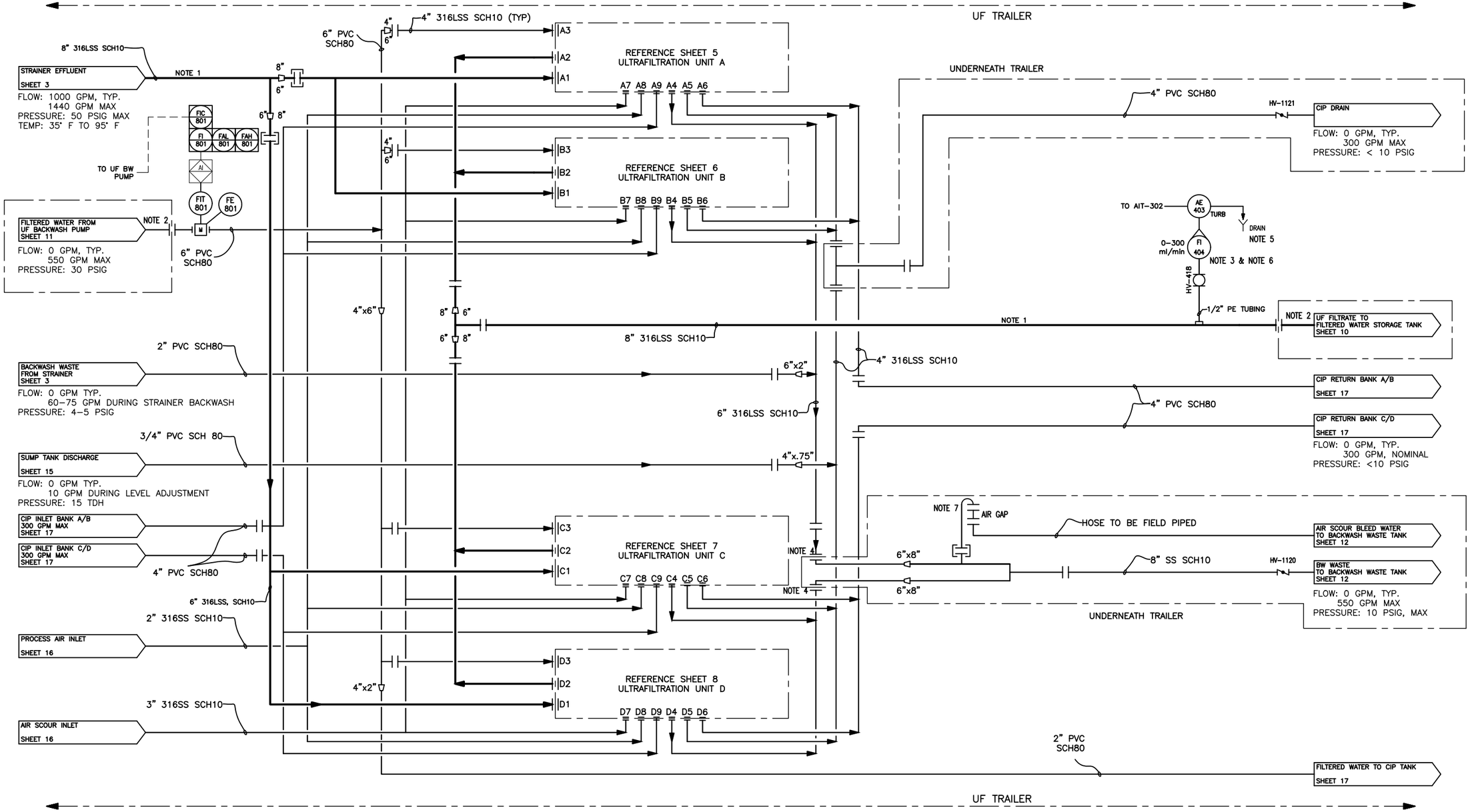
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
AUTO BACKWASH STRAINER
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719–570–9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	3 OF 18	4

STD: BORDER–0106–24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



NOTES:
1. VICTAULIC CONNECTIONS (NOT SHOWN) ARE TO AID IN THE ASSEMBLY/DISASSEMBLY OF THE PIPING MANIFOLDS.
2. TRAILER CONNECTION BOX, FRONT CURB SIDE LOCATION.
3. FLOWMETERS HAVE INTEGRAL NEEDLE VALVE.
4. DRAIN CONNECTION BOX, SIDE CS & SS LOCATIONS TIED TOGETHER UNDER TRAILER.
5. 2" PVC SCH80 PIPE DRAIN TO SUMP TANK.
6. TURBIDITY METER TO INCLUDE BUBBLE TRAP.
7. BACKWASH AIR SCOUR BLEED LINE TO HAVE AIR GAPB AT TRAILER CONNECTION.

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

	DATE
DESIGNER DRA	12/1/16
CHECKER JMP	12/1/16
ENGINEER DRA	12/1/16
MANAGER ZW	12/1/16

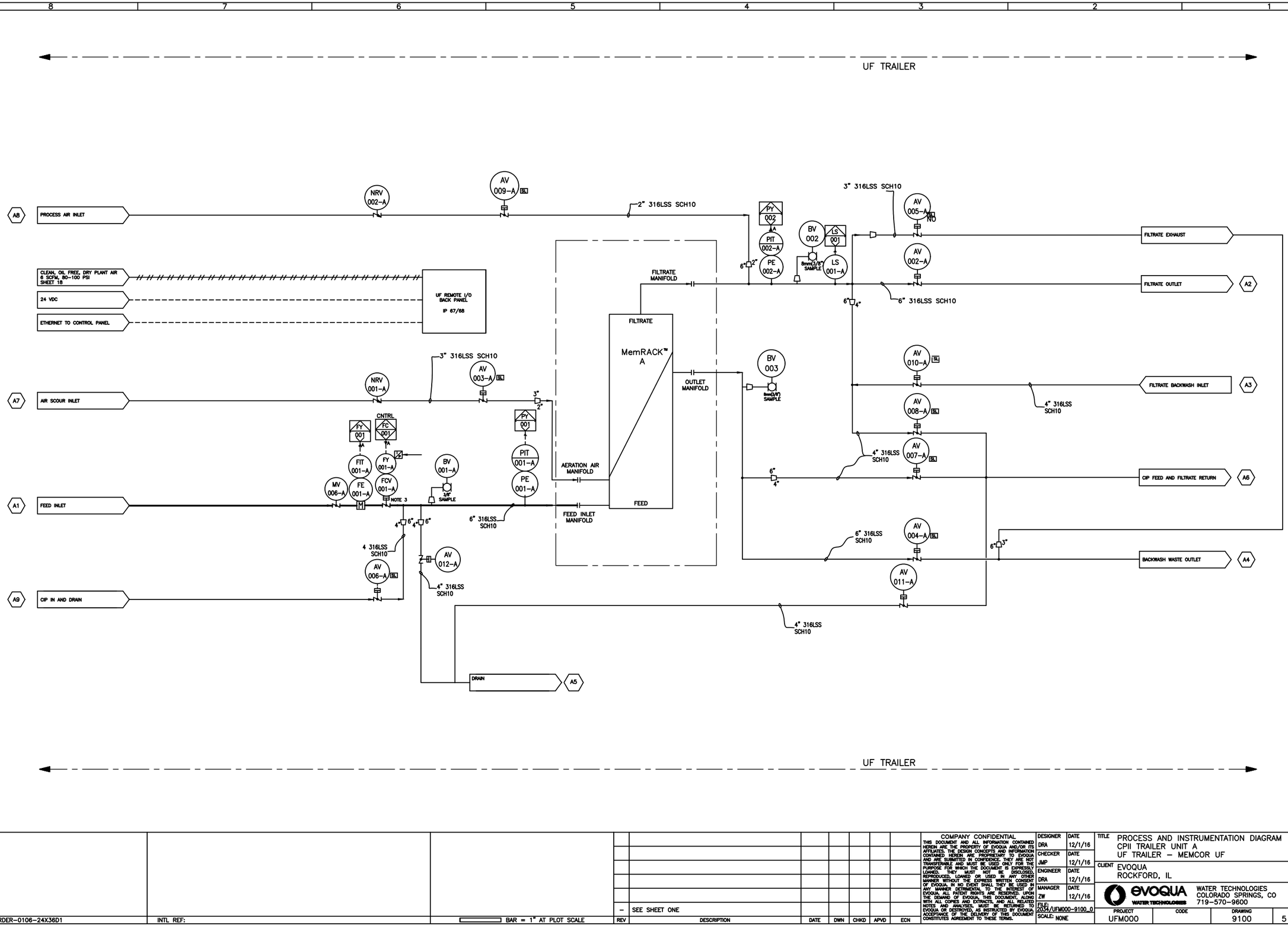
FILE: 2034/UFM000-9100_0
SCALE: NONE

TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
UF UNITS
UF TRAILERS – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	4 OF 18	4



			–	SEE SHEET ONE							
			REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN		

DESIGNER	DRA	DATE	12/1/16
CHECKER	JMP	DATE	12/1/16
ENGINEER	DRA	DATE	12/1/16
MANAGER	ZW	DATE	12/1/16
FILE:	2036/UFM000-9100_0		
SCALE:	NONE		

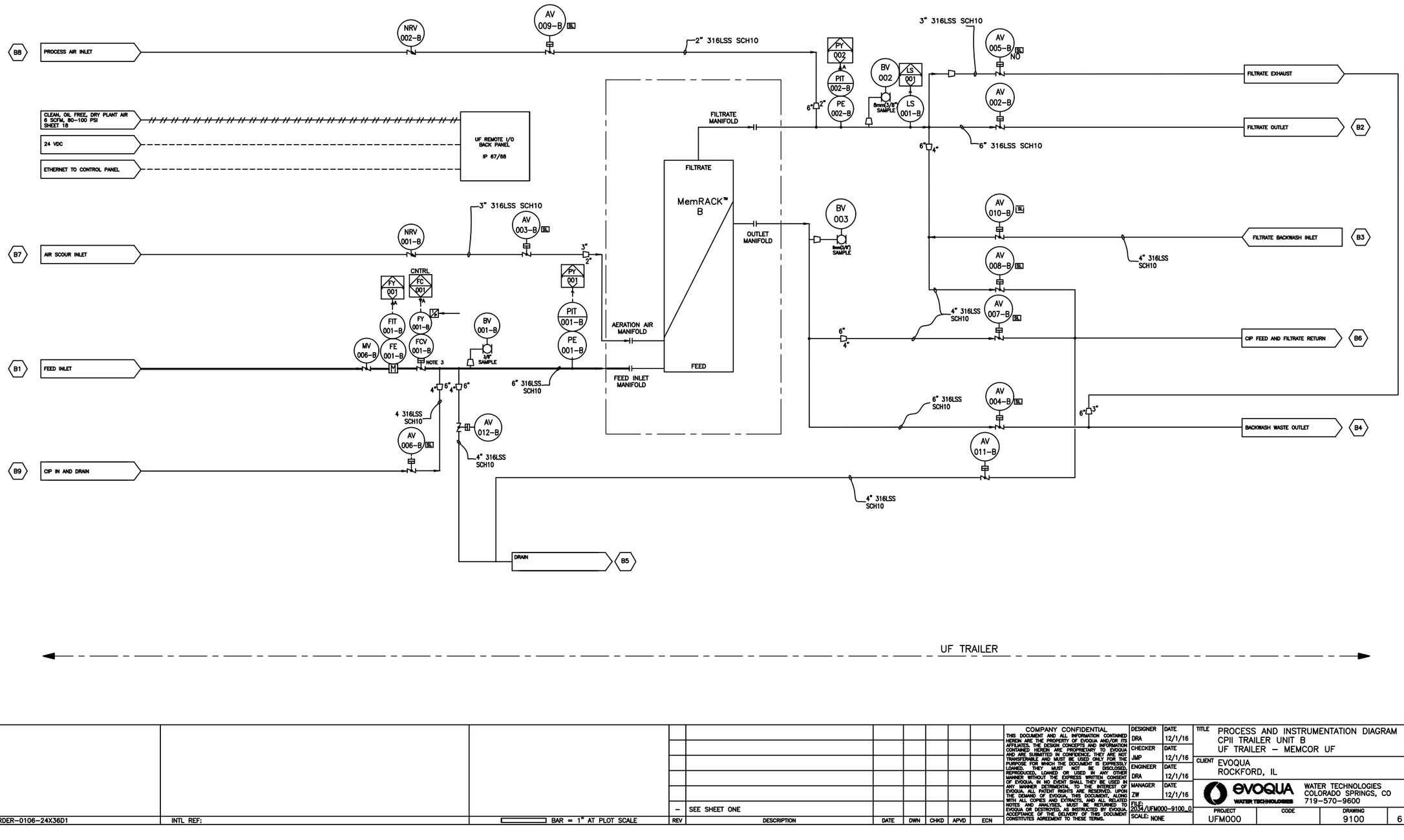
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CPII TRAILER UNIT A
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	5 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



			–	SEE SHEET ONE						
			REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN	

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

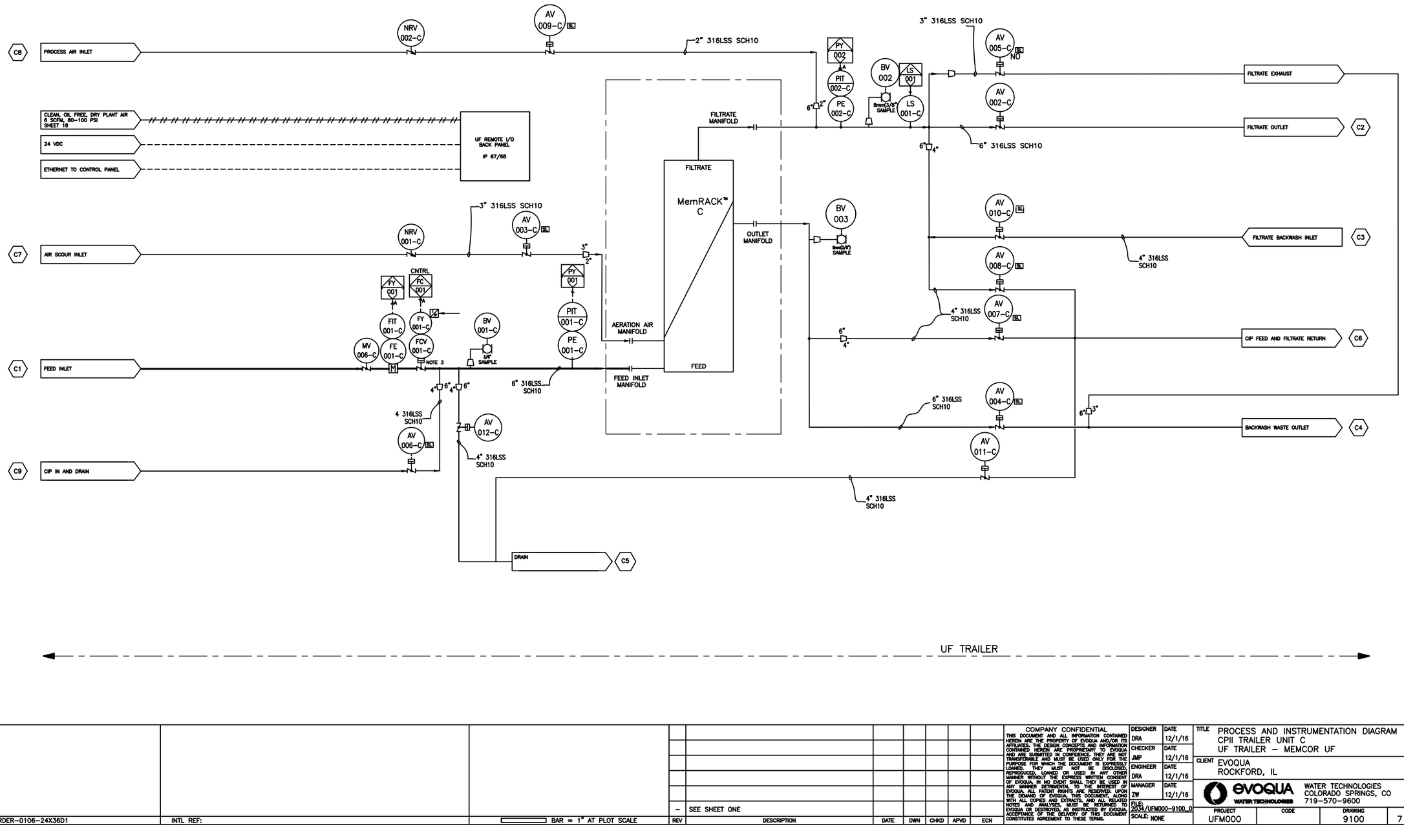
FILE: 2036/UFM000-9100_0
SCALE: NONE

TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CPII TRAILER UNIT B
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	6 OF 18	4



REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

DESIGNER	DRA 12/1/16
CHECKER	JMP 12/1/16
ENGINEER	DRA 12/1/16
MANAGER	ZW 12/1/16
FILE:	2034/UFM000-9100_0
SCALE:	NONE

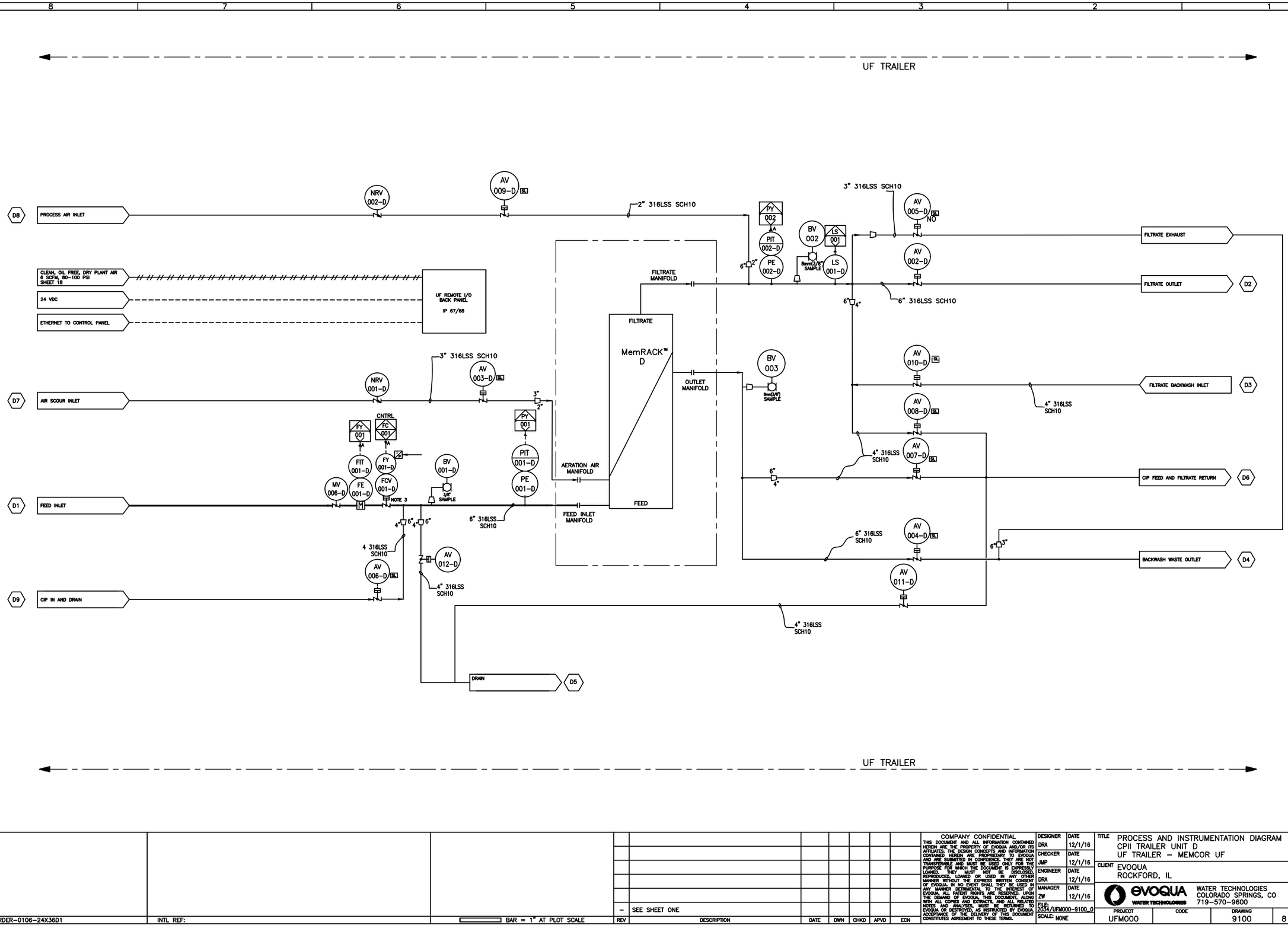
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CPII TRAILER UNIT C
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	7 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



			–	SEE SHEET ONE							
			REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN		

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

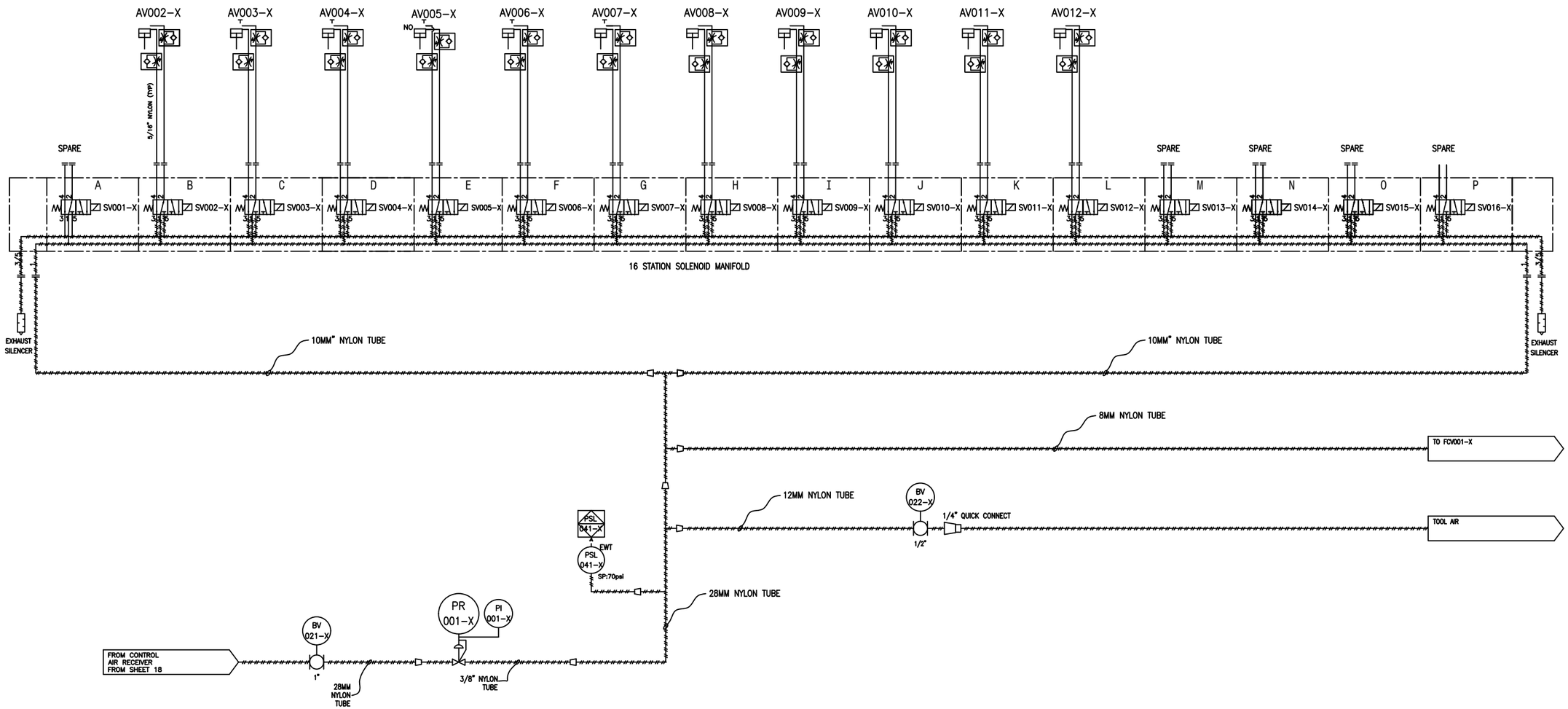
FILE: 2034/UFM000-9100_0
SCALE: NONE

TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CPII TRAILER UNIT D
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	8 OF 18	4



TYPICAL FOR UF CPII UNITS A, B, C, & D
SHEETS 5–8

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 2054/UFM000-9100_0
SCALE: NONE

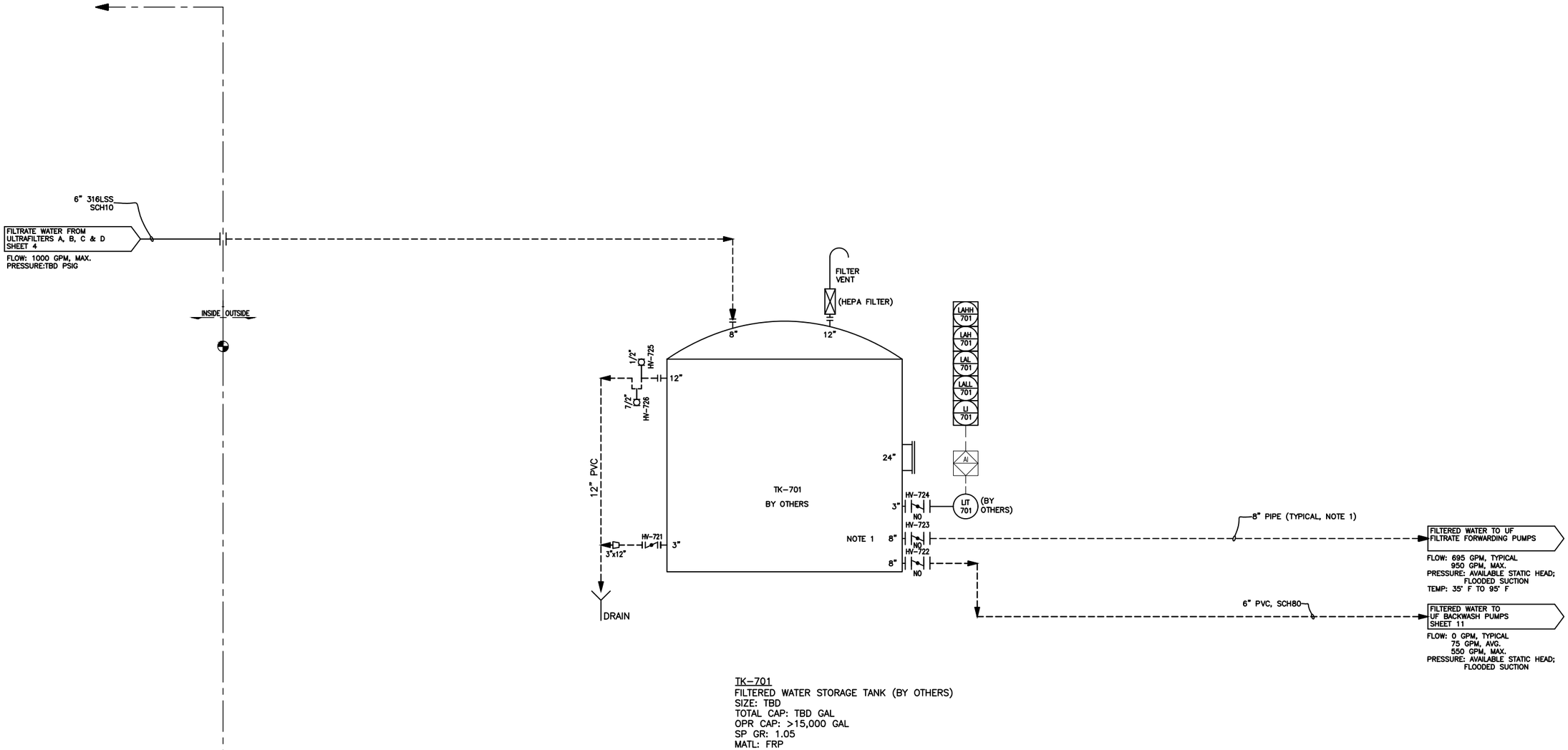
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CPII TRAILER UNIT
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	9 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



TK-701
FILTERED WATER STORAGE TANK (BY OTHERS)
SIZE: TBD
TOTAL CAP: TBD GAL
OPR CAP: >15,000 GAL
SP GR: 1.05
MATL: FRP

NOTES:

1. FILTERED WATER CONNECTION AND FILTRATE LINE SIZES TO FORWARDING PUMP WILL BE SET PER JOB.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

	DESIGNER	DATE
	DRA	12/1/16
	CHECKER	DATE
	JMP	12/1/16
	ENGINEER	DATE
	DRA	12/1/16
	MANAGER	DATE
	ZW	12/1/16

FILE: 2034/UFM000-9100_0
SCALE: NONE

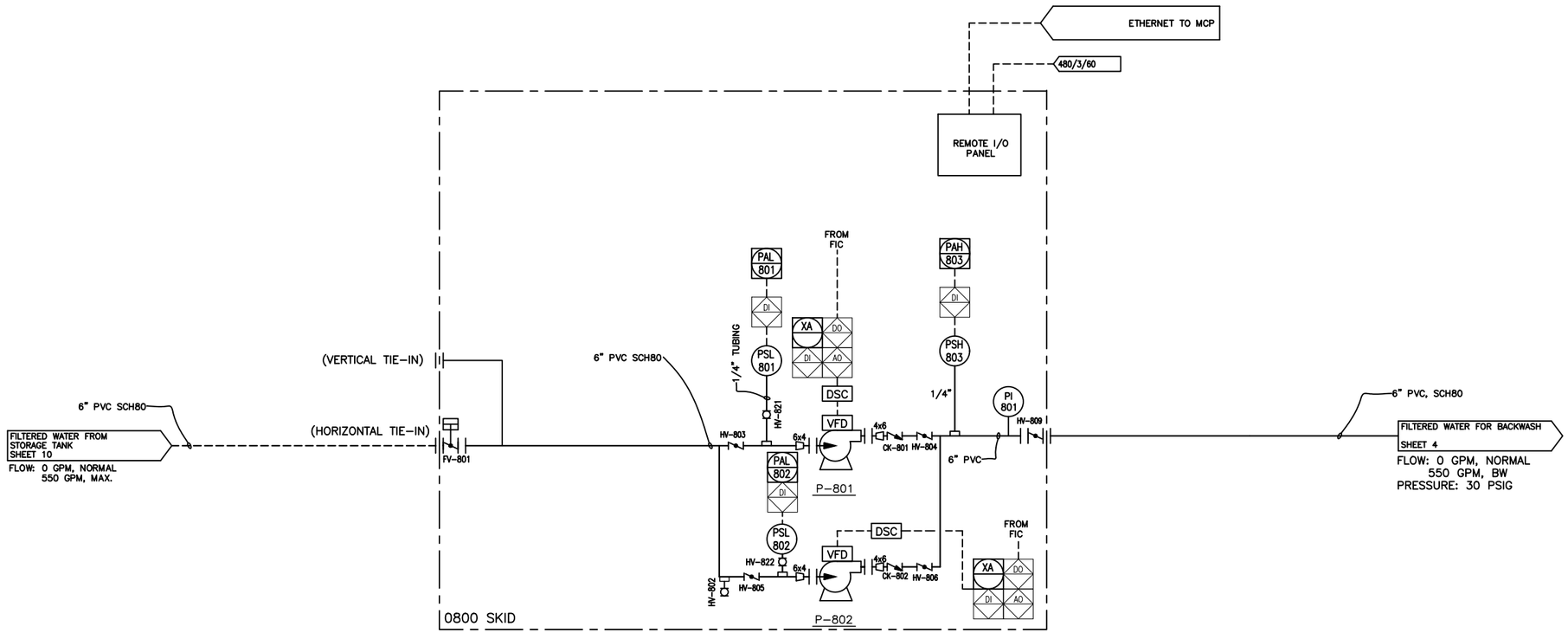
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
FILTRATED WATER STORAGE TANK
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	10 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



P-801, P-802
(2 PUMPS)
UF FILTRATE BACKWASH PUMP
MFG: GRUNDFOS CRNE150-1-1
DESIGN: 550 GPM @ 30 PSI
DRIVER: 25 HP / 3600 RPM
(460V/3Ph/60 Hz / 40C MAX. OPERATING TEMP)(VFD)
ENVIRONMENTAL CONDITIONS/LIMITATIONS TO BE TAKEN INTO ACCOUNT AT SITE
SP GR: 1.0
MATL: 316SS

NOTES:

1. FLOWMETERS HAVE INTEGRAL NEEDLE VALVE.
2. 2" PVC SCH80 PIPE DRAIN TO SUMP TANK.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

		DATE
DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 2054/UFM000-9100_0
SCALE: NONE

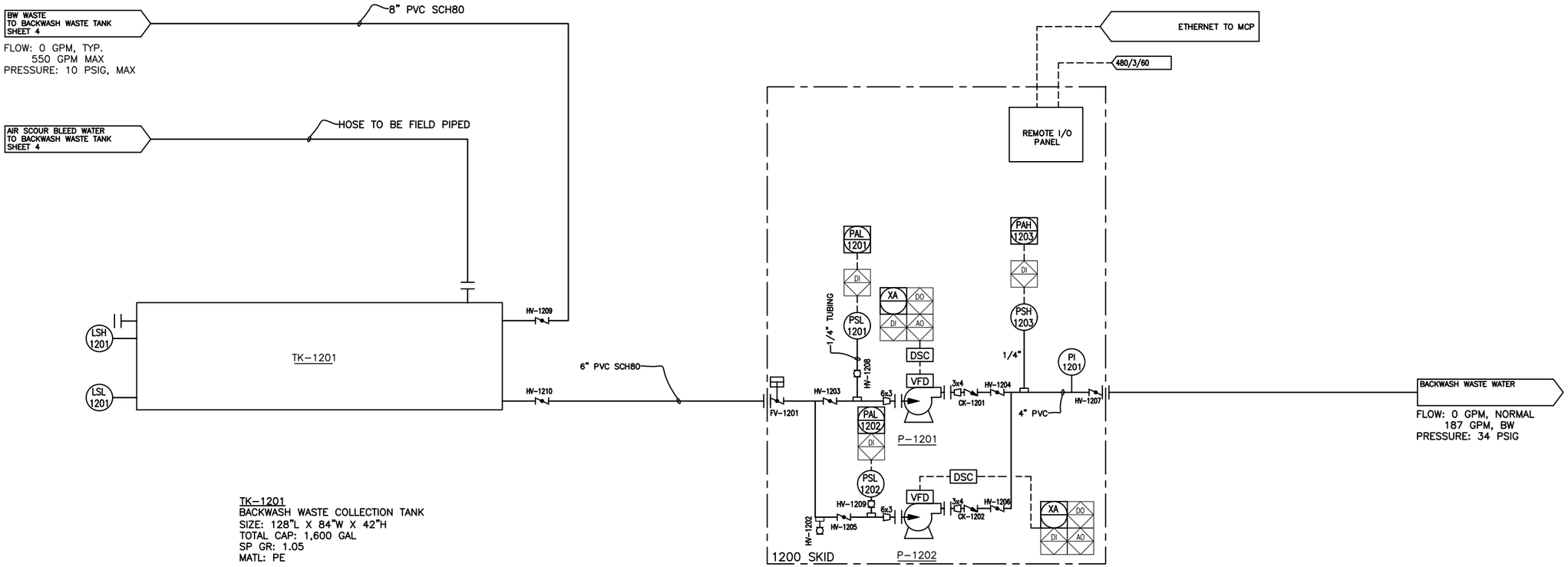
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
UF BACKWASH PUMP
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	11 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



TK-1201
BACKWASH WASTE COLLECTION TANK
SIZE: 128"L X 84"W X 42"H
TOTAL CAP: 1,600 GAL
SP GR: 1.05
MATL: PE

P-1201, P-1202
(2 PUMPS)
UF BACKWASH TRANSFER PUMPS
MFG: GRUNDFOS CRNE45-1-1
DESIGN: 187 GPM @ 34 PSI
DRIVER: 7.5 HP / 3600 RPM
(460V/3Ph/60 Hz / 40C MAX. OPERATING TEMP)(VFD)
ENVIRONMENTAL CONDITIONS/LIMITATIONS TO BE TAKEN INTO ACCOUNT AT SITE
SP GR: 1.0
MATL: 316SS

NOTES:

1. FLOWMETERS HAVE INTEGRAL NEEDLE VALVE.
2. 2" PVC SCH80 PIPE DRAIN TO SUMP TANK.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

		DATE
DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 2054/UFM000-9100_0
SCALE: NONE

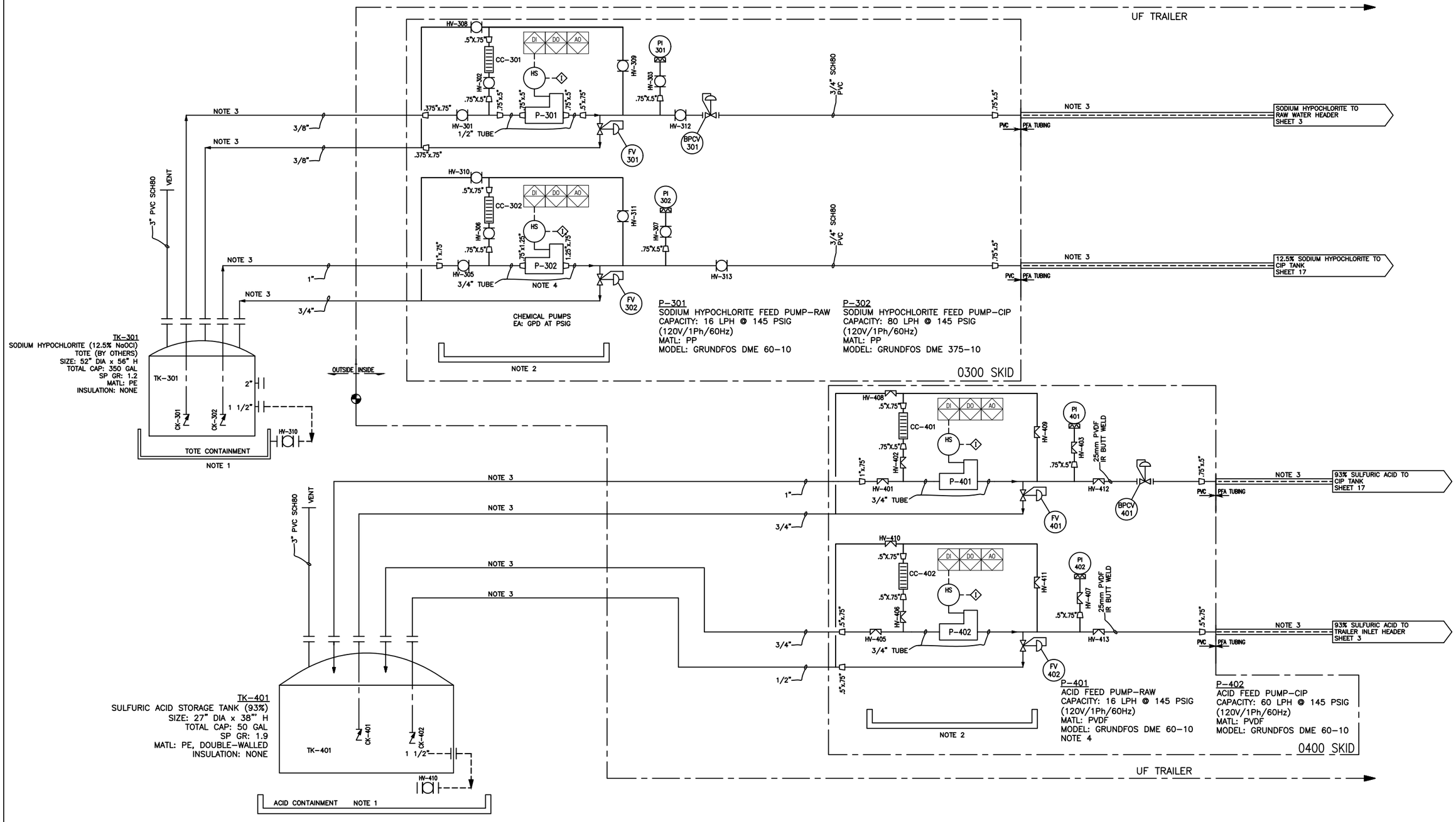
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
UF BACKWASH PUMP
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	12 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



NOTES:

1. TANK CONTAINMENTS SPECIFIC TO JOB.
2. METERING PUMP CONTAINMENT - PE RECTANGULAR BASINS PROVIDED TO PROTECT FLOORING.
3. OFF PUMP SKID TUBING SUPPLIED/INSTALLED BY JOB.
4. ACID CIP DOSING PUMP CONTROLLED BY CIP RECIRCULATION pH TRANSMITTER AIT-101.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

		DATE
DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 2034/UFM000-9100_0
SCALE: NONE

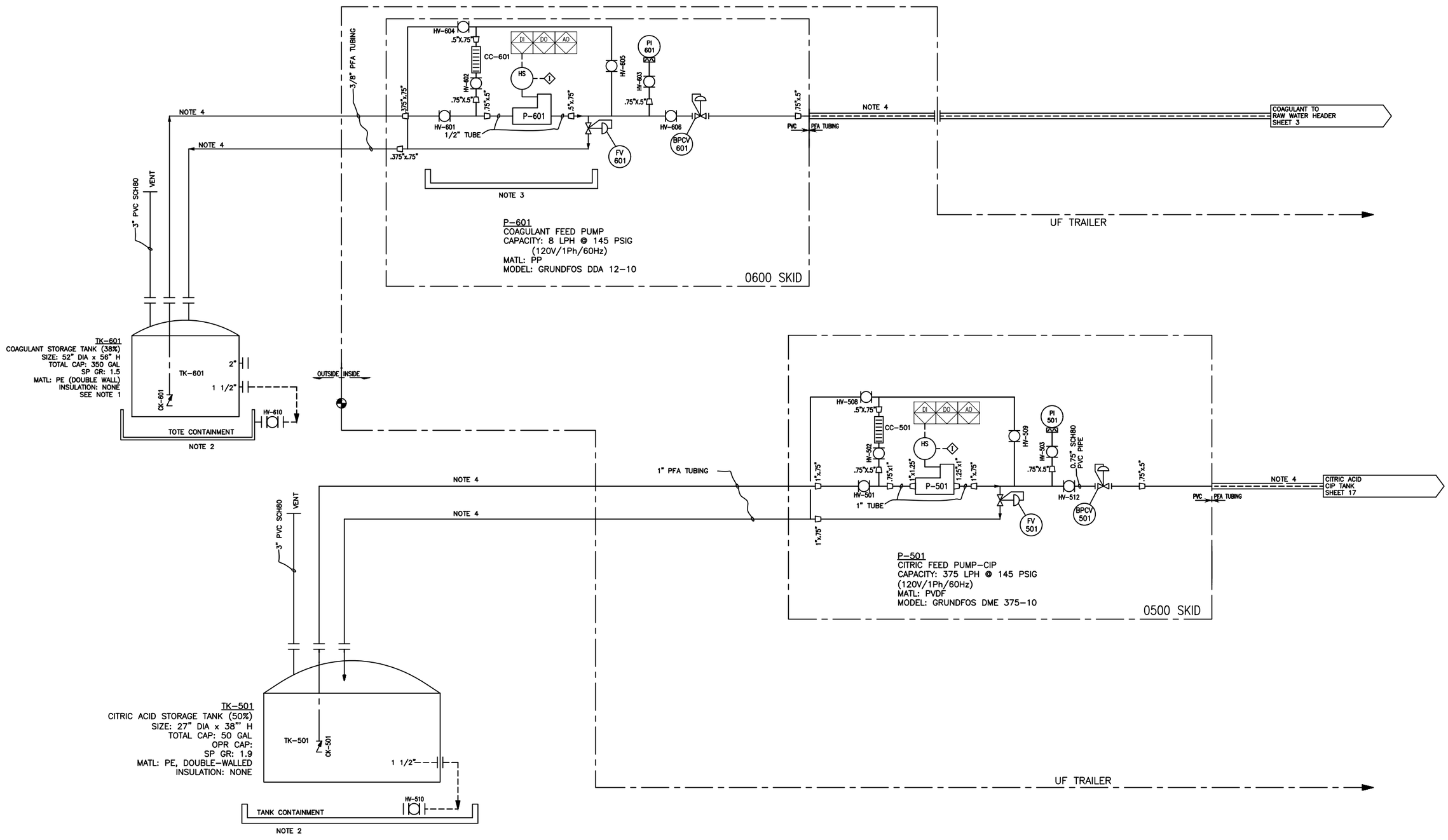
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
SODIUM HYPOCHLORITE AND SULFURIC ACID
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	13 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



NOTES
1. COAGULANT TO BE IRON OR ALUMINUM BASED, NO ORGANIC BASED PRODUCT.
2. TANK CONTAINMENTS SPECIFIC TO JOB.
3. METERING PUMP CONTAINMENT – PE RECTANGULAR BASINS PROVIDED TO PROTECT FLOORING.
4. OFF PUMP SKID TUBING SUPPLIED/INSTALLED BY JOB.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

		DATE
DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

FILE: 2034/UFM000-9100_0
SCALE: NONE

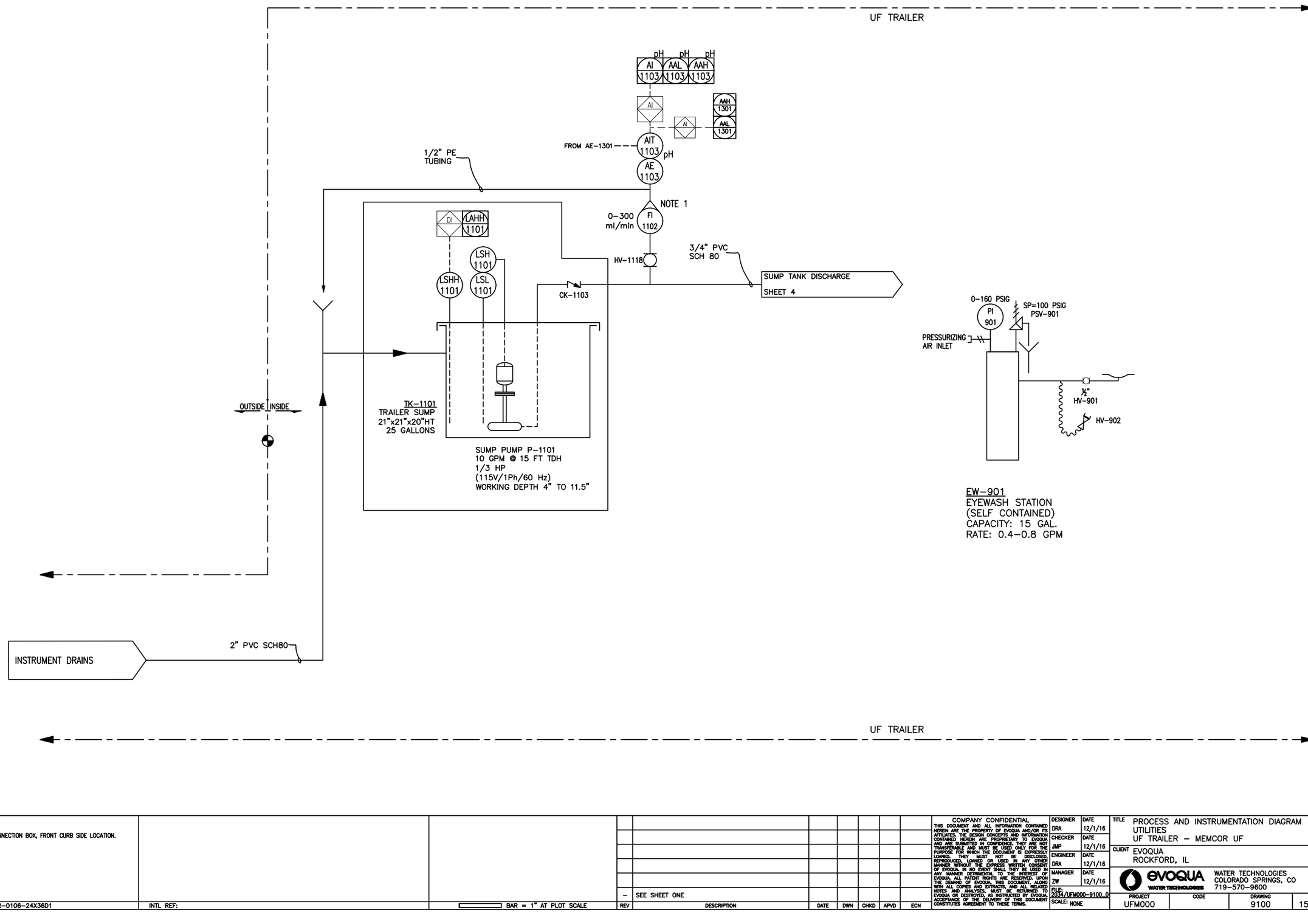
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CITRIC ACID AND COAGULANT
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	14 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



NOTES:

1. TRAILER CONNECTION BOX, FRONT CURB SIDE LOCATION.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

	DATE
DESIGNER DRA	12/1/16
CHECKER JMP	12/1/16
ENGINEER DRA	12/1/16
MANAGER ZW	12/1/16

FILE: 2034/UFM000-9100_0
SCALE: NONE

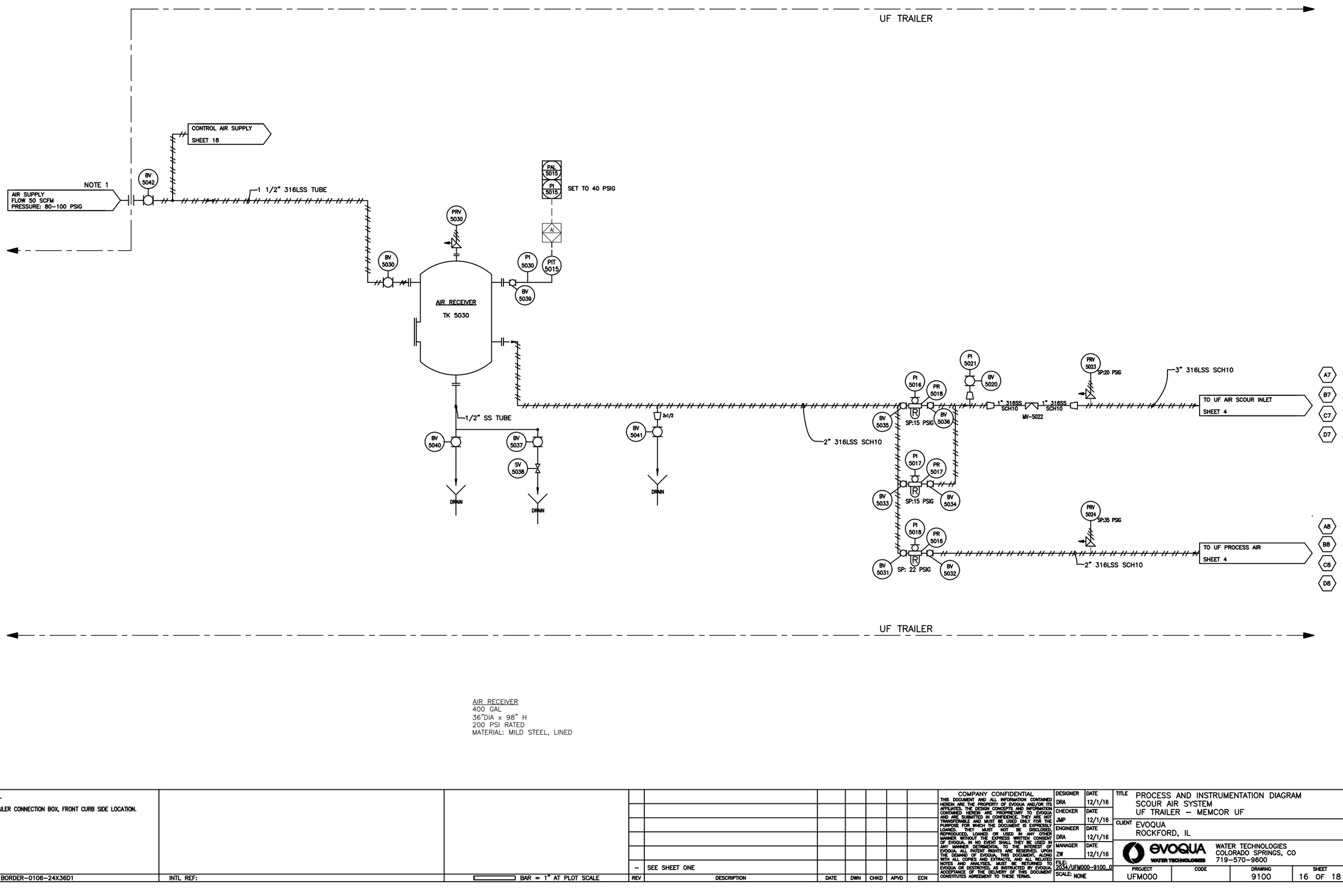
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
UTILITIES
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	15 OF 18	4

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE



AIR RECEIVER
400 GAL
36"DIA x 98" H
200 PSI RATED
MATERIAL: MILD STEEL, LINED

NOTES:

1. TRAILER CONNECTION BOX, FRONT CURB SIDE LOCATION.

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

		DATE
DESIGNER	DRA	12/1/16
CHECKER	JMP	12/1/16
ENGINEER	DRA	12/1/16
MANAGER	ZW	12/1/16

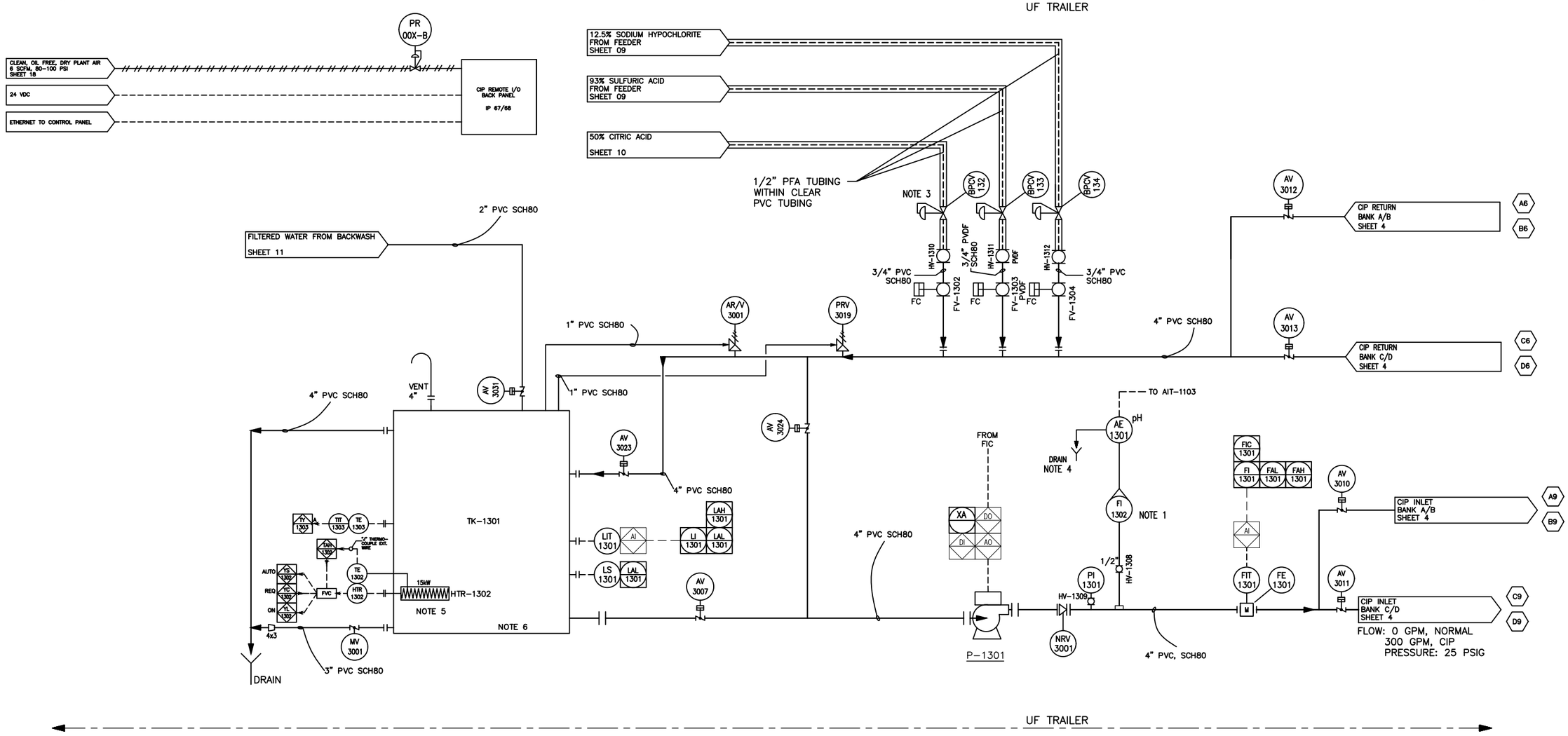
FILE: 2034/UFM000-9100_0
SCALE: NONE

TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
SCOUR AIR SYSTEM
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	16 OF 18	4



CIP TANK
TK-1301
SIZE: 32"x36"x96" HIGH
MATERIAL: FIBERGLASS
CAPACITY: 400 GALLONS

CIP TANK HEATER
HTR-1302
480V/3PH/60Hz
15 kW
WATLOW FNR725A5XS-1

P-1301
UF CIP PUMP
MFG: GRUNDFOS CRNE150-1-1
DESIGN: 300 GPM @ 25 PSI
DRIVER: 25 HP / 3600 RPM
(460V/3Ph/60 Hz / 40C MAX. OPERATING TEMP)(VFD)
ENVIRONMENTAL CONDITIONS/LIMITATIONS TO BE TAKEN INTO ACCOUNT AT SITE
SP GR: 1.0
MATL: 316SS

NOTES:
1. FLOWMETERS HAVE INTEGRAL NEEDLE VALVE.
2. TRAILER CONNECTION BOX, FRONT CURB SIDE LOCATION.
3. BPCV TO BE LOOSE SHIPPED.
4. 2" PVC SCH80 PIPE DRAIN TO SUMP TANK.
5. HEATER ELEMENT.
6. TANK FLOOR TO SLOPE TOWARDS DRAIN AND OUTLET CONNECTIONS.

STD: BORDER-0106-24X36D1 | INTL REF: | BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
–	SEE SHEET ONE					

	DATE
DESIGNER DRA	12/1/16
CHECKER JMP	12/1/16
ENGINEER DRA	12/1/16
MANAGER ZW	12/1/16

FILE: 2034/UFM000-9100_0
SCALE: NONE

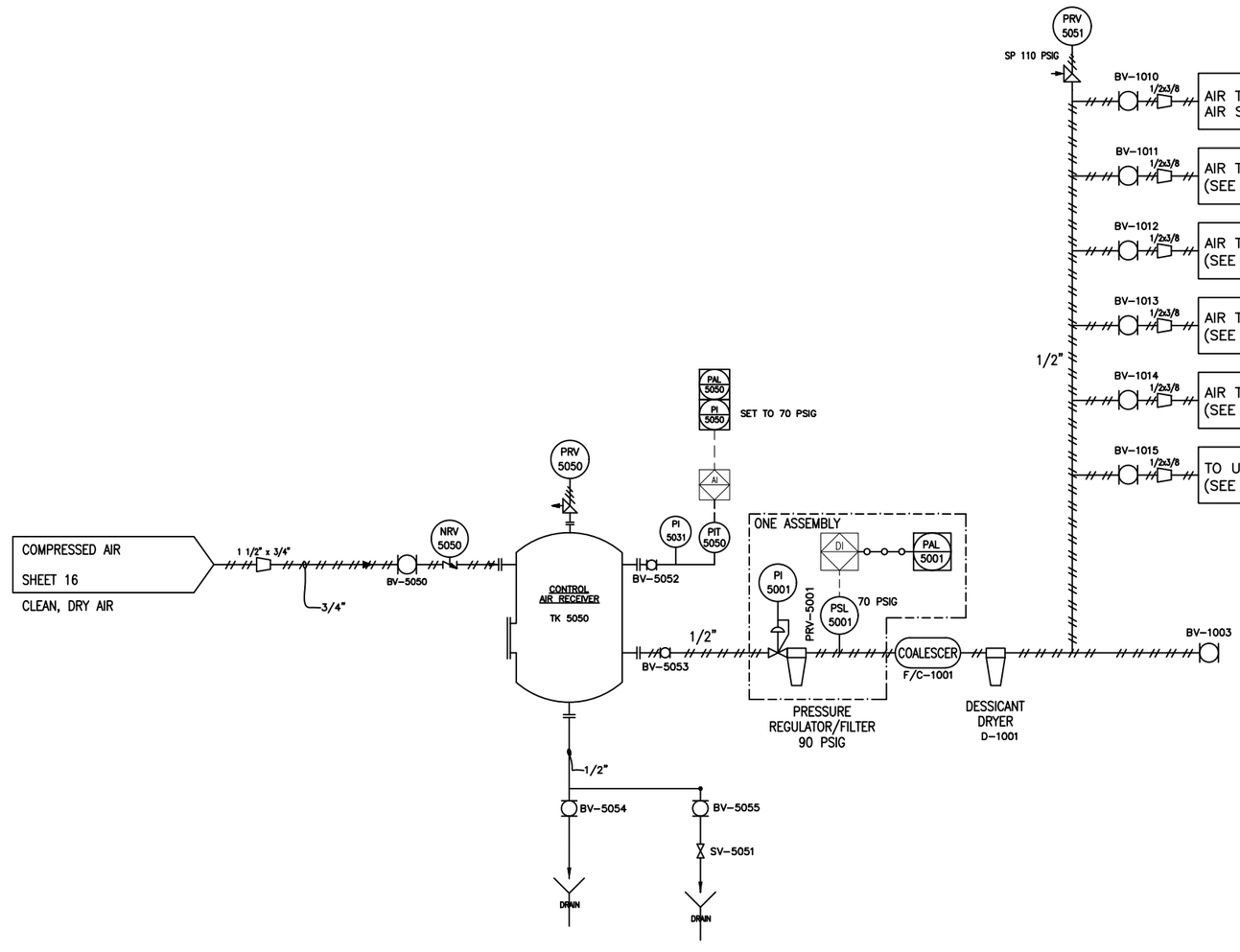
TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
CIP SYSTEM
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES
COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	17 OF 18	4

UF TRAILER



AIR RECEIVER
15 GAL
12"DIA x 33" H
200 PSI RATED
MATERIAL: MILD STEEL, LINED
MANCHESTER CAT NO 302402

UF TRAILER

			–	SEE SHEET ONE							
STD: BORDER-0106-24X36D1	INTL REF:	BAR = 1" AT PLOT SCALE	REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN		

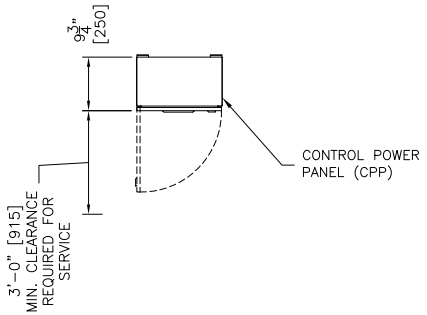
DESIGNER	DRA	DATE 12/1/16
CHECKER	JMP	DATE 12/1/16
ENGINEER	DRA	DATE 12/1/16
MANAGER	ZW	DATE 12/1/16
FILE: 2034/UFM000-9100_0		
SCALE: NONE		

TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
PROCESS AIR
UF TRAILER – MEMCOR UF

CLIENT: EVOQUA
ROCKFORD, IL

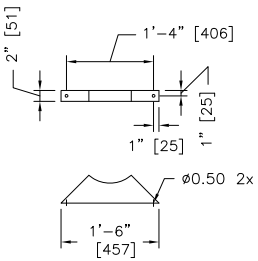
EVOQUA WATER TECHNOLOGIES
WATER TECHNOLOGIES COLORADO SPRINGS, CO
719-570-9600

PROJECT	CODE	DRAWING	SHEET	REV
UFM000		9100	18 OF 18	4



TOP VIEW OF CPP

SCALE: NOT TO SCALE



BRACKET DETAIL

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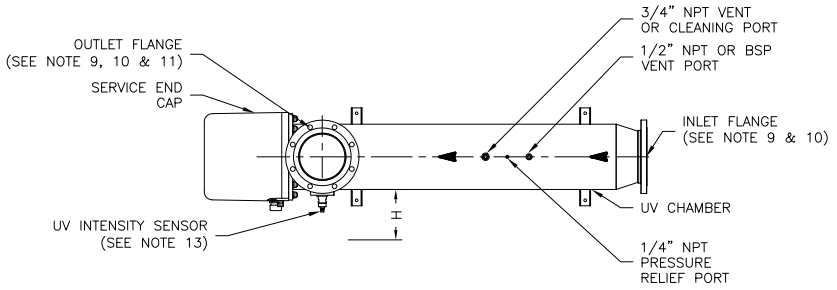

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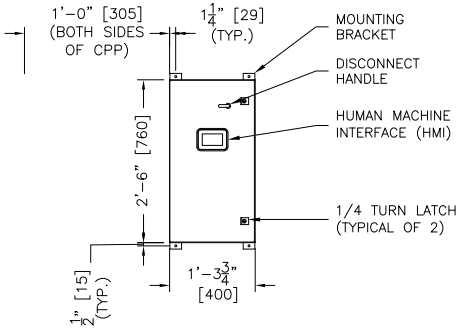

FRONT VIEW OF CPP

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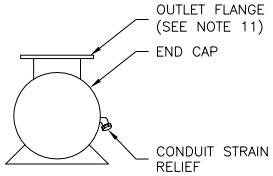

END VIEW

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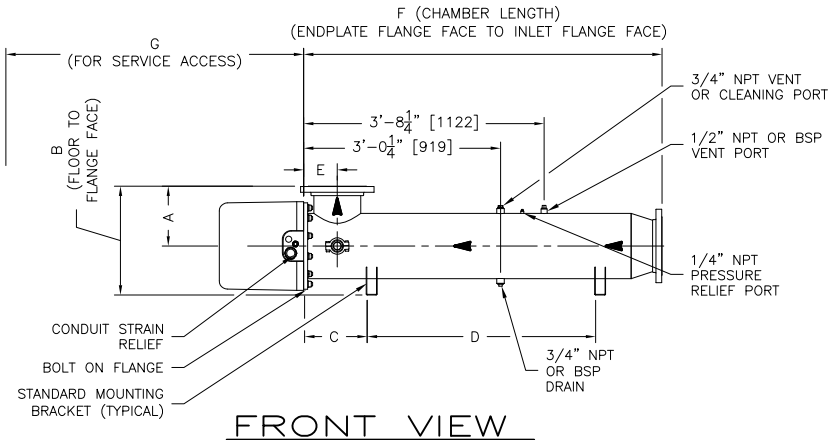

FRONT VIEW

SCALE: NOT TO SCALE

NOTES:

1. [ ] INDICATES MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CONNECTION SEALS AND HARDWARE TO BE SUPPLIED BY CUSTOMER.
3. INTERCONNECTING CABLE LENGTH TO BE 15ft [4.5m].
4. MAXIMUM OPERATING PRESSURE TO BE 150 psi [10 BAR].
5. MOUNTING AND SAMPLING PORTS ARE TO BE SUPPLIED BY THE CUSTOMER.
6. CLEARANCES FOR WIPING SYSTEMS FALL WITHIN CLEARANCES REQUIRED FOR SLEEVE REMOVAL.
7. LAMP TYPES AVAILABLE: A – DISINFECTION
   V – VALIDATED DISINFECTION
8. AMWS – AUTOMATIC MECHANICAL WIPING SYSTEM OPTIONAL
9. ANSI FLANGE: ASME/ANSI B16.5 SLIP–ON WELDING CLASS 150
   DN FLANGE: EN 1092–1, TYPE 1, PN 10. (STANDARD)
10. ANSI FLANGE: ASME/ANSI B16.5 SLIP–ON WELDING CLASS 300
    DN FLANGE: EN 1092–1, TYPE 1, PN 16. (OPTIONAL)
11. OUTLET LOCATION OPTION: 12,3,6,9 O'CLOCK (VIEWED FROM SERVICE END).
12. WHEN OUTLET LOCATION IS NOT 12 O'CLOCK AIR VENT IS PROVIDED
13. UV INTENSITY SENSOR LOCATION MOVES TO THE OPPOSITE SIDE OF THE UV CHAMBER WHEN THE OUTLET IS ROTATED 90° CW FROM THE END VIEW SHOWN.

MODEL	LAMP LENGTH	UV CHAMBER ASSEMBLY DIAMETER	# LAMPS AVAILABLE	FLANGE TYPE	FLANGE SIZE	DIM. 'A'	DIM. 'B'	DIM. 'C'	DIM. 'D'	DIM. 'E'	DIM. 'F'	DIM. 'G'	DIM. 'H'	OPTIONAL WIPING SYSTEM	PANEL RATING	PANEL MATERIAL
D06	LONG	12" [300]	6	ANSI/ DN	8" [200]	11" [279]	1'-8" [508]	11½" [292]	3'-6" [1067]	6¼" [157]	5'-6" [1673]	5'-10" [1778]	9" [229]	AMWS	TYPE 12 (IP54) TYPE 3R (IP55) TYPE 4X (IP66)	MILD PAINTED STEEL MILD PAINTED STEEL 304 SST

TROJANUV
A TROJAN TECHNOLOGIES BUSINESS

DESCRIPTION: STD, TROJANUVSWIFTSC D06 MODEL

DRAWN BY : MVW/SAH	DATE : 14NO27	STD. DRAWING NO.	SW0053
CHECKED BY : SZ	DATE : 14NO27	REFERENCE NO.	N/A
APPROVED BY : MVW	DATE : 14NO27	DWG NO.	D01
SCALE (8.5x11) : NOT TO SCALE	LOG NUMBER : N/A	REV.	L

TECHNICAL SPECIFICATIONS

FOR

WALLA WALLA BASIN WATERSHED COUNCIL

CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT

2018

RENEWS: 6-30-2020

ANDERSON PERRY & ASSOCIATES, INC.

Walla Walla, Washington
La Grande, Redmond, and Hermiston, Oregon

Job No. 7008-625

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UNDERGROUND PIPING

TECHNICAL SPECIFICATIONS

SECTION 1

UNDERGROUND PIPING

PART 1 - GENERAL

1.1 Summary

A. These Specifications cover the excavation and backfill of trenches for the installation of underground pipes and other underground utilities. Work shall be completed in accordance with these Specifications and Oregon Occupational Safety and Health standards.

B. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections, as determined by the Engineer, shall apply to the Work outlined in the Contract Documents.

1.2 Definitions

A. Foundation material or stabilization fabric will only be required when standard bedding requirements will not adequately support the pipe.

B. Backfill is the filling of the trench to the existing ground level or the finish grade line shown on the Drawings.

C. General trench excavation shall include whatever materials that are encountered (except solid rock) to the depths shown on the Drawings or as required to properly install the pipe.

D. Solid Rock

1. Solid rock is defined as being rock formations other than cemented gravels that require hard ripping, jackhammering, blasting, or other extra work beyond the capability of heavy-duty trench excavating equipment such as a Caterpillar 235 or 345B Excavator.

2. Cemented gravel excavation may be included as "Rock Excavation" when said excavation requires hard ripping, jackhammering, or blasting and ONLY when, in the opinion of the Engineer, such conditions were unforeseen and are beyond the capability of heavy duty trench excavating equipment such as a Caterpillar 235 or 345B Excavator.

1.3 Submittals

A. Water Supply Pipe and Fitting
B. Waste Pipe and Fittings
C. Manholes

1.4 Safety

A. The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work, including excavation safety. The Contractor shall comply with all applicable Laws and Regulations, ordinances, rules, and orders of any public body having jurisdiction as it relates to Project and Work safety.

B. The Contractor shall maintain local access to area residents and emergency traffic throughout the life of the Project and coordinate construction activities closely with area residents to keep them informed of operations that may impact their use of any streets or roadways.

C. All signs, barricades, barriers, lights, cones, trench boxes, shoring/bracing, and other such "devices" required to warn, protect, or direct the public and workmen during the life of the Contract shall be furnished, installed, moved, and removed by the Contractor. When conditions warrant their use, flagpersons shall also be provided by the Contractor. The determination of what measures are required, in addition to those specifically called for by the Drawings and Specifications, shall be solely the responsibility of the Contractor.

D. The Engineer and Owner are not responsible for determining whether proper safety precautions, etc., are being utilized. Should the Contractor fail to furnish the necessary protective measures, the Owner or Engineer may, but shall not be required to, bring to the Contractor's attention by written notice of such failure and the Contractor shall undertake such corrective measures as is proper.

E. All construction Work shall be performed in accordance with the provisions of the Occupational Safety and Health Regulations of the Oregon Occupational Safety and Health Division, and other applicable regulations. It shall be the Contractor's responsibility to meet all requirements of Chapter 437 of the State of Oregon Administrative Rules. In addition, Oregon Revised Statutes (ORS) 757.541 through 757.571 and Oregon Administrative Rules (OAR) 860-024-0006 and 860-024-0007 administered by the Oregon Public Utilities Commission shall apply.

F. The materials used for and the installation of all warning and traffic control devices shall conform to the applicable provisions of the Oregon Standard Specifications for Construction - 2018 edition, Sections 00220 and 00225, and the Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration, current edition.

G. It shall be the Contractor's sole responsibility to provide a "competent person" as defined in the regulations to be on the Project Site during all trenching operations. The "competent person" appointed by the Contractor shall fulfill all requirements of the regulations.

H. Prior to opening an excavation, the Contractor shall arrange for field location of utility installations such as sewer, telephone, fuel, electric, gas, water lines, or any other underground installations that reasonably may be expected to be encountered during the excavation work. When excavation operations approach the estimated location of underground installations, the Contractor shall determine the exact location of the installations by safe and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard workers.

I. The Contractor shall ensure that structural ramps that are used by workers as a means of access or egress from an excavation shall be designed by a competent person, in accordance with all requirements of the regulations.

J. Workers exposed to public vehicular traffic shall be provided with and shall wear warning vests or other suitable garments marked with, or made of, reflectorized or highly visible material. No worker shall be permitted underneath loads handled by lifting or digging equipment. Workers shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped in accordance with the regulations to provide adequate protection for the operator during loading and unloading operations.

K. The Contractor shall take adequate precautions, in accordance with the regulations, to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions. These precautions include providing proper respiratory protection or ventilation and, when controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, the Contractor shall provide testing as often as necessary to ensure that the atmosphere remains safe. The Contractor shall provide emergency rescue equipment, such as breathing apparatus, safety harness, etc., where hazardous atmospheric conditions exist or may reasonably

be expected to develop during work in an excavation. This equipment shall be attended when in use.

L. The Contractor shall not allow work in excavations in which there is accumulated water or in excavations where water is accumulating, unless adequate precautions have been taken to protect workers against the hazards posed by water accumulations. The precautions necessary to protect workers adequately vary with each situation, but include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and life line. If the Contractor is controlling water or preventing it from accumulating by the use of water removal equipment, the water removal equipment and operation shall be monitored by a competent person to ensure proper operation. If excavation work interrupts the natural drainage of surface water, such as streams, then diversion ditches, dikes or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation.

M. In situations where the Contractor feels their trench operations pose a risk to the stability of adjoining buildings, walls, or other structures, the Contractor shall notify the Engineer and shall provide adequate support systems per the requirements of the regulations. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to workers shall not be permitted except when the Contractor has retained a Registered Professional Engineer and said Registered Professional Engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity, or said Registered Professional Engineer has approved the determination that such excavation will not pose a hazard to workers.

N. Sidewalks, pavements, and appurtenant structures shall not be undermined unless a support system or other method of protection is provided to protect workers from the possible collapse of such structures. The Contractor shall provide adequate protection to all persons from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. The Contractor shall also provide protection by placing and keeping excavated materials or equipment at least two feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations or by a combination of both, if necessary.

O. The Contractor shall ensure that daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person appointed by the Contractor for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of Work

and as needed throughout the shift. Inspection shall also be made after every rain storm or other hazard increasing occurrence. These inspections are only required when worker exposure can be reasonably anticipated. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, the Contractor shall remove workers from the hazardous area until the necessary precautions have been taken to ensure their safety.

P. It shall be the Contractor's responsibility to provide all physical barrier protection at all excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Further, no trenches shall be left open at any time unless guarded with adequate barricades, warning lamps, and signs. Proper traffic and pedestrian control shall be provided by the Contractor.

Q. The Contractor shall ensure that each worker in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with the regulations.

R. It shall be the Contractor's responsibility to design the sloping and benching systems for trench excavation in accordance with the requirements of the regulations stated herein. Where the Contractor takes the option to not utilize one of the standard tables or trench excavation designs contained in OAR Chapter 437, then it is the Contractor's responsibility to retain a Registered Professional Engineer to design said sloping and benching system. When the Contractor chooses this option, the design shall be in written form and shall include at least the following information:

S. The magnitude of the slopes that were determined to be safe for the particular Project.

T. The configurations that would determine to be safe for the particular Project.

U. The stamp and signature of the Registered Professional Engineer approving the design.

V. At least one copy of the design shall be maintained at the Project Site while the slope is being constructed. After that time the design need not be at the Project Site, but a copy shall be made available to the Owner upon request.

W. Where the design of a support system, shield system, or other protective system is required, it shall be the Contractor's responsibility to meet all requirements of the regulations. It shall be the Contractor's responsibility to have on site at least one copy of the manufacturer's tabulated data which identifies the Registered Professional Engineer who approved the data or, when a support system or shield system or other protective system is not a standard manufactured item but is designed by a Registered Professional

Engineer, at least one copy of the design shall be maintained at the Project Site during construction of the protective system. After that time, the design may be stored off the Project Site, but a copy of the design shall be made available upon request.

X. The determination of the safe trench width is the sole responsibility of the Contractor.

1.5 Existing Utilities

A. The following utilities may be affected by the Contractor's Work:

1. Power
   City of Milton-Freewater
   722 S. Main / P.O. Box 6
   Milton-Freewater, Oregon 97862
   Rick Rambo
   541-938-8231

2. Telephone/Fiber
   CenturyLink
   Craig Redelings
   541-385-0296
   Craig.redelings@centurylink.com

3. Gas
   Cascade Natural Gas
   300 S.W. 17th Street
   Pendleton, Oregon 97801
   Dan Harris
   888-522-1130

4. Cable Television
   Charter Communications
   1145 Abadie Street
   Walla Walla, Washington 99362
   888-438-2427

5. Water
   City of Milton-Freewater Public Works Department
   501 Lamb / P.O. Box 6
   Milton-Freewater, Oregon 97862
   Shane Wright
   541-938-8271

6. Sewer
   City of Milton-Freewater Public Works Department
   501 Lamb / P.O. Box 6
   Milton-Freewater, Oregon 97862
   Bryan DeBeaumont
   541-938-8271

B. Known utilities and structures expected to be adjacent to or encountered in the Work are shown on the Drawings. Information on existing utilities may be provided by others and existing records may not be complete or accurate. It is expected there may be discrepancies and omissions in the location, size, and quantities of utilities and structures shown. Those shown are for convenience of the Contractor only, and no responsibility is assumed by either the Owner or Engineer for their accuracy. The Contractor shall work closely with the owner of any utilities or structures affected by the Work to avoid any damage.

C. The Contractor shall be responsible for the actual locating and protecting of existing utilities. The Contractor, prior to commencement of Work, shall contact existing Utility Companies such as water, sewer, power, telephone, gas, etc., to have the Utility Companies locate all utilities which will be affected by the Work to be performed. The Contractor shall give 48-hour notification in accordance with ORS 757-541. The "call before you dig" number is 811 or 1-800-332-2344. The Contractor shall perform all necessary coordination work with the Utility Companies in performing the Work and shall be fully responsible for any damage to existing utilities caused by the Contractor's operations. The Contractor shall make any advance exploration necessary to protect all existing utilities and to properly plan the installation of pipelines or other work to the design line and grade. No payment shall be made for this work for up to two hours of advanced backhoe excavation work necessary to locate each existing utility at each specific site. The Work shall include all labor, equipment, etc., necessary to perform the location work. These costs shall be understood to be included in the Contract Prices. Should the Contractor be unable to locate the existing utility after its location has been marked by the appropriate utility company and diligent effort made by the Contractor to locate the utility including up to two hours of backhoe excavation work for each

utility at each location site, the Contractor may be entitled to additional compensation as outlined hereafter. When prior notice has been given to the Engineer and the Engineer gives approval, the Contractor shall be paid for all additional backhoe excavation work required to locate the utility on an hourly basis under the bid item "Additional Potholing" when listed in the Bid Schedule or through an approved Change Order. Any additional potholing work performed by the Contractor without prior written approval of the Engineer will not be paid for.

D. If a conflict develops between the design line and grade of a pipeline or Project improvement and an existing utility, the Engineer may adjust the pipeline grade or have the existing utility relocated. The existing utility may be relocated by the owner of the utility or its designated representative or by the Contractor upon the approval of the utility owner and the Engineer. The Contractor shall perform all relocation work required by the Engineer. If the Contractor performs the relocation work, a Change Order shall be negotiated prior to any actual work unless payment for the work is specified otherwise.

E. The owner of the utilities shall normally be responsible for taking the utility out of service if necessary for the performance of the Work; i.e., shutting valves, etc. In the case of water valves, the owner of the water system may operate the valves or request the Contractor to do so. When the Contractor is requested to do so, the Contractor shall operate water valves as a normal part of the Work at no additional cost to the Owner. All water valves shall be operated as instructed by the owner of the valves. It can be expected that some valves may not fully operate properly which may require that additional valves be operated. This situation shall be considered a normal requirement of the Work.

F. The Contractor shall receive prior approval from the appropriate authority or utility owner before any public or private utility service is interrupted.

1. The Contractor shall give a minimum of four hours notice to all utility customers who will be affected by the Contractor's operations. No utility service shall be disconnected or interrupted for more than nine hours or as required by the utility owner, whichever is less, in any 24-hour period. When disruption of service will be longer than nine hours in any one day, the Contractor shall provide safe and appropriate temporary service. All temporary service shall be coordinated with the utility owner.

2. When regular utility service interruption is required during the course of the Work, the Contractor shall submit a written plan to the Engineer and utility owner which details proposed Work plan notification procedures, and estimated

extent of service interruption. The Contractor must obtain written approval of their plan from the utility owner prior to interrupting the utility service. As a minimum, notification shall include door hangers and public notification in the newspaper and radio, as appropriate. Personal contact shall be made where practical.

3. The Contractor shall make every effort possible to provide continuous utility service to all utility customers. When special conditions exist where an interruption of utility service would create an extra hardship on the utility customer or create a hazardous condition, the Contractor shall provide continuous service. Particular care and planning must be arranged to provide continuous service of existing services or temporary services as approved by the utility owner and the Engineer.

4. If the Contractor inadvertently damages or interrupts an existing utility, the Contractor shall immediately notify the affected utility company, Owner, Engineer, and utility users and make arrangements to provide temporary service to the parties affected.

5. The Contractor shall, as requested by the Engineer, either immediately arrange for the utility company to make the needed repairs or immediately make the repair to the damaged utility.

6. The Contractor shall pay the full cost of repair and damages when the utility was previously located and was within four feet on either side of the marked location as required by the Call Before You Dig notification system, or where negligence of the Contractor occurred.

7. The Contractor will be paid for the cost of repair and damages when existing utilities encountered during the performance of the Work were not previously located by the utility as required by the Call Before You Dig notification system, where existing utilities were farther than four feet away on either side of the marked location, and where damage to the utilities occurred due to no negligence of the Contractor.

8. If the Contractor fails to make immediate repairs and provide service as required, the Owner may have said Work performed by others and deduct the cost of said Work from payment to the Contractor.

G. The Contractor shall support and otherwise protect all pipes, conduits, cables, poles, and other existing services where they cross the trench or are otherwise undermined or affected by their Work. The Contractor shall restore the support of an undermined existing utility using select backfill compacted to 95 percent maximum density as determined by ASTM D698, as applicable.

1.6 Dust and Mud Control

A. The Contractor shall take appropriate action to control dust and mud caused by his operations. This shall include, but not be limited to, watering of exposed areas, cleaning of roadways, etc. This is considered a normal part of the construction Project.

B. No measurement or payment shall be made for this Work.

1.7 Soil and Groundwater Conditions

A. Soils data and groundwater conditions, when shown on the Drawings, are provided for the Contractor's information, may not be relied upon, and are a general description only. This information may or may not be shown. The Engineer assumes no responsibility for actual soil conditions.

B. Soils data and groundwater conditions, when shown, shall not relieve the Contractor from the responsibility of making additional investigations. The Contractor shall perform investigations as deemed necessary to acquaint with actual conditions to be encountered in performing the Work. Groundwater conditions in particular should be carefully considered and are subject to change.

1.8 Dewatering

A. The Work shall consist of the removal of surface water and groundwater as needed to perform the required construction. This also includes the dewatering of borrow sites. It shall include furnishing, construction, and operation of all temporary facilities and equipment. This construction specification also includes removal of temporary facilities.

B. Protective measures needed to divert streamflow and other surface water shall be built, maintained, and operated during construction.

C. The construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. Dewatering shall include furnishing, installing, operating, and maintaining all equipment including pumps as needed.

D. After the temporary work has served its purpose, it shall be removed or graded to present a sightly appearance without interfering with permanent drainage systems or stream flows.

E. All temporary work shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized in accordance with NRCS Standards and Oregon Department of Environmental Quality requirements.

PART 2 - MATERIALS

2.1 Foundation Material

Foundation material shall be well-graded 2-1/2"-0 or 1-1/2"-0 crushed rock.

2.2 Bedding and Select Backfill

Bedding and select backfill shall be well-graded 3/4"-0 or 1"-0 crushed rock or approved equal. All bedding and select backfill materials shall be subject to the approval of the Engineer.

2.3 General Backfill

A. General backfill will consist of material excavated from the trench, or material imported by the Contractor. General backfill material shall be free of vegetative matter, boulders (10-inch plus), frozen material and any other unsuitable material, and shall have a moisture content that will allow for the required compaction of the general backfill material unless approved otherwise by the Engineer. Use of backfill material containing consolidated masses 3 inch in diameter or greater is prohibited within 2 feet of the pipe. Masses 10 inch in diameter or greater are prohibited.

B. When necessary, the Contractor shall selectively separate suitable general backfill material from unsuitable general backfill material.

C. When the Engineer determines that the native material excavated from the trench is unsuitable or unacceptable for use as general backfill, the Engineer may require the Contractor to remove the unsuitable material from the project site and import suitable general backfill material. Suitable material shall be similar in nature to native soils as approved by the Engineer. When imported general backfill must be placed in or below the groundwater, the imported general backfill shall be free draining granular material with less than 20 percent passing a No. 4 sieve and less than 3 percent passing a No. 200 sieve.

2.4 Controlled Density Fill (CDF)

A. CDF material shall be a flowable cement, sand or pea gravel, and Fly Ash Pozzolanic, or other approved materials, mixture that contains 75 to 120 pounds of Type II cement per cubic yard.

B. The sand and other aggregates shall generally conform with the requirements of ASTM C33.

C. Air-entraining agent shall be added at the rate of 3 to 5 ounce per cubic yard.

D. The material shall have a 28-day compressive strength of 100 to 200 psi and have a slump of 7 inches plus or minus 1-1/2 inches at the time of placement. The Contractor shall provide a mix design and data on the CDF material proposed to use, along with typical compression test results.

2.5 Anti-Flotation, Dewatering, and Trench Stabilization Fabrics

A. Fabric for anti-flotation and dewatering shall be Mirafi 500X or approved equal.

B. Fabric for trench stabilization shall be Mirafi 140N Fabric or approved equal.

2.6 Water Supply Pipe

A. Polyvinyl Chloride (PVC) Pipe

1. AWWA C900, latest addition, DR 18 (235 pounds per square inch [psi]).

2. Flexible rubber gasketed joints conforming to ASTM F477.

3. JM Eagle Big Blue, North American Pipe Corporation Pipe, or approved equal.

B. Ductile Iron (DI) Pipe

1. DI pipe and fittings shall conform to AWWA C150, AWWA C115, AWWA C151, AWWA C153, and AWWA C110 and shall be minimum pressure Class 150 unless specified otherwise.

2. All DI pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104 on the interior.

3. All joints unless otherwise specified shall be push-on rubber gasket joints conforming to AWWA C111 and shall be furnished complete with all necessary accessories.

   a. Flanges for couplings and fittings shall conform to ANSI B16.1, 125-pound bolt hole template.

   b. Mechanical joints shall conform to AWWA C111.

4. When flanged pipe is required, the Contractor shall provide the DI pipe class required by the flange manufacturer to ensure the pipe and flange units are compatible. This data shall be provided to the Engineer for review prior to ordering these materials.

C. HDPE Tubing

1. HDPE tubing shall be iron pipe size (IPS) meeting the requirements of AWWA C901 and ASTM D2239, SIDR 7 (PE 4710), rated for 200 psi working pressure. Stainless steel inserts shall be installed at all compression fittings.

2.7 Water Supply Fittings

A. General

1. Unless specified otherwise, all fittings such as elbows, tees, crosses, valves, etc., shall have mechanical joints conforming to AWWA C111 and shall be short-bodied compact DI fittings conforming to AWWA C153, Class 350.

2. When called for, flanged cast iron fittings shall conform to AWWA C110 with ANSI B16.1, 125-pound bolt hole template.

3. All fittings shall be cement mortar lined in accordance with AWWA C104.

4. Gaskets shall be either ring or full faced, 1/8-inch thick, conforming to AWWA C111, Appendix C.

B. Restrained Fittings for PVC Pipe

1. All fittings shall be restrained by mechanical joint DI with "MEGALUG" field-installed restraint devices as manufactured by EBAA Iron, Inc., or approved equal.

2. All restrained fittings shall have a half-sized thrust block installed per the calculations from Sheet C-503.

C. Restrained Pipe Joints and Fittings for Ductile Iron Pipe

1. Restrained Pipe Joints, 24-inch Diameter and Less

a. All restrained DI pipe joints shall be secured with FIELD LOK 350® Gaskets by U.S. Pipe, Fast Grip Gaskets by American Cast Iron Pipe Company, or approved equal.

D. Couplings

1. Couplings shall be fabricated steel mechanically restrained couplings as manufactured by Romac Industries, Inc., or approved equal, conforming to AWWA C219.

2. The Contractor shall provide the appropriate coupling and gaskets as required to match the irrigation pipe types and sizes being utilized.

3. Couplings shall be rated for the working pressure of the pipe main for which they will be utilized.

2.8 Waste Pipe

A. PVC Pipe

1. PVC gravity sewer pipe and fittings 15-inch diameter and smaller shall conform to ASTM D3034, SDR 35 unless called for otherwise on the Drawings.

2. The joints shall be flexible joint with rubber ring gasket.

B. Couplings

1. Couplings shall have stainless steel shear rings of the size and style required to match the pipe size and type being utilized. Couplings shall be manufactured by Fernco with stainless steel shear rings or approved equal.

2.9 Manholes

A. Precast Concrete Base Sections

1. Precast concrete base sections shall be approved by the Engineer and shall conform to ASTM C478. Concrete shall be consolidated by mechanical vibration. Reinforcing shall be provided in the base and walls. Minimum concrete thickness shall be 5 inches unless otherwise required for deep manholes.

2. Required "U" shaped channels shall be constructed by the use of properly shaped forms. Intersecting flow channels shall have smooth uniform transitions. All channels shall have smooth troweled finishes. All shelf area shall be uniformly shaped, have a rough float finish and shall slightly slope towards the channel. The shelf shall be above the top of the sewer pipe.

3. The Contractor shall be responsible for the determination of pipe hole orientation and grade. Precast base sections shall be used unless specifically called for otherwise on the Drawings or by the Engineer.

B. Precast Concrete Manhole Sections

1. Precast concrete manhole sections shall conform to ASTM C478 and consist of circular sections in the standard 48-inch diameter, unless otherwise noted. No more than two lift holes shall be cast into each section. Holes shall be located as to not damage reinforcing or expose it to corrosion. All lift holes shall be patched to prevent water seepage into the manhole, utilizing an approved, non-shrink grout.

2. Precast manhole cones shall be eccentric unless otherwise specified and shall meet ASTM C478.

3. Flat slab covers for manholes shall conform to ASTM C478. Slabs, cones and ring sections shall be free from fractures, cracks, rock pockets, or exposed reinforcement. Joint seal material shall be "Kent seal" mastic acrylic polymeric sealant, O-ring rubber gasket, or approved equal.

4. Manholes which have a depth of 5-1/2 feet or less, from the top of the manhole cover to the pipe invert, shall utilize a 48-inch diameter section and flat slab cover. Cone sections shall not be used for manholes less than 5-1/2 feet in depth, unless approved by the Engineer, or called for on the Drawings. Manholes

with a flat slab cover may be required for depths greater than 5-1/2 feet when called for on the Drawings.

C. Pipe Connection to Manholes

1. All pipe connections to manholes shall be constructed as shown on the Drawings, shall be flexible, and shall allow movement of the sewer pipe in all directions. Manhole pipe couplings shall be suitable for the sewer pipe type connecting to the manhole.

2. A-Lok field sleeve, or approved equal, may be used for cast-in-place manhole bases.

3. When precast base sections are used, an A-Lok pipe connector as manufactured by A-Lok Products, Inc., PSX Flexible Connector as manufactured by Press Seal Gasket Corporation, Kor-N-Seal as manufactured by Core and Seal Company, or approved equal shall be used.

4. Fittings for drop manholes shall be of the same material as the attached sewer pipe.

D. Manhole Rings and Covers

1. Castings shall be tough, close-grained, gray iron free from blow holes, shrinkage and cold sheets.

2. Manhole rings and covers shall conform to ASTM A48 and shall be smooth, sound, clean and free from blisters and defects. Castings and covers shall be planed and ground when necessary to insure flat and true surfaces. Covers shall be true and shall seat within the ring at all points.

3. Manhole rings and covers shall be Inland Foundry Co., Inc., No. 802 Suburban, no hole cover, Style 1 Blind Pickhole, or two hole cover, or approved equal.

4. When watertight cover is called for on the Drawings, an Inland Foundry No. 804 frame with watertight cover shall be provided, or equal. Provide two extra gaskets for each watertight cover furnished.

PART 3 - EXECUTION

3.1 Clearing and Grubbing

A. The Contractor shall do all clearing and grubbing and removal of structures, etc., necessary to permit proper installation of the pipeline and to eliminate the possibility of stumps, logs, brush, or rubbish being mixed with the backfill material. A sufficient amount of all stumps and stump roots shall be removed so that any future removal of any remaining parts of the stumps and/or roots will not damage the pipeline. All stumps, roots, logs, brush, and rubbish shall be removed and disposed of in conformance with the requirements of local authorities controlling air pollution and solid waste disposal.

B. Should the area in which construction takes place be served by rural mail carrier service, the Contractor shall cooperate with the mail service and re-install, in a convenient location, any rural mail boxes that will have to be removed or be blocked by construction operations. As soon as the Work is completed, all removed mail boxes shall be replaced undamaged in their original location.

C. As soon as the Work is completed, all signs, guardrails, utility poles, fences, etc., that were moved for the construction operation shall be replaced undamaged in their original location. Damaged items shall be replaced by the Contractor with new items of equal quality.

3.2 Cutting of Asphalt Pavement, Concrete Sidewalks, Curbs, and Driveways

A. Where the excavation is made in a paved street, the asphalt surface shall be cut on each side of the trench prior to excavation, to provide a vertical joint in the surface. Cutting of the asphalt will be made with a saw designed for the cutting of asphalt.

B. The use of a jackhammer, wheel cutter, or other similar tool may be allowed by the Engineer only where the Contractor can demonstrate that the alternate method provides a neat straight edge.

C. Prior to excavating across a concrete structure such as a curb, sidewalk, or driveway, the Contractor shall cut and remove a section of the structure to provide for excavation. The dimensions of the removed section shall be such that the Contractor's excavation will not result in undermining the remaining structure.

D. The Contractor shall cut the concrete structure with a diamond saw or other equipment designed for that purpose such that a neat, straight, vertical edge is left on the

remaining concrete structure. The Contractor shall similarly cut and remove any such concrete structure undermined or damaged construction work.

E. The Contractor shall repair streets and replace curbs, sidewalks, and/or driveways following proper backfill and compaction of the excavation, as specified herein and in conformance with the Drawings. If no Drawings are provided, repair streets and replace curbs, sidewalk, and/or driveways to equal or better condition prior to removal.

3.3 Trench Excavation

A. General

When solid rock is encountered in trench excavation, the Engineer shall be notified.

B. Trench Width

1. The maximum trench width in the pipe zone shall be 2 feet plus the O.D. of the pipe and the minimum trench width in the pipe zone shall be 1 foot plus the O.D. of the pipe. This width shall be maintained to the top of the pipe.

2. The maximum clear width above the top of the pipe will not be limited except in cases where excess width of excavation would cause damage to adjacent structures or utilities.

C. Unsuitable Material

1. When natural soil conditions exist in the bottom of the trench that are unsuitable for proper pipe installation, the Contractor shall immediately notify the Engineer. The Contractor shall then over-excavate the trench below the design grade to a depth specified by the Engineer. Such over-excavation shall be to provide for foundation material as specified herein. No additional payment will be made to the Contractor for additional excavation without prior approval of the Owner.

2. Foundation material or stabilization fabric, as shown on the Drawings, shall be provided by the Contractor only when specifically called for on the Drawings or in these Specifications or when required by the Engineer. No additional payment will be made to the Contractor for foundation material or stabilization fabric placed without prior written approval of the Owner of such additional payment.

3. As an alternative to over-excavation and placement of foundation material, a geotextile fabric may be used if field use proves acceptable. The fabric material

shall be placed on the bottom of the trench and the bedding material placed over the fabric to proper pipe grade. The fabric width shall be 1-foot wider than the trench bottom.

D. Exploratory Work

The Contractor shall perform appropriate exploratory work to locate utilities when they are known to exist, but the specific location is unknown or not marked accurately. Appropriate exploratory work shall be performed in these situations.

3.4 Shoring, Sheeting, and Bracing of Trenches

A. The Contractor shall adequately sheet and brace the trench during excavation whenever necessary to satisfy trench safety standards, prevent cave-ins, or to protect adjacent structures or property. Where sheeting and bracing are used, the Contractor shall increase trench widths for the bracing material accordingly.

B. The sheeting must be kept in place until the pipe has been placed, backfilled at the pipe zone, tested for defects, and repaired if necessary. All sheeting, shoring, and bracing of trenches shall conform to the requirements of the public agency having jurisdiction.

3.5 Dewatering Excavated Areas

A. All groundwater, seepage, or stormwater that may occur or accumulate in the excavation during the progress of the Work shall be removed. In areas where the nature of soil and hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the dewatering operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench.

B. All excavations shall be kept free of water during the construction or until otherwise requested by the Engineer.

C. The Contractor shall dispose of all waste and water removed from the trench. Disposal shall be in accordance with all state and local regulations.

3.6 Location of Excavated Materials

A. During trench excavation, the excavated material shall be located within the construction easement or right-of-way so that the excavated material will not obstruct any private or public traveled roadways or streets or cause undue damage to the streets.

B. The Contractor shall provide means of containing overly saturated soils (i.e., muck or remove the muck from the Work area as it is excavated), if such soils are encountered in the excavation. The intent is to prevent excessive damage or disruption to street rights-of-way or easement beyond what would normally occur during such Work. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least two feet from the edge of the trench. It shall be the Contractor's responsibility to determine the safe loading of all trenches.

3.7 Disposal of Excavated Materials

The Contractor shall dispose of all excavated material, which is not required for or is unsuitable for backfill. The Contractor's method of disposal shall comply with regulations of the governing body having jurisdiction.

3.8 Trench Backfill

A. All backfill material shall be placed into the trench so that free fall of the materials into the trench is prevented until at least 2 feet of cover is provided over the pipe. Under no circumstances shall sharp or heavy pieces of material be allowed to drop directly onto the pipe. Methods of backfilling, other than as specified herein, shall be used only upon the approval of the Engineer.

B. Bedding and Select Backfill

1. A minimum 4-inch depth of bedding shall be placed on the trench bottom, compacted to 85 percent of the maximum density as determined by ASTM D698, as applicable, and smoothed to provide uniform bedding so the pipe is supported along its full length and not by the bells. Bell holes at each joint shall be provided to ensure support along the entire pipe length.

2. It shall be understood that the 4-inch depth is a minimum depth only, not an average depth and does not preclude the Contractor's option from placing additional depth of bedding to facilitate Work. Once the pipe is properly installed, the bedding material shall be brought up to the spring line of the pipe in 4-inch lifts and compacted to 85 percent density. Care shall be used to ensure the bedding material is properly worked under the haunch of the pipe for its full length. No additional payment will be made in the event the Contractor elects to use additional bedding material for convenience only. Payment for any additional bedding material used as foundation material must be approved by the Owner prior to any Work being performed.

3. Select backfill shall then be brought up from the spring line to the minimum distance above the top of the pipe shown on the Drawings, leveled and compacted to 85 percent of ASTM D698, as applicable, density. Compaction of the bedding and select backfill by hand tamping will be allowed if the 85 percent density is achieved; otherwise, mechanical tamping will be required.

4. When an open-graded material is used for bedding or foundation material to facilitate trench dewatering, the open graded material shall be placed to the spring line of the pipe. The Contractor shall make provisions to ensure that fines from the select backfill do not migrate into the open graded bedding or foundation material. To prevent soil migration the Contractor may use any of the following:

    a. Provide a properly graded select backfill approved by the Engineer;

    b. Provide an approved fiber/fabric between the open graded bedding material and select backfill;

    c. Hydraulically jet select backfill fines into open graded bedding material after dewatering is complete and before general backfill is placed; or

    d. Provide an alternative approved by the Engineer.

C. All general backfill material shall be pushed first onto the slope of the backfill previously placed and allowed to roll down into the trench. The Contractor shall not push the backfill material directly into the trench until at least 2 feet of cover is provided over the pipe.

D. Compaction

1. In roadways, driveways, under curbs and sidewalks, as shown on the Drawings, or as required by the Engineer, general backfill shall be placed in horizontal lifts not to exceed 12 inches in depth and compacted to 90 percent of the laboratory density as determined by ASTM D1557, as applicable. The method of compaction shall be selected by the Contractor.

2. The Contractor shall exercise extreme care to avoid damage to the pipe during compaction of the trench. Where materials consist of cobbles and coarse gravels, compaction of each lift shall be accomplished by at least five passes of an appropriate vibrating type compactor. When materials are such that

meaningful in place density test cannot be run, then the Contractor and Engineer will agree on a method of compaction that will provide adequate compaction.

3. In sections where specific compaction requirements are not specified or required by the Engineer, general backfill shall be compacted, as a minimum, to a density equal to that of the natural ground adjacent to the trench. All trenches shall be maintained for a period of one year after final acceptance of the Project. Any settlement of the trenches during the 1-year guarantee period shall be remedied promptly at the request of the Engineer and at no additional cost to the Owner.

E. Controlled Density Fill (CDF) Placement

1. When called for on the Drawings, the Contractor shall backfill trenches with CDF.

2. CDF shall be placed in the trench in such a manner to ensure the trench is completely filled to the lines and grades called for on the Drawings.

3. CDF shall be protected from traffic loads for a 3-hour period, after which required surface restoration work may be performed.

F. Canal or Irrigation Ditch Crossing

1. Where the trench crosses a canal, irrigation ditch or culvert, the backfill shall be compacted the entire trench depth with mechanical tampers to 90 percent of the laboratory density as determined by ASTM D1557.

2. All backfill material in the canal or ditch liner and in the trench cut-off wall shall be imported clay or a soil/bentonite mixture as approved by the Engineer. Unless required otherwise, the soil/bentonite mixture shall be 1-part bentonite to 10 parts soil by weight. A high-grade bentonite material shall be used.

3. The ditch lining, conduit, or pipe shall be restored to its original condition. The crossing shall be water tight and free of any leakage or seepage. The Contractor shall be fully responsible for repairing canal or ditch banks at no cost to the Owner should leakage occur at the crossing.

G. Anti-Flotation Fabric Placement

1. When called for on the Drawings or called for by the Engineer, the Contractor shall place geotextile fabric over the select backfill material prior to placing general backfill. This fabric will help reduce the exposure to pipeline flotation.

2. The fabric shall be placed in accordance with the requirements shown on the Drawings.

3.9 Installation of Water Supply Pipe

A. General

The installation of pipe fittings shall be in accordance with the Drawings and Specifications and the manufacturer's requirements.

B. PVC pipe installation shall conform to the Uni-Bell Plastic Pipe Association, "Guide for Installation of PVC Pressure Pipe for Municipal Water Main Distribution Systems" and also AWWA M23 "PVC Pipe - Design and Installation."

C. DI pipe installation shall conform to the requirements of AWWA C600.

D. Irrigation pipe shall be installed with bell ends laid facing in the direction of laying, unless otherwise directed by the Engineer. Each pipe shall be properly bedded so as to be supported for the full length of the pipe. A suitable foundation shall be achieved by a slight excavation under the bell at each joint. All rubber ring joints shall be lubricated and installed in accordance with the installation instructions of the pipe manufacturer, taking particular care to avoid pinching or otherwise causing damage to the rubber ring. All joints shall be free of dirt and other foreign matter prior to the joining of the next pipe. All joints shall be restrained to prevent creep and misalignment of joints.

E. Irrigation lines shall be installed to the minimum depths called for on the Drawings and to the lines and grades when shown.

1. It shall be recognized that irrigation piping depths may vary from the minimum depths shown when adjustment of grade is required to avoid conflict with existing utilities.

2. Additional fittings may also be required when a grade adjustment is required.

F. No pipe shall be installed in water or when conditions exist that, in the opinion of the Engineer, are unsuitable for the laying of the pipe.

1. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other approved means. This provision applies during the noon hour as well as overnight.

2. If there is water in the trench, the seal should remain in place until the trench is dewatered sufficiently to prevent groundwater from entering the pipe. Adequate provisions shall be made by the Contractor for final disposal of the groundwater pumped from trenches.

G. All pipe shall be installed true to line. The Contractor may deflect pipe joints according to manufacturer's recommendations. Pipe bending is not allowed.

H. Thrust and Anchor Blocks

1. Thrust and anchor blocks shall be constructed as shown on the Drawings and placed at all changes in direction, all changes in the diameter of the pipe, all dead-ends, as specifically shown on the Drawings and as required by the Engineer.

2. All thrust blocks shall be placed between the undisturbed ground and the fitting to be anchored. Plastic sheeting shall be used to provide a bonding barrier between the fittings and the concrete. The quantity of concrete and the area of bearing on the soil shall be as shown on the Drawings or as approved by the Engineer.

3. All thrust blocks shall be placed so that the entire pipe and fitting joints will be accessible for repairs. Bolts for mechanical and flange fittings shall not be covered with concrete. All bolts shall be accessible and removable without interference from the thrust block.

4. Thrust blocks may not be required where approved restraint joint pipe and fittings are utilized.

5. Concrete thrust blocks shall cure for 3 to 5 days before hydrostatic or leakage testing of pipelines, unless otherwise approved by the Engineer.

6. No backfill of thrust blocks shall occur until the Work has been observed by the Owner's representative.

3.10 Installation of Waste Pipe

A. Gravity service lines shall be constructed in accordance with the Drawings, Specifications, and applicable provisions of the International Plumbing Code (IPC) as amended by the State. The minimum slope of service lines shall be 1/4-inch per foot unless otherwise approved by the Engineer. The pipe size of gravity service lines shall be a minimum 4-inch diameter unless otherwise specified. The Contractor shall end gravity

service lines at the location as per the Drawings and at the invert elevation as shown on the Drawings or as set by the Engineer. Dead ends of service lines shall be marked with steel fence posts installed in the ground as shown on the Drawings.

B. Connection of service lines to new or existing gravity sewer main lines shall be as per the Drawings and shall be inspected and accepted by the Engineer prior to backfilling. All sewer service connections shall be watertight utilizing appropriate sewer service saddles or wyes. An approved tee fitting shall be used when new sewer mains are being installed. All holes and taps into an existing sewer main shall be cut using an approved tapping machine.

C. In the construction of new sewage collection systems, connection of new services allowing sewage into the system shall not be made until approval for connections has been given by the Engineer. No existing sewer service shall be interrupted without the approval of the Engineer and service owner. Connections of new service lines to existing service lines shall be by the proper adaptor coupling.

D. The Contractor shall obtain all necessary permits required to construct service lines on private property. The Contractor must utilize a licensed plumber for service line work on private property when required by state or local regulations.

3.11 Waste Pipe Testing

A. General

The Contractor shall furnish all labor, necessary equipment, and other apparatus including, but not limited to, gauges, mechanical or pneumatic plugs, and air hoses, necessary to properly perform the testing of sewer lines as specified. The Contractor may low pressure test sections of sewer lines before backfilling at his own option; but the acceptance test shall be performed only after backfilling, cleaning, and flushing has been completed.

B. Acceptance Test

The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the Engineer's representative. The Contractor shall coordinate the timing of this acceptance test with the Engineer's representative. The lines will not be accepted until the acceptance test has been witnessed and documented as passing.

C. Test Procedure

1. The method of testing follows the procedures outlined in the Oregon Standard Specifications for Construction, Part 00400, Section 00445.72(c), current edition. All air testing shall be by the Time Pressure Drop Method. Specific questions concerning test procedures may be referred to this publication. To facilitate test verification by the Engineer, all air used shall pass through a single, above-ground control panel. The pressure gauge used in air testing shall have minimum divisions of 0.10 psi and have an accuracy of 0.0625 psi (one ounce per square inch). The Engineer shall have the option of requiring the use of his own gauge. Test procedures are summarized below:

2. Field Test

    a. The Contractor may wet the lines prior to testing.

    b. Determine the average height of the groundwater over the line. The test pressures required shall be increased 0.433 psi for each foot of average water depth over the exterior crown of the pipe, but no greater than 9.0 psig.

    c. Add air slowly to the section of system being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure due to groundwater.

    d. After the test pressure is reached, allow at least two minutes for the air temperature to stabilize adding only the amount of air required to maintain pressure.

    e. After the temperature stabilization period, disconnect the air supply.

    f. Record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average back pressure due to groundwater.

    g. Compare the time recorded in the above step with the test time determined hereafter.

3. Acceptance

   a. Record the diameter in inches and the length in feet of all pipe in the section to be tested, including the service connections on the worksheet found at the end of Technical Specifications - "Sanitary Sewer Lines."

   b. Using the nomograph (Figure No. 1) found at the end of Technical Specifications - "Sanitary Sewer Lines," place a straightedge from the "d" column (diameter in inches) to the "L" column (length in feet). Read the corresponding "K" and "C" values for each of the pipes listed above, and record them on the worksheet.

   c. Add all values of "K" and all values of "C" for the section being tested.

   d. If the total of all the "C" values is less than one, the time shall be the total of all the "K" values.

   e. If the total of all the "C" values is greater than one, the time shall be found by dividing the total of all the "K" values by the total of all the "C" values. The result is the maximum test time. To make this division using the nomograph (Figure No. 1), use the total "C" and "K" values and read the time from the "tq" scale.

   f. In the event that the "d" and "L" values for a particular section of the system do not fall within the limits of the nomograph, the values of "K" and "C" may be computed from the following equations: "K" = 0.011d2L; "C" = 0.0003882dL.

D. If the "actual time" (field test) is equal to or greater than the "test time" required for the pipe section being tested, the pipe section will have passed the pressure test. (See worksheet.)

E. Infiltration Allowance

Groundwater infiltration to the collection system, including manholes, shall not exceed 50 gallons/inch diameter of pipe/mile/day. Any infiltration in excess of this amount shall be corrected at the Contractor's expense.

F. Deflection Test for PVC Pipe

1. All sanitary sewers constructed of PVC pipe shall be able to pass a deflection test. The test shall be conducted by pulling a go-nogo solid pointed mandrel or

sewer ball through the completed pipeline. The diameter of the mandrel or ball shall not be less than 95 percent of the base inside pipe diameter as defined by ASTM D3034, SDR 35 and ASTM F679, T-1 pipe. The base inside pipe diameter and minimum mandrel diameter are as follows:

Nominal Pipe Size, In.	Minimum Mandrel Dia., In.	Base Inside Pipe Dia., In.
6	5.46	5.742
8	7.28	7.665
10	9.08	9.568
12	10.79	11.361
15	13.20	13.898
18	16.13	16.970
21	19.00	20.004
24	21.36	22.480
27	24.06	25.327

2. All lines shall be tested unless determined otherwise by the Engineer based upon his observations during pipeline installation and visual inspection of the pipeline. Testing shall be conducted on a manhole to manhole basis and shall be done after the line has been completely cleaned and flushed with water. The Contractor shall, at his own expense, locate and repair any sections failing to pass the deflection test. All areas failing the deflection test shall be retested after corrective action has been taken.

G. Equipment

The Contractor shall perform all Work and furnish all materials and equipment as required to perform all required tests.

3.12 Connections to Existing Lines

A. Information shown on the Drawings indicating the size, type, class, and location of existing lines and associated fittings has been obtained from Record Drawings and other municipal records. It is expected that there may be some discrepancies and omissions in the information shown on the Drawings. Therefore, it shall be the responsibility of the Contractor to excavate and inspect existing irrigation piping requiring a connection to determine the exact fittings needed.

B. In connecting to existing lines, the Contractor may select the combination of fittings, subject to approval of the Engineer. Approved fabricated steel couplings, repair bands, transition couplings, or tapping sleeves are among the options available to the

Contractor. The Contractor shall submit to the Engineer information on the type of couplings proposed to use.

C. The Contractor shall provide watertight plugs and thrust restraints, as required, to cap old lines after they are disconnected.

D. The Contractor shall provide special attention in providing thrust restraint for fittings installed as part of a connection to an existing line, when such connection will be placed into service before normal cast-in-place thrust blocks can achieve required strength. In such cases thrust restrained joints, precast thrust blocks, etc., must be utilized to provide thrust restraint. Methods used by the Contractor shall be approved by the Engineer.

E. The Contractor shall not interrupt service for the purpose of connecting to an existing line until the required location is excavated, the connection point is visually inspected, and all fittings required for completion of the connection or connections are verified available on site. Isolation of a section of line to be modified will be accomplished by the Contractor only after consultation with the utility owner for the purpose of determining the proper valves to close to affect the isolation. The Contractor shall cooperate with the utility owner in accomplishing this isolation. When Work is started on a connection, it shall proceed continuously without interruption, and as rapidly as possible until completed. If the connection involves turning off the water, the Contractor shall be responsible for notifying the residents affected by the shutoff.

3.13 Execution of Dust and Mud Control

If the Contractor fails to properly control the dust and mud, the Engineer may request him to do so in writing. If, after 24 hours from this request, the Contractor has not corrected the dust or mud problem, the Owner may elect to have the corrective work performed and withhold the cost from the Contractor's payments.

3.14 Restoration, Finishing, and Cleanup

A. The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees and shrubbery, lawns, pastures and fences, or other existing facilities disturbed by the Work, unless otherwise specified. Restoration and cleanup shall be a continuing operation and shall be diligently pursued until completed.

B. All surplus material and temporary structures, as well as excess excavation, shall be removed by the Contractor and the entire Site of Contractor operations shall be left in a neat and clean condition.

C. All existing facilities shall be replaced or restored equal to their original condition.

3.15 Other Installations

Installations of valves and valve boxes shall be in accordance with the manufacturer's requirements and the Drawings.

3.16 Removal and Salvage of Appurtenances, Fittings, and Other Items

A. The Contractor shall remove all existing facilities as required to properly perform the Work as shown in the Drawings. All such materials to be salvaged shall be transported to an area designated by the Owner and stockpiled. Materials shall be removed and handled in such a manner that will prevent damage.

B. The abandoned existing pipe is to remain in the ground, unless otherwise specified.

3.17 Testing

A. General

The Contractor shall furnish all necessary equipment and other apparatus, including gauges, necessary to properly perform the testing of irrigation lines as specified. Each section of the lines, before being tested and placed into service, shall be isolated and slowly filled with water. Air should be expelled from the line through hydrants or taps made at the high points. The Engineer shall have the option of requiring the use of his own gauges. Irrigation piping shall be generally tested in sections between valves and as the Work progresses. The Contractor shall be responsible for determining the length, timing, and section of lines to be tested, unless otherwise noted. When appropriate, testing intermediate sections of long lines should be considered. The Contractor shall provide any temporary test heads, fittings, blocking, etc., as may be required to properly test any given irrigation piping section. The Contractor shall be responsible for locating and repairing any defects in the irrigation piping that fail to pass the required test.

B. Acceptance Test

The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the Engineer's representative. The Contractor shall coordinate the timing of this acceptance test with the Engineer's representative. The lines will not be accepted until the acceptance test has been witnessed and documented as passing. Forms for performing

the various tests are included at the end of this Technical Specification for use and reference by the Contractor.

C. Hydrostatic Testing of Pressure Lines

All lines shall be pressure tested at 150 psi gauge or 1.5 times the actual working pressure, whichever is greater, for one hour, unless otherwise indicated on the Drawings. Any cracked or defective pipe, joints, or fittings shall be removed and replaced.

D. Leakage Test

Each section of the line, after all backfill and compaction work has been completed and before being placed into service, shall be tested for leakage for a period of 2 hours at a minimum average gauge pressure of 100 psi. Leakage is defined as the quantity of water supplied into the section of line being tested, during and at the end of the test, that quantity being such that the pressure at the end of the test is equal to the pressure at the beginning of the test. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints until the leakage is within the specified allowance.

PVC Pipe: $L = \frac{ND\sqrt{P}}{7{,}400}$ DI Pipe: $L = \frac{SD\sqrt{P}}{148{,}000}$

In which:

- L = Allowable Leakage Gal/Hr
- S = Length of Pipe Tested in Ft.
- N = Number of Joints or Connections
- D = Nominal Diameter in Inches
- P = Gauge Pressure in psi

END OF SECTION

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SECTION 2

WELLHEAD IMPROVEMENTS

ATTACHMENT

Test Worksheet for the Water Lines – Leakage Test

TECHNICAL SPECIFICATIONS

SECTION 2

WELLHEAD IMPROVEMENTS

PART 1 - GENERAL

1.1 Scope

A. These Specifications cover general mechanical requirements for aboveground and/or vaulted pipe, valves, downhole well valve, and associated fittings for improvements to the existing Well No. 5 wellhouse. For additional requirements and related work, refer to other Technical Specifications and the Drawings.

B. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections, as determined by the Engineer, shall apply to the Work outlined in the Contract Documents.

1.2 Submittals

A. Pipe
B. Fittings
C. Valves

PART 2 - MATERIALS

2.1 Pipe

A. General

Pipe shall be of the type called for on the Drawings and shall conform to the following Specifications. Pipe substitutions may be made only with prior approval of the Engineer.

B. Ductile Iron Pipe

1. Ductile iron pipe and fittings shall conform to AWWA C150, AWWA C115, AWWA C151, and AWWA C110 and shall be minimum special Class 350, unless specified otherwise. All ductile iron pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104. All joints for buried service, unless otherwise specified, shall be push-on rubber gasket joints conforming to AWWA C111. When required for fittings, mechanical joints shall conform to AWWA C111.

2. When flanged pipe is required, the Contractor shall provide the ductile iron pipe class required by the flange manufacturer to ensure the pipe and flange units are compatible. This data shall be provided to the Engineer for review prior to

ordering these materials. Flanges for couplings and fittings shall conform to ANSI B16.1, 125-pound bolt hole template.

C. Galvanized Pipe

Galvanized wrought iron pipe, when required, shall conform to ASTM A120.

D. Copper Tubing and Fittings

Copper tubing shall be Type K or Type L as called for on the Drawings and shall conform to ASTM B88. Fittings shall be cast bronze conforming to ANSI B16.18 or wrought copper fittings conforming to ANSI B16.22.

E. PVC Pipe - 2-inch Diameter or Smaller

PVC pipe shall be the size and type called for on the Drawings and shall conform to the following applicable ASTM Standards:

1. D1784, PVC and CPVC plastic compounds

2. D1785, Schedules 40, 80, and 120 PVC pipe

F. Miscellaneous Pipe

Miscellaneous small pipe, not otherwise specified, shall be of first class material and suitable for the intended service.

2.2 Fittings

A. Fittings for Iron and PVC Pipe

1. Unless specified otherwise, all fittings such as elbows, tees, crosses, etc., for buried pipe shall be mechanical joint short-bodied compact ductile iron fittings conforming to AWWA C153, Class 350.

2. When called for, flanged cast iron fittings shall conform to AWWA C110 with ANSI B16.1, 125-pound bolt hole template.

3. All fittings shall be cement mortar lined in accordance with AWWA C104.

4. Gaskets shall be either ring or full faced, 1/8-inch thick conforming to AWWA C111, Appendix B.

B. Sleeve Type Straight Couplings

Sleeve type couplings shall be ductile iron or fabricated steel as manufactured by Dresser, Ford, Romac, or approved equal conforming to AWWA C219. The Contractor shall provide the appropriate coupling and gaskets as required to match the water line types and sizes being utilized. Couplings shall be rated for the working pressure of the pipe main for which they will be utilized.

C. Restrained Joint Pipe and Fittings

1. Where called for on the Drawings, restrained joint pipe and fittings shall be:

   a. Restrained Push-on Joint Pipe

      When restrained joint ductile iron pipe is required, the pipe shall be the same class and type as the ductile iron pipe specified herein. Joints shall be Tyton Joint with Field Lok 350 gaskets, or approved equal. The restraint shall be boltless, integral restraining system, rated for 350 psi in accordance with the performance requirements of ANSI/AWWA C111/A21.11.

   b. Restrained Fittings

      All mechanical joint fittings called out to be restrained shall be equipped with a MEGALUG Series 1100 mechanical joint restraint system as manufactured by EBAA Iron, Inc., or approved equal.

2. Dismantling joints, when specified, shall be Viking Johnson, Romac DJ400, or approved equal.

D. PVC Fittings

PVC fittings shall be the size and type called for on the Drawings and shall conform to the following applicable ASTM standards:

1. D2464, Threaded Schedule 80 PVC fittings

2. D2466, Socket-type Schedule 40 PVC fittings

3. D2467, Socket-type Schedule 80 PVC fittings

4. D2564, PVC solvent cements

E. Pipe Taps

1. Pipe taps for accessories such as pressure gauges, flow switches, pressure switches, air release valves, hose bibs shall be made as follows:

   a. Ductile Iron Pipe - Drilled and tapped or saddle tap.

   b. PVC Pipe - Saddle tap, direct tapping not acceptable.

2. All taps for accessories shall be provided with an isolation valve between the tap and accessory.

2.3 Valves

A. General

Valves shall be of the type called for on the Drawings and shall conform to the following:

B. Gate Valves

1. Gate Valves, 2 inches and smaller

   Valves shall be all bronze, non-rising stem, conforming to Federal Specification MSS-SP-80, rated for a minimum working pressure of 125 psi.

2. Gate Valves, 2-1/2-inch to 12-inch

   a. Valves shall conform to AWWA C509 or C515. Valves shall be designed for 200 psi minimum working pressure and shall be of iron body, resilient seat, non-rising stem construction. Valves shall be equipped with O-ring type packing.

   b. Unless shown otherwise on the Drawings, aboveground valves shall have a handwheel operator and shall have position indicators.

   c. Buried valves shall have a 2-inch AWWA operating nut, or as called for on the Drawings.

   d. The valve ends shall be of the type required to match the pipe to which they will be connected, or as shown on the Drawings.

   e. Valves shall be resilient seated Kennedy KSRW or KSFW, M&H Style 4067 or 7000, Clow, or equal.

C. Ball Valves

1. Type V300 Ball Valve, 3 inches and Smaller, for General Water and Air Service

   a. All-bronze body and end piece, hard chrome-plated solid bronze or brass ball, end entry type, RTFE seats and packing, hand lever operator, rated 600-pound WOG, 150-pound SWP, complies with MSS SP-110.

   b. Bronze ball valves shall be installed where shown on the Drawings.

   c. Manufacturers and Products:

      1) Milwaukee Valve UPBA100
      2) Nibco T-585-80
      3) Or approved equal

2. Type V330 PVC Ball Valve, 2 inches and Smaller

   Rated 150 psi at 73°F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon "O" ring stem seals, to block flow in both directions. Valves shall be Spears, True Union, or approved equal. PVC ball valves shall be installed where shown on the Drawings.

D. Butterfly Valves

1. Butterfly valves shall be of the rubber seated tight-closing type and shall meet or exceed the requirements of AWWA C504.

2. Unless otherwise shown on the Drawings, aboveground valves shall have handwheel operator with closing turns approximately equal to that of the same sized gate valve.

3. Buried valves shall have an AWWA 2-inch operating nut.

4. Valves shall be M&H 4500 or approved equal.

5. Position indicators shall be provided with all aboveground butterfly valves. The valve ends shall be of the type required to match the pipe to which they are connected.

E. Check Valves

1. Check valves shall be of the non-slam type as called for on the Drawings. Non-slam type check valves shall have semi-steel body, stainless steel trim (plug, seat, etc.), stainless steel return spring, and shall have a plug guided at both ends. Pressure drop shall not exceed 1 psi at 5 fps. Valve shall be APCO Series 600 as manufactured by Valve and Primer Corporation, or approved equal.

2. Where called for on the Drawing, ball check valves shall be ball style check valve with sinking ball as manufactured by Flygt Model HDL, or approved equal.

3. Swing check valves shall be swing-type, lever-operated valves. The valve shall have a cast iron body and disc, bronze seat, rubber seat ring, and 303 stainless steel shaft. The external lever shall have an adjustable weight. The valve shall be equipped with an air cushion device for slowed opening and closing of the valve. Swing check valves shall be Mueller, Kennedy, or equal.

F. Control Valves

1. Control valves shall be furnished and installed as shown on the Drawings and in accordance with the manufacturer's instructions. The types of control valves included under these Specifications are:

   a. CV-1 : 1 – 8 inch 636EA-03BPSVYKCKR CLA-VAL reduced port solenoid control valve, energized to open, valve to be built and installed in reverse flow, ductile iron body with stainless steel trim, epoxy coated, 150 flanged ends, epoxy coated in/out, with X101 valve position indicator installed, 120/60 AC, P1 0-60 psi, P2 0-60 psi. **Valve to be built and installed in reverse flow.**

   b. CV-3: 1 – 4 inch 610G-09BPSKC, CLA-VAL reduced port combination altitude and back pressure valve, ductile iron body stainless steel trim, 150 Flange ends, epoxy coated in and out, 5- to 40-foot spring range CDS6A, 0-75 on CRL, P1 0-60 PSI, P2 0-60 psi, and X101 valve position indicator installed

G. Miscellaneous Valves

Miscellaneous valves not specified herein or on the Drawings shall be of first class construction and shall be suitable for the intended purpose.

H. Valve Labels

1. A valve label shall be provided for buried valves associated with pumping stations, reservoirs, etc.

2. The label shall be permanently cast into a concrete collar at each valve box.

3. The label shall note the valve number, if applicable, and valve function, as required by the Engineer.

2.4 Pressure Gauges

A. Clean Water

1. Pressure gauges for clean water shall have stainless steel bourdon tube and movement with stainless steel bodies and polycarbonate lenses.

2. Pressure gauges shall be glycerin-filled 500 series as manufactured by NoShok.

3. Graduation intervals shall be the smallest available for the pressure range required.

4. Pressure gauges shall have a minimum 4-inch diameter dial face and be provided with a pressure snubber and ball-type isolation valve.

2.5 Down Hole Well Valve

A. The well downhole control valve shall be NSF 61 approved, fully automated complete system, vertically sliding with spring close on failure, hydraulically actuated valve system with independent PLC valve controller, piston assembly, pressure sensors, and position indicators. The downhole control valve system shall have the following components:

1. Pistons: Lead free materials and NSF 61 certified

2. Sensors: 0 – 2,500 psi

3. Programmable Logic Controller: Equal to Allen Bradly L16 Compact Logix

4. Hydraulic Hoses: Equal to Diebolt NSF

5. Seals: NSF 61 certified

6. Hydraulic fluid: Equal to Clarion® Food Machinery AW 68

7. 5-Year Warranty: 5-year warranty on the valve and one-year warranty on all other parts, plus a 10 percent refund of the purchase price to be used to remove and install the valve if there should be a failure during the warranty time.

B. See Drawings for valve size.

C. Valve to be installed inline of well column pipe above the well pump and below the pumping water level.

D. The well downhole valve shall be 3R Valve as manufactured by 3RValve LLC (541) 376-8107; http://3rvalve.com or equivalent.

PART 3 - EXECUTION

3.1 Pipe Installation and Testing

A. General

Pipe shall be installed in accordance with good trade practice with respect to handling, joining, supporting, and testing. A calibrated torque wrench shall be provided and used where specific torque requirements are specified by the manufacturer.

B. Pipe Supports and Couplings

All pipe shall be rigidly secured in place by means of blocking, hangers, brackets, clamps, or by other approved methods, in such a manner to adequately support the pipe under all operating conditions, whether or not such supports are shown on the Drawings. Sufficient unions and couplings shall be provided to facilitate the installation of any section of piping.

C. Testing

1. The Contractor shall furnish all necessary equipment and other apparatus, including gauges, necessary to properly perform the testing and disinfection of water lines as specified. Lines to be tested include mains and service lines. Each section of the lines before being tested and placed into service shall be isolated and slowly filled with water. Air should be expelled from the line through hydrants or taps made at the high points. The Engineer shall have the option of requiring the use of his own gauges.

2. The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the Engineer's representative. The Contractor shall coordinate the timing of this acceptance test with the Engineer's representative. The lines will not be accepted until the acceptance test has been witnessed and documented as passing. Forms for performing the various tests are included at the end of this Technical Specification for use and reference by the Contractor.

3. All lines shall be pressure tested at 150 psi gauge or 1.5 times the actual working pressure, whichever is greater, for one hour. Any cracked or defective pipe, joints, or fittings shall be removed and replaced.

4. Each section of the line, after all backfill and compaction work has been completed and before being placed into service, shall be tested for leakage for a period of 2 hours at a minimum average gauge pressure of 100 psi. Leakage is defined as the quantity of water supplied into the section of line being tested, during and at the end of the test, that quantity being such that the pressure at the end of the test is equal to the pressure at the beginning of the test. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints until the leakage is within the specified allowance.

PVC Pipe: $L = \frac{ND\sqrt{P}}{7{,}400}$ DI Pipe: $L = \frac{SD\sqrt{P}}{133{,}200}$

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
N = Number of Joints or Connections
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

5. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints or pipe until the leakage is within the specified allowance. Prior to testing, potable water pipe and equipment shall be disinfected in accordance with Oregon Administrative Rules, Chapter 333, Public Water Systems, 1993, Section 333-61-050(10) "Disinfection of New Facilities" prepared by the DWS.

3.2 Painting

All pipes, valves, and fittings shall be painted in accordance with Technical Specifications - "Painting" and the Drawings.

END OF SECTION

TEST WORKSHEET FOR THE

WATER LINES - LEAKAGE TEST

Project Name _____

Date _____ Job No. _____

Location of Test/Stationing _____

_____

Hydrostatic Test

Test Pressure _____

Time Test Started _____

Time Test Completed _____

TOTAL TIME _____ minutes

Test Passed ☐ Yes ☐ No

Leakage Test (Min. Test Pressure 100 psi)

PVC Pipe: $L = \frac{ND\sqrt{P}}{7,400}$ DI Pipe: $L = \frac{SD\sqrt{P}}{133,200}$

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
N = Number of Joints or Connections
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

Allowable Leakage

Pipe Section	Nominal Diameter	Number of Joints or Connections	Length of Pipe	Allowable Leakage

Total Allowable Leakage _____ gal/hr

Time Test Started _____ Total Leakage Measured _____gal.

Time Test Completed _____ Total Leakage Measured/Gal=_____ gal/hr

TOTAL TIME _____mins. _____Time (hr.)

Test Passed ☐ Yes ☐ No

Contractor's Firm Name: _____

_____

Contractor's Representative Signature _____

Engineer's Representative Signature _____

Note: See Technical Specifications for directions of use.

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SECTION 3

MOBILE WATER TREATMENT SYSTEMS

TECHNICAL SPECIFICATIONS

SECTION 3

MOBILE WATER TREATMENT SYSTEM

PART 1 - GENERAL

1.1 Summary

A. These Specifications cover general mechanical requirements for a mobile ultrafiltration and ultraviolet (UV) light water treatment system. This system includes a rental pre-engineered ultrafiltration water treatment trailer, a rental UV disinfection unit, temporary water storage, site security, and required electrical and plumbing connections and appurtenances. For additional requirements and related work, refer to other Technical Specifications and the Drawings.

B. The Contractor shall furnish and install a complete and operable pump system as shown on the Drawings and specified herein.

PART 2 - MATERIALS

2.1 Mobile Ultrafiltration Membrane Water Treatment Trailer

A. Designed to remove suspended solids and organic debris from a raw water source.

B. Treatment Capacity and Requirements

1. Raw Water

Parameter	Maximum or Range
Flow	230-915 gpm typical 1,150 gpm maximum
Pressure	35-70 psig
Temperature	3-25 degrees C 37-77 degress F
pH	6-9
Total Organic Carbon	< 2.0 mg/L
Turbidity	< 20 NTU
Langelier Saturation Index	+0.5
Hardness	< 100 mg/L as $CaCO_3$
Iron	< 0.3 mg/L
Dissolved Iron	< 0.1 mg/L
Manganese	< 0.05 mg/L
Dissolved Manganese	< 0.025 mg/L

2. Treated Water Quality

Parameter	Maximum or Range
Flow	200-800 gpm typical 1,000 gpm maximum
Pressure	15 psig
Turbidity	< 0.1 NTU 95% of time < 0.3 NTU 100% of time
Silt Density Index	< 3.0
Particle Removal	> 4.0 log removal

C. Equal to Evoqua Water Technologies MEMCOR CP II Membrane Filtration System.

2.2 Ultraviolet Light Disinfection Unit

A. Radiation

1. UV Dose Range: 186 millijoules per centimeter squared (mJ/cm^2)
2. UVT Range: 70 percent to 98 percent
3. Water Temperature: 34°F to 104°F

B. Chamber

1. Type 316L stainless steel material
2. Minimum 6 lamps
3. Mounting feet
4. 150 psi maximum operating pressure
5. Automatic wiping system

C. Control Panel

1. Ballast Power Level: Electronic Variable Output (60 percent to 100 percent)
2. 240 V, single phase, 2 wire + ground, 60 Hz
3. Type 4X rating
4. Painted Mild Steel material
5. Input/Outputs: 5 analog in, 2 discrete in, 4 analog out, 7 discrete out

D. Instrumentation

1. One UV sensor per chamber

E. Equal to TrojanUVSwift SC Model D06.

F. Guarantee

1. Unit shall have third-party performance guarantee to validate UV Dose range.

G. Warranties

The manufacturer shall provide a written warranty that provides for:

1. Full replacement of all defective lamps within the first 3,000 hours of operation, provided that the system is operated continuously.

2. Full replacement of components against defects in materials and workmanship for a period of 1 year from date of final acceptance by the Owner.

3. Performance warranty as outlined in Paragraph 1.1, Scope and Paragraph 2.3.A. System Operating Conditions.

2.3 Filtered Water Storage Tank, TK-701

A. Minimum 15,000-gallon operational capacity.
B. Epoxy coated, NSF 61 approved.
C. Penetrations

1. One 8-inch diameter flanged inlet
2. Two 8-inch diameter flanged outlets
3. One 12-inch diameter flanged overflow
4. One 12-inch diameter flanged air vent

D. Material

1. Fiberglass
2. NSF 61 approved epoxy coated steel

2.4 Temporary Piping

A. PVC Pipe

1. PVC pipe shall be the size and type called for on the Drawings and shall conform to the following applicable ASTM Standards:

   a. D 1784, PVC and CPVC plastic compounds
   b. D 1785, Schedule 80, and 120 PVC pipe

2. Insulation

   a. Heat Tape
   b. Glycol Heater
   c. Pre-Insulated
      1) Polyurethane foam insulation injected in annual space between carrier pipe and jacket

B. Steel Pipe and Fittings

1. Steel pipe shall conform to the provisions of AWWA Standards C201 and C202. Pipe 10 inch and smaller shall be Schedule 40; pipe over 10 inch shall have 0.375-inch wall thickness.

2. Fittings for steel pipe less than 3-inch diameter shall be threaded malleable iron. Fittings for pipe 3-inch diameter and larger shall be seamless steel welding fittings with wall thickness equal to the pipe with which they are joined.

3. Flanges shall conform to AWWA Standard C207 and shall be the flat face type. Flanges shall have ANSI B16.1, Class 125 bolt hole template. Gaskets shall be either ring or full face, 1/8-inch thick conforming to AWWA C111, Appendix B.

4. Unless other linings are required by the Drawings, pipe 3-inch diameter and smaller shall be hot dipped galvanized and pipe 4 inch and larger shall be epoxy lined and coated, AWWA C210.

PART 3 - EXECUTION

3.1 Site Preparation

A. During trench and general excavation, the Contractor shall minimize the disturbance of adjacent gravel surfaces.

B. Backfill of trenches and other work areas shall be in accordance with Technical Specifications - "Underground Piping" or other applicable requirements.

3.2 Water System Assembly

A. Coordinate assembly of the mobile water treatment system with the manufacturer.

B. Assembly shall result in operational system as shown on the Drawings.

C. Filtered water shall meet all drinking parameters per Oregon Administrative Rule 333-61-0030.

3.3 Demonstration Test

Demonstration shall be operated continuously for 2 weeks followed by 2 weeks for recovery. This process shall be repeated for up to 3 months of operation.

END OF SECTION

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SECTION 4

INTAKE SCREEN AND INFEED PUMP STATION

TECHNICAL SPECIFICATIONS

SECTION 4

INTAKE SCREEN AND INFEED PUMP STATION

PART 1 - GENERAL

1.1 Scope

A. These Specifications cover general mechanical requirements for mechanical equipment for pump stations and well houses. For additional requirements and related work, refer to other Technical Specifications and the Drawings.

B. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of Work to be constructed. All applicable sections, as determined by the Engineer, shall apply to the Work outlined in the Contract Documents.

C. The Contractor shall furnish and install a complete and operable pump system as shown on the Drawings and specified herein.

1.2 Submittals

A. Inferred Pump - Certified Pump Performance Curve

The Contractor shall provide a certified pump performance curve from the pump manufacturer for the actual pump to be furnished on the Project. The curve shall show the head capacity, efficiency, and horsepower, and shall cover the complete operating range of the pump from zero capacity to maximum capacity including the design point.

B. Intake Screen

C. Silent Check Valve

D. Flexible Suction Hose

E. Flexible Discharge Hose

F. Shop Drawings of suction intake connection including dimensions, pipe material, and pipe fittings.

1.3 Storage of Equipment

The Contractor shall provide indoor storage facilities for all mechanical equipment including pumps, motors, and control equipment before they are installed. Any equipment that is damaged due to exposure to the weather shall be replaced at the Contractor's expense.

PART 2 - MATERIALS

2.1 Inferred Pump

A. Pump Type

The pump shall be a single-stage, end-suction, vertical mounted, close-coupled centrifugal pump. The pump shall be Cornell 4HH-VM or equal.

B. Operating Conditions

1. The pump shall be capable of delivering water under the following conditions:

Pumping Capacity (Primary)	987 gpm at 115 ft. total dynamic head (TDH)
Minimum Pump Efficiency at Primary Point	77 percent
Suction Lift	10 ft.
Maximum Speed	1,870 RPM
Minimum Horsepower	40 Hp
Suitable for surface water	

2. It shall be the Contractor's and Supplier's responsibility to furnish a pump that will operate under the conditions listed above and as shown on the Drawings.

C. Performance Characteristics

A pump with a flat curve is desired to provide a wide range of flow and to extend the distance to the pump shutoff or maximum operating head.

D. Pump Construction

1. The pump shall be a close-coupled, horizontal end suction centrifugal pump with close grained cast iron or ductile iron case and replaceable bronze or stainless steel wear rings.

2. The impeller shall be bronze, stainless steel, or cast iron and shall be balanced. Impeller shall be keyed to the shaft and secured by a vibration resistant lock screw.

3. The pump shall utilize a mechanical seal with a stainless steel or bronze shaft sleeve. Mechanical seals shall be constructed of 303 stainless steel with ceramic seals, Buna-N elastomers, Ni-resistant, and carbon washers. The pump shaft shall have O-ring seals.

E. Motor

1. Electric motor shall be of the high efficiency energy saver horizontal open drip-proof squirrel cage induction type, NEMA Design B, NEMA Code designation for applicable locked rotor kVA, for operation in 40°C ambient, with a service factor of 1.15 on sine wave or 1.0 on PWM inverter, motor shall meet NEMA MG-1 Part 31 requirements.

2. Class F insulation, continuous duty rated.

3. Motors shall be sized to ensure the motor will not be overloaded at any point on the pump operating curve without considering the service factor. Motor shall be suitable for 460 volt, 3-phase, 60 Hz power.

4. Motor lubrication instructions shall be stamped on a nameplate attached to the motor.

5. Inverter duty rated.

F. Spare Parts

Two spare mechanical seal kits shall be furnished with each pump.

G. Steel Pipe Manifolds

1. Fabricated steel piping manifolds will be acceptable for clean water applications.

2. Steel pipe shall be A53 Schedule 40 for up to 10-inch diameter and standard weight for pipes 12 inches and larger.

3. Flanges shall conform to AWWA C206-Class D and be compatible with ANSI B16.1 flanges on cast and ductile iron fittings.

4. All welds shall conform to the requirements of AWWA C206. All rough areas, spatter, etc., shall be ground smooth.

5. The interior of the steel pipe manifold shall be painted with an epoxy system approved by the Engineer, and the exterior of the pipe shall be painted in accordance with Technical Specifications - "Painting."

2.2 Pressure Gauges

A. Clean Water

1. Pressure gauges for clean water shall have stainless steel bourdon tube and movement with stainless steel bodies and polycarbonate lenses.

2. Pressure gauges shall be glycerin-filled 500 series as manufactured by NoShok.

3. Graduation intervals shall be the smallest available for the pressure range required.

4. Pressure gauges shall have a minimum 4-inch diameter dial face and be provided with a pressure snubber and ball-type isolation valve.

B. Wastewater

1. Pressure gauges for wastewater shall have stainless steel bourdon tube and movement with stainless steel bodies and polycarbonate lenses.

2. Pressure gauges shall be glycerin-filled 500 series as manufactured by NoShok.

3. Pressure gauge shall have a NoShok 29-04-SS-SS-04-SS-F diaphragm seal with SS treaded orifice in the gauge.

4. Graduation intervals shall be the smallest available for the pressure range required.

5. Pressure gauges shall have a minimum 4-inch diameter dial face and be provided with a ball-type isolation valve.

PART 3 - EXECUTION

3.1 Inferred Pump Operation

See Electrical Drawings for details.

3.2 Painting

All pipes, valves, and fittings shall be painted in accordance with Technical Specifications - "Painting" and the Drawings.

3.3 Testing

A. Field Test

1. The Contractor will arrange with the Engineer to witness a test of all mechanical systems and equipment after installation is completed. These tests shall demonstrate that the complete facility operates in accordance with the Drawings and Specifications and the required functions. All defects shall be corrected at the Contractor's expense before final acceptance. Refer to the General Requirements.

2. A field performance acceptance test shall be conducted on all pumps after completion of pump installation. The test shall be conducted by the installing Contractor and a representative of the pump manufacturer provided by the Contractor. The representative shall certify in writing that the pump installation is in accordance with the manufacturer's standards. The representative shall certify in writing, based upon actual field testing, that the pump meets the performance as shown on the applicable pump curve relative to discharge head, volume, and efficiency. A vibration test shall be made by the representative and he shall certify in writing that velocity and displacement of each pump are within the manufacturer's design tolerances. It shall be the Contractor's responsibility to take whatever corrective actions are necessary if the pumps do not meet the performance criteria.

B. Motor Rotation

1. Check for correct rotation of the motor. After the correct rotation is established, the amount of current unbalance between legs shall be calculated. Current unbalance between legs shall not exceed 5 percent. The current unbalance is defined and calculated as follows:

$$\% \text{ current unbalance} = \frac{\text{Maximum current difference from average current}}{\text{average current}}$$

2. Current readings should be checked on all legs using the three possible hookups. The best hookup will have the lowest percentage of unbalance. To avoid changing motor rotation when taking the readings, the motor leads should be rolled across the starter terminals by moving them in the same direction. The hookup with the lowest percent of unbalance shall be used.

3.4 Installation of Conduit for Pressure Transducer or Electric Probe

Conduit for the installation of pressure transducers or electric probes shall be securely attached to the discharge column with stainless steel bands at a maximum spacing of 20 feet.

END OF SECTION

THE FOLLOWING FORM SHALL BE COMPLETED

FOR EACH PUMP

Pump/Motor Installation Record

Date_____ Filled In By_____

Installation

Installer:_____ Telephone_____

Street:_____ City _____ State_____ Zip_____

Owner/User:_____ City_____ State_____ Zip_____

Well Identification, If Any:_____

Well Is For: City/Town_____ OR_____

Water Is Pumped To: Storage Tank_____ Distribution Piping_____

OR

New Installation? Yes_____ No_____ If Not, It replaces_____

Well (When Applicable)

Well Diameter:_____ In. Well Depth_____ Ft. Cased_____ OR Uncased_____

Casing:_____ In. Length _____ Ft._____ Screened _____ OR Unscreened _____

Casing Is: Steel _____ Stainless Steel _____ Plastic _____ OR _____

Screen _____ OR Perforated Casing _____ From _____ Ft. To_____ Ft. & _____ Ft. To ___ Ft.

Static Water Level Is: _____ Ft. Water Temperature Is:_____ °F

Drawdown Level Is: _____ Ft., After Pumping At _____ GPM

Pump/Motor Is Set At: _____ Ft., On Steel Pipe _____

Flow Sleeve On The Motor? Yes _____ No _____ If Yes, Mfr._____

Size _____ Model _____

Wiring

Transformers: KVA No. 1 _____ No. 2 _____ No. 3 _____ Connected: Wye _____ Delta _____

Supply Cable: (Service Entrance To Control): _____ Ft. of No. ___ Copper _ Alum._

Drop Cable: (Control To Motor): _____ Ft. of No. _____ Copper _____ Alum. _____

Cable is: Flat _____ Round _____ OR 3 Individual Conductors _____ Jacketed: Yes __ No __

Insulation Is: Neoprene _____ PVC _____ OR _____

Splice Is: Crimped ___ OR Soldered _____ And, Taped _____ Heat Shrink _____ OR _____

Controls and Protective Devices

Solid State Soft Start? Yes _____ No _____. If Yes, Type_____

Reduced Voltage Starter? Yes _____ No _____. If Yes, Type

Mfr._____Setting _____% Full Voltage In _____Seconds

Pump Panel? Yes _____ No _____ . If Yes, Mfr._____ Size_____

Magnetic Starter/Contactor: Mfr. _____ Model_____ Size _____

Heaters: Mfr. _____ No. _____ If Adjustable; Set At _____

Fuses: Mfr. _____ Size _____ Type _____

Lightning/Surge Arrester: Mfr. _____ Model _____

Controls Are Grounded: To _____ With No. _____Wire

Phase Converter? Yes _____ No_____ . If Yes, Mfr. _ Model .

Motor

Model No. _____ Serial No. _____ Date Code _____

Horsepower _____ Voltage _____ Phase _____ Diameter _____

Pump

Mfr. _____ Model _____Rated_____GPM At_____Ft.

Operating Cycle

Pump/Motor Operates; Continuously (Non-Stop) _____ OR is controlled by: _____

Manual Switch _____ Pressure Switch _____Float/Level Control _____ Flow Switch _____

Timer _____ OR

_____Off_____

_____On_____

_____Minutes Or _____ Hours_____Minutes Or _____ Hours

Startup Data

Insulation Check

Initial Megs: Motor & Lead Only Black_____ Yellow _____ Red _____

Installed Megs: Motor, Lead, & Cable Black_____ Yellow _____ Red_____

Voltage To Motor

Non-Operating: B-Y _____ Y-R _____ R-B _____

At Rated Flow of _____ GPM B-Y _____ Y-R _____ R-B _____

At Open Flow _____ GPM B-Y _____ Y-R _____ R-B _____

Amps To Motor

At Rated Flow of ____ GPM Black _____ Yellow _____ Red _____

At Open Flow _____ GPM Black _____ Yellow _____ Red _____

At Shut Off* Black _____ Yellow _____ Red _____

*Do NOT Run at Shut Off More Than Two (2) Minutes.

Comments: _____

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SECTION 5

PAINTING

PART 1 - GENERAL

1.1 Scope

A. This Technical Specification covers the furnishing of labor, materials, and equipment necessary to provide surface preparation, coating application, and inspection for a complete coating system as specified.

B. As a general guideline, exposed improvements shall be painted unless specifically noted otherwise on the Drawings or Specifications. For piping systems above ground and in vaults, all pipe, valves, flowmeters, pumps, motors, etc., shall be painted.

C. In general, painting finishes are not required on the following, unless specifically noted otherwise on the Drawings or in the Specifications:

1. Stainless steel items of equipment, materials, and furniture having a factory finish, if the factory finish is in good condition.

2. Aluminum not in contact with concrete or masonry.

3. Galvanized fencing materials.

4. Manholes and covers.

5. Buried or concealed improvements.

D. Items specified in this Technical Specification are intended to be broad in scope and may not always apply to every item of Work to be constructed. All applicable sections, as determined by the Engineer, shall control the Work outlined in the Contract Documents.

1.2 Reference Standards

A. Protective coatings on potable water structures shall conform to applicable standards of the Oregon Health Authority - Drinking Water Services (DWS), AWWA, and ANSI/NSF.

B. Without limiting the general aspects of other requirements of these Specifications, all surface preparation, coating, and painting of interior and exterior surfaces shall conform to the applicable requirements of the National Association of Corrosion Engineers, the Steel Structures Painting Council, the DWS, and the paint system manufacturer's printed instructions.

C. The below listed standards in Table 1 are part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail. Where standards of surface preparation are described by citing SSPC specification, numbered reference is made to the "Steel Structures Painting Manual," Volume 2, published by the Steel Structures Painting Council.

Table 1
Reference Standards

Reference	Title
ANSI-NSF 61	Drinking Water System Components – Health Effects
SSPC-SP1	Specification for Solvent Cleaning
SSPC-SP2	Specification for Hand Tool Cleaning
SSPC-SP3	Specification for Power Tool Cleaning
SSPC-SP5	Specification for White Metal Blast Cleaning
SSPC-SP6	Specification for Commercial Blast Cleaning
SSPC-SP10	Specification for Near-White Metal Blast Cleaning
SSPC-PA2	Measurement of Dry Film Thickness with Magnetic Gages
ASTM D4060	Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D2794	Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D4541	Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM F1249	Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
ASTM B117	Test Method of Salt Spray (Fog) Testing
ASTM D741	Method for Evaluating Degree of Blistering of Paints
ASTM D870	Practice for Testing Water Resistance of Coatings Using Water Immersion
ASTM D1014	Method of Conducting Exterior Exposure Tests of Paints on Steel
ASTM D1653	Test Method for Water Vapor Permeability of Organic Coating Films
ASTM D1654	Method of Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D4585	Practice for Testing the Water Resistance of Coatings Using Controlled Condensation
ASTM D5894	Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal (Alternating Exposure in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

1.3 Storage and Handling

A. Materials shall be brought to the Project Site in original sealed containers. The containers shall bear a legible product designation, batch number, and date of manufacture on the side of each container. They shall not be used until the Engineer has inspected contents and obtained data from information on containers or labels. Materials exceeding storage life recommended by the manufacturer shall be rejected. Submit paint receipts/invoices, upon request, to the Engineer.

B. Coating materials shall be handled and stored according to the manufacturer's latest published instructions, and shall be protected from damage, moisture, direct sunlight, and temperatures below 40°F or above 100°F. Flammable coatings and paints must be stored to conform with city, county, and state safety codes for flammable coating or paint materials. Water base coatings or paints shall be protected from freezing.

1.4 Submittals

A. Submit in accordance with the General Requirements in one complete package.

B. Prior to ordering material, submit a complete schedule of materials to be used. Include manufacturer's brand name, product name, and designation number for each coat of each system to be used. Include information indicating percent solids by volume, minimum recommended dry film thickness per coat, recommended surface preparation, recommended thinners, application instructions, and a statement indicating that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

C. Prior to commencing Work, submit a detailed list of all surfaces and equipment items upon which the Contractor intends to apply protective coatings.

D. Provide the following information on each paint product:

1. Abrasion resistance, ASTM D4060, 1 kg load at 1,000 cycles, CS-1 7 wheel

2. Impact resistance, ASTM D2794, direct and reverse

3. Moisture vapor transmission, ASTM Fl249

4. Adhesion, ASTM D4541

5. Salt fog, ASTM B117

6. QUV, ASTM G53 (exterior finish coat only)

7. Fresh water immersion, ASTM D870 (immersed coatings only)

8. Humidity, ASTM D4585

E. If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Engineer may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Owner. For substituted materials, provide a list of references, including contact person and phone number, where proposed substitute paint system has been used in similar exposures. Provide a minimum of five references (no duplicate owners or agencies).

F. Provide Material Safety Data Sheets (MSDSs) for all products.

G. Manufacturer's Certification: That products furnished meet applicable air quality regulations as to allowable VOC content for the place of application and use intended.

H. Submit to the Engineer a full range of the manufacturer's standard and let down finish colors for review and selection by the Owner. After final colors have been selected, submit two 8-1/2 by 11-inch Samples on cardboard of each color indexed as to manufacturer and color designation. Color chips 3/4-inch by 1-1/2-inch may be used for pipe color codes.

1.5 Quality Assurance

A. The Contractor shall submit to the Engineer a written detailed description of the painting Subcontractor's qualifications and experience relative to the application of the specified coating systems. Such description shall include the following minimum information:

1. Name of the company that will be performing the painting work.

2. Experience of the company on similar projects, including experience with sandblasting, preparation of steel structures, concrete, piping, buildings, equipment, etc., and use of the paint systems specified herein.

3. List of similar projects that the company has completed (five minimum).

4. List of contact persons and telephone numbers for each job reference.

5. Names of personnel who will be performing the Work on this Project and their experience.

6. Name of the on-the-job painting supervisor and his/her experience.

B. Coating Manufacturer's Qualifications

1. Protective coatings furnished under this section shall:

a. Be of a manufacturer who has been regularly engaged in the manufacture of protective coatings with a minimum of 10 years of successful experience.

b. Demonstrate to the satisfaction of the Engineer successful performance on comparable projects.

C. Applicator's Qualifications

Applicator shall be experienced in application of specified protective coatings for a minimum of 5 years, practical experience in application of the specified coatings, and successful completion of a minimum of five projects of similar size and complexity within the last 3 years.

D. Coating manufacturer's authorized representative shall provide a written statement attesting that the applicator has been instructed on proper preparation, mixing, and application procedures for coatings specified as well as the applicator's qualifications.

E. The coating system manufacturer shall provide a qualified representative to visit the Site a minimum of two times during the coating operations. The manufacturer's representative shall provide a written report at the conclusion of each site visit.

PART 2 - MATERIALS

2.1 General

A. TNEMEC products are listed as the basis of design and quality in terms of performance and characteristics. Other manufacturers' products will be considered subject to meeting the listed quality, performance, and characteristics of the standard/product(s) for the particular application and compliance with the Specifications. Substantiating Technical Data are required. Submit requests for substitution in accordance with the General and Supplementary Conditions. Substitutions that decrease the film thickness, solids by volume, or number of coats will not be considered. Requests for substitutions

shall include test reports that demonstrate the product(s) meets or exceeds the performance and characteristics of the listed standard/product(s).

B. The Contractor shall submit any proposed substitutions on Table 2 "Protective Coating - Substitution List" at the end of this section. Colors where not specified shall be approved by the Owner.

PART 3 - EXECUTION

3.1 Surface Preparation

A. General

Surfaces to be painted shall be prepared in accordance with the manufacturer's instructions in a professional manner with the objective of obtaining a smooth, clean, and dry surface. No painting shall be done before the prepared surfaces are approved by the Engineer.

B. Metal

1. Metal surfaces, including piping, not shop primed or painted shall be thoroughly cleaned by sandblasting, in accordance with the paint manufacturer's instructions, and as specified herein prior to painting. Any metal items with a paint incompatible with the specified finish shall be primed as recommended by the paint manufacturer.

2. Previously painted surfaces such as piping which are pitted, scaling, rusty, etc., or in otherwise poor condition shall have existing paint removed to bare metal or as approved by the Engineer. Oils, dirt, and other surface contaminants, shall be removed so that surfaces are properly prepared for painting. Priming and painting shall then be applied in accordance with these Specifications.

C. Wood

Wood surfaces exposed to view shall be sanded to remove any dirt or blemishes. Roof decking and beams need not be sanded if protected during construction such that no blemishes occur. Existing wood surfaces previously painted shall be scraped, sanded, and cleaned as required prior to painting.

D. Concrete and Masonry

Concrete and masonry surfaces shall be cleaned of all dust, form oil, curing compounds, and other foreign matter. Concrete intended for immersion service shall be brush blasted prior to coating.

E. Concrete Floors

Concrete floors must be swept blasted to provide a light profile. ASTM WET MAT TEST shall be conducted by the Contractor on concrete that has not cured for 28 days.

3.2 Application

A. Paint shall be applied in a neat, professional manner. Finished surfaces shall be uniform and pleasing in appearance, free of runs, drips, sags, or variable texture. Defective painting shall be removed and replaced.

B. The painter shall apply each coating at the rate specified for application by the manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material.

C. Drying time shall be construed to mean "under normal conditions." Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying time will be necessary. Additional coats of paint shall not be applied nor shall units be put into service until paints are thoroughly dry.

D. Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, shall be allowed, and all such thinning shall be done strictly in accordance with the manufacturer's instructions, as well as with the full knowledge and approval of the Engineer.

E. No paint shall be applied in fog, snow, rain, or to wet or damp surfaces, or when air temperatures are below 40°F and surface temperatures are below 35°F or when the relative humidity exceeds 85 percent. The Contractor shall provide heaters, fans, etc., when necessary to keep moisture off of piping to be painted.

F. Coating materials shall not be applied when the ambient air temperature, surface temperature, or humidity is outside the boundaries as stated on the product data sheets.

G. Materials shall be evenly applied to form a smooth, continuous, unbroken film.

H. Dirt, grease, oil, paint chalk, or any other contamination will not be permitted between coats.

I. Welds, bolt heads, nuts, rivets, and connections shall be stripe coated by brush with primer prior to applying full coat of primer.

J. Concrete and masonry surfaces shall be thoroughly cured and free of other surface contaminants prior to application of protective coatings. Curing compounds shall not be used where painting will be required.

K. Each application of protective coatings, with the exception of coal tars, shall be a different shade in color than the specified finish.

3.3 Painting Schedule

Painting schedule for the Work is given in Table 3 (end of section).

3.4 Inspection

A. Dry Film Thickness

After application of each coating in the specified system, the total dry film thickness shall be taken as follows:

1. Make 5 separate spot measurements spaced evenly over each section of 100 square feet in area per SSPC-PA 2. Measurements, as much as possible, should be taken at surfaces with dissimilar exposures, that is, at different angles, faces, bolts, etc., to ensure uniformity of the coatings.

2. No single spot measurement (average of 3 readings) in any section shall be less than 80 percent of the specified thicknesses.

B. Documentation

Applicator is to keep a log of ambient and surface temperature, humidity, dew point, and dry film thicknesses (paragraph 3.4.A.). These are to be logged every day at the beginning, middle, and end of each shift. This log is to be current and available at all times for the Owner, Engineer, and coatings manufacturer to verify.

3.5 Colors

A. General

Colors shall be as called for on the Drawings or as approved by the Owner and directed by the Engineer. The Contractor shall provide color charts to the Engineer when required.

B. Color Pipe Coding

1. To facilitate identification of piping in plants and pumping stations, the color scheme given in Table 4 (end of section) shall be utilized. Final color selection will be as approved by the Engineer.

2. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be painted on one of the pipes at approximately 30-inch intervals. Identification labels shall also be painted on the pipe. Paint arrows indicating the direction of flow. For each pipe to be provided with labeling, the Engineer shall provide the Contractor with the list of identification labels.

3.6 Extra Paint

The Contractor shall provide a minimum of one gallon of extra paint for each major color and system used. A minimum of one quart of extra paint shall be provided for colors used as trim or for minor items as determined by the Engineer. The Contractor shall provide either fresh labels from paint cans with a list of places used, or a written description of painting systems, locations used, and applications requirements.

Table 2
Protective Coatings – Substitution List

System No.	Specified Coating		Substitute Coating Manufacturer's Name, Generic, Performance, Percent Solids, Surface Preparation, No. Coats, Industrial Use, Standards
	Generic	Coating Name[1]	
1	Modified Aromatic Polyurethane (Primer) Aliphatic Acrylic Polyurethane (Finish)	Series 1 Series 73	
2	Modified Aromatic Polyurethane (Primer) Alkyd (Finish)	Series 1 Series 2H	
3	Modified Aromatic Polyurethane (Primer) Polyamidoamine Epoxy (Intermediate) Polyamidoamine Epoxy (Finish)	Series 1 Series N69 Series N69	
4	Modified Aromatic Polyurethane (Primer) Polyamidoamine Epoxy (Finish)	Series 1 Series N69	
5	Modified Alkyd (Primer) HDP Acrylic Polymer (Finish)	Series 10 Series 1029	
6	Epoxy Modified Cementitious Mortar (Surface Filler) Polyamidoamine Epoxy (Primer) Polyamidoamine Epoxy (Finish)	Series 218 Series N69 Series N69	
7	Polyamide Epoxy (Primer and Finish)	Series 20	
8	Coal Tar	Series 46-465	
9	Acrylate (Primer and Finish)	Series 156	
10	Water Repellent Sealer	Degussa Protectosil Chem-Trete 40 VOC	
11	Acrylate (Primer and Finish)	Series 156	
12	Modified Polyamine Epoxy (Primer and Finish)	Series 280	
13	Vinyl Acrylic (Primer) Self-Crosslinking Hydrophobic Acrylic (Finish)	Series 51-792 PVA Series 115	
14	Vinyl Acrylic (Primer) Self-Crosslinking Hydrophobic Acrylic (Intermediate) Waterborne Acrylic Epoxy (Finish)	Series 51-792 PVA Series 115 Series 113	
15	Polyamidoamine Epoxy (Primer and Finish)	Series N69	
16	Waterborne Modified Polyamine Epoxy (Primer) Acrylic Emulsion (Finish)	Series 151-1051 Series 6	

[1] All listed coating names are TNEMEC products, except System No. 10.

TECHNICAL SPECIFICATIONS

SECTION 5

PAINTING

Table 3
Painting Schedule

Paint System No., Type, and Location	Surface Preparation	Prime Coat ([1,2])	Intermediate/Finish Coat ([1,2])
Ferrous Surfaces			
No. 1 - MC Polyurethane and Polyurethane Protective Coating - Exterior non-immersed ferrous surfaces such as exterior pipes, valves, supports, handrails, braces, covers, fabrications, etc.	**New** - Blast clean per SSPC-SP 6. Dry abrasive blasting performed with media that provides 1 to 2 mil anchor profile. **Touchup** - SSPC 1, 2, or 3	TNEMEC Series 1 Omnithane, 2.5 to 3.5 mils DFT	**Finish** - TNEMEC Series 73 Endurashield, 3 to 5 mils DFT
No. 2 - Alkyd Protective Coating - Interior non-immersed ferrous surfaces such as interior pipes, valves, flowmeters, pumps, motors, supports, braces, lids, fabrications, etc.	**New** - Cleaned with SSPC-SP3. Spot blast to SSPC-SP6 for highly corroded areas or areas in poor condition as determined by Engineer. **Touchup** - SSPC 1, 2, or 3	TNEMEC Series 1 Omnithane, 2.5 to 3.5 mils DFT	**Finish** - TNEMEC 2H Hi Build TNEMEC gloss, 2.5 to 3.5 mils DFT
No. 3 - Epoxy Protective Coating - Immersed or below grade ferrous surfaces that are shop primed and field finished such as flood gates, sewage plant equipment, non-potable water applications, etc.	**New** - Blast clean per SSPC-SP 5. Dry abrasive blasting performed with media that provides 2 to 3 mil anchor profile. **Touchup** - same as New.	TNEMEC Series 1 Omnithane, 2.5 to 3.5 mils DFT	**Intermediate -** TNEMEC Series N69 Hi Build Epoxoline, 3 to 5 mils DFT **Finish** - TNEMEC Series N69 Hi Build Epoxoline, 8 to 10 mils DFT
No. 4 - Epoxy Protective Coating - Immersed or below grade ferrous surfaces that are field primed and finished such as flood gates, sewage plant equipment, non-potable water applications, etc.	**New** - Blast clean per SSPC-SP 5. Dry abrasive blasting performed with media that provides 2 to 3 mil anchor profile. **Touchup** - same as New.	TNEMEC Series 1 Omnithane, 2.5 to 3.5 mils DFT	**Finish** - TNEMEC Series N69 Hi Build Epoxoline, 8 to 10 mils DFT
No. 5 - Acrylic Protective Coating - Interior and exterior architectural ferrous surfaces such as structural steel, metal roofing, siding, sashes, trim, doors, etc.	**New** - Prepared in accordance with SSPC –SP 6. **Touchup** - same as New.	TNEMEC Series 10 Primer, 2 to 3 mils DFT	**Finish** - TNEMEC Series 1029 Enduratone, 2 to 3 mils DFT
Masonry and Concrete Surfaces			
No. 6 - Epoxy Protective Coating Immersed masonry and concrete surfaces, non-potable such as storage tanks, basins, flumes, wetwells, etc.	**New** - Allow concrete to cure for 28 days or until passing the ASTM D4263 plastic mat test. Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination. Brush off blasting to provide anchor profile similar to medium grit sandpaper. **Touchup** - spot blast as described under New.	TNEMEC Series 218 Mortar Clad at 1/16-inch to fill surface voids flush to plane to ensure finish is monolithic and pinhole free; TNEMEC Series N69 Hi Build Epoxoline, 3 to 5 mils DFT	**Finish** - TNEMEC Series N69 Hi Build Epoxoline, 8 to 10 mils DFT

Table 3 (cont.)
Painting Schedule

Masonry and Concrete Surfaces (cont.)			
No. 7 - Epoxy Protective Coating - Immersed masonry and concrete, potable application such as water tanks, basins, wetwells, etc.	**New** - Allow concrete to cure for 28 days or until passing the ASTM D4263 plastic mat test. Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination. Brush off blasting to provide anchor profile similar to medium grit sandpaper. **Touchup** - spot blast as described under New.	TNEMEC Series 20 POTA-POX, 4 to 6 mils DFT.	TNEMEC Series 20 POTA-POX, 4 to 6 mils DFT.
No. 8 - Coal Tar Protective Coating - Damp Proofing of masonry surfaces such as below grade vapor barrier for walls of buildings, pump stations, and other structures, etc.	**New –** Allow concrete to cure for 28 days or until passing the ASTM D4263 plastic mat test. Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination. Brush off blasting to provide anchor profile similar to medium grit sandpaper. **Touchup** - spot blast as described under New.		TNEMEC 46-465 H.B. TNEMECOL, 12 mils DFT
No. 9 - Exterior Acrylic/Latex Protective Coating - Non-immersed, non-colored masonry concrete block such as visible walls	**New** - Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination.	TNEMEC Series 156 ENVIRO-CRETE, 6 to 8 mils DFT	TNEMEC Series 156 ENVIRO-CRETE, 8 to 9 mils DFT
No. 10 - Water Repellent Sealer - Non-immersed colored masonry concrete block such as outside walls	**New** - Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination.	Same as Finish Coat	Degussa Protectosil Chem-Trete 40 VOC applied according to manufacturer's recommendations
No. 11 - Exterior Acrylic/Latex Protective Coating - poured or precast concrete, stucco such as outside walls	**New** - Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination. **Touchup** same as New	TNEMEC Series 156 ENVIRO-CRETE, 6 to 8 mils DFT	TNEMEC Series 156 ENVIRO-CRETE, 8 to 9 mils DFT
No. 12 - Modified Polyamine Epoxy Protective Coating - concrete Floors	**New** - Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination. Brush off blasting to provide anchor profile similar to medium grit sandpaper. **Touchup** - spot blast as described under New.	TNEMEC Series 280 TNEME-GLAZE, 6-8 mils DFT. Broadcast aggregate into wet primer per manufacturer's recommendations	TNEMEC Series 280 TNEME-GLAZE, 8 to 12 mils DFT with anti-skid sand per manufacturer's recommendations

Table 3 (cont.)
Painting Schedule

Drywall and Plaster Board Surfaces			
No. 13 - Hydrophobic Acrylic - normal interior conditions.	**New** - Remove dirt, grease, oil or any other contamination. **Touchup** - same as New.	TNEMEC Series 51-792 PVA Sealer, 1.5 to 2 mils DFT	TNEMEC Series 115 Uni-Bond DF, 3 to 4 mils DFT
No. 14 - Acrylic Epoxy - interior humid conditions.	**New** - Remove dirt, grease, oil or any other contamination. **Touchup** - same as New.	TNEMEC Series 51-792 PVA Sealer, 1.5 to 2 mils DFT	**Intermediate** - TNEMEC Series 115 Uni-Bond DF, 2 to 3 mils DFT **Finish** - TNEMEC Series 113 H.B. TNEMEC-Tufcoat, 4 to 6 mils DFT
Aluminum			
No. 15 - Polyamidoamine Epoxy - aluminum in contact with concrete or masonry	**New** - Remove dirt, grease, oil or any other contamination. **Touchup** - same as New.	Same as Finish coat	TNEMEC Series N69 Epoxoline, 8 to 10 mils DFT
Interior and Exterior Wood			
No. 16 - Penetrating Alkyd Acrylic Emulsion - wood surfaces, trim etc.	**New** - Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination. Brush off blasting to provide anchor profile similar to medium grit sandpaper.	TNEMEC Series 151-1051, 1.0 to 1.5 mils DFT	TNEMEC Series 6 TNEMEC CRYL A7, 2 to 3 mils DFT, two coats required.
No. 17 - Wood Penetrating Alkyd Resin Sealer - Primer - exposed roof deck and beams.	**New** - Remove dirt, grease, oil, loose masonry, efflorescence, or any other contamination.	Same as Finish Coat	TNEMEC Chemprobe Wood Saver Plus at 150 to 200 square feet per gallon
Other Surfaces not defined herein requiring painting for protection or finished appearance	Per Engineer's approval	Per Engineer's approval	Per Engineer's approval

(1) – Prime and finish coats for touch-up or spot work shall be of the same system and dry film thickness (DFT) as the specified coating system.
(2) – DFT = dry film thickness

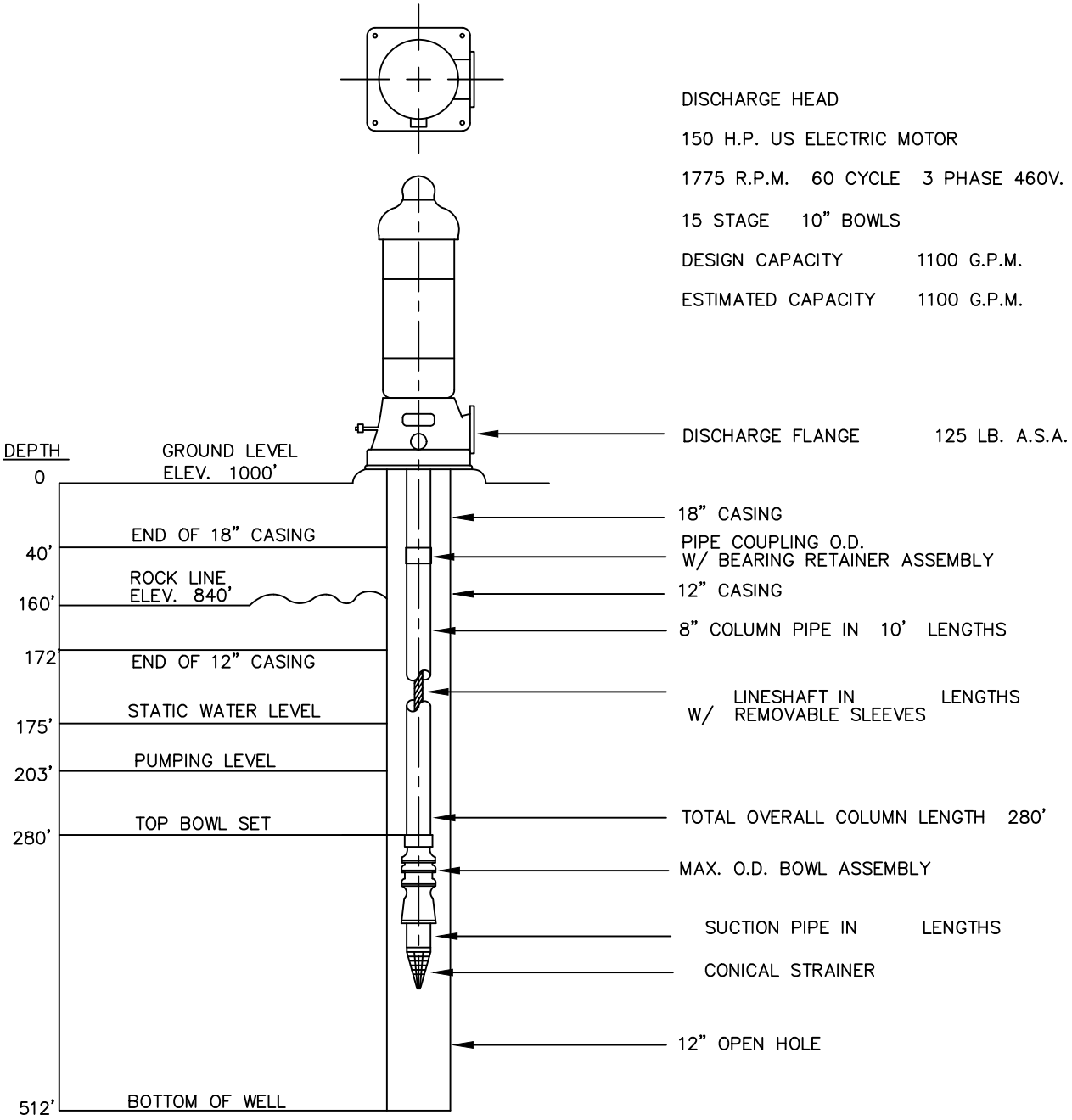
Table 4
Color Pipe Coding

Type of Pipe	Color
Water Lines	
Raw	Olive Green
Settled or Clarified	Aqua
Finished or Potable	Dark Blue
Chemical Lines	
Alum	Orange
Ammonia	White
Carbon Slurry	Black
Chlorine (Gas and Solution)	Yellow
Chlorine (Sample)	Light Yellow
Fluoride	Light Blue with Red Bands
Lime Slurry	Light Green
Potassium Permanganate	Violet
Sulfur Dioxide (Gas and Solution)	Green with Yellow Bands
Sulfur Dioxide (Sample)	Light Green with Yellow Bands
Waste Lines	
Backwash Waste	Light Brown
Sludge	Dark Brown
Sewer (Sanitary or Other)	Dark Gray
Other	
Compressed Air	Dark Green
Gas	Red
Other Lines	Light Gray

END OF SECTION

APPENDIX A

Well No. 5 Pump and Well Information



WELL #5

CITY OF
MILTON–FREEWATER

LOW COST UTILITIES
MILTON-FREEWATER
WATER-SEWER-ELECTRICITY

WELL #5
PUMP & WELL INFORMATION

REV: 1	FILE: WELL5	SCALE: NONE
	APPR.	SHT. 1 OF 1
DRFTR.: DM	ENGR.:	DATE: 10-28-93

STATE ENGINEER
Salem, Oregon

UMAT 3909

Well Record

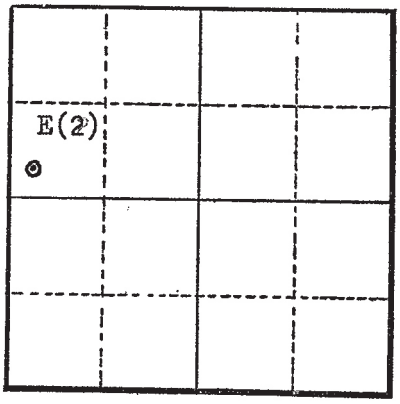
STATE WELL NO. 5N/35-1E(2)
COUNTY Umatilla
APPLICATION NO. U- 809

OWNER: City of Milton-Freewater
MAILING ADDRESS:

LOCATION OF WELL: Owner's No. 5
CITY AND STATE: Milton-Freewater, Oregon

SW ¼ NW ¼ Sec. 1 T. 5 ~~N~~ S., R. 35 ~~E~~ W., W.M.

Bearing and distance from section or subdivision corner N. 32°2'E. 365.5' from W¼ cor. of sec. 1 to a 2" iron pipe, thence S.50°35'W. 31.5' to the well.



Section 1

Altitude at well 995'

TYPE OF WELL: Drilled Date Constructed 1936

Depth drilled 502' Depth cased 212'

CASING RECORD:
18 inch set from 0 to 40 feet
12 inch set from 40 to 212 feet

FINISH:

AQUIFERS:
Basalt from 435 to 502 feet

WATER LEVEL:
67 feet (10/5/54)
120 feet (5/1/57)

PUMPING EQUIPMENT: Type Peerless turbine H.P. 150
Capacity 1200 G.P.M.

WELL TESTS:
Drawdown 47 ft. after hours 750 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Municipal Temp. °F., 19
SOURCE OF INFORMATION USGS U-718
DRILLER or DIGGER A.A. Durand & Son
ADDITIONAL DATA:
Log X Water Level Measurements X Chemical Analysis Aquifer Test

REMARKS:

State Printing 89316

STATE ENGINEER
Salem, Oregon

State Well No. 5N/35-1E(2)
County UMATILLA
Application No. U804

Well Log

Owner: Milton-Freewater Owner's No. 5

Driller: A.A. Durland & Son Date Drilled 1936

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Soil	0	3	3
Gravel and boulders, partly cemented & partly loose	3	80	77
Clay	80	90	10
Boulders and gravel	90	135	45
Clay and sand	135	145	10
Gravel and boulders, loose	145	160	15
Basalt, black, hard	160	245	85
Basalt, red porous	245	290	45
Basalt, blue and black hard	290	405	115
Basalt, red	405	435	30
Basalt, black, water bearing	435	502	67

Umatilla

5N/35-1E(2)

Oregon State Board of Health

SANITARY ENGINEERING LABORATORY

REPORT OF MINERAL ANALYSIS OF WATER

Location of source Milton-Freewater Description of source Pump 65

Analysis by MP Date 11/12/54 Collected by _____ Date 6/25/54

RESULTS

	Parts per million
Turbidity	6
Color: Apparent _____ True	3
Odor: Hot _____ Cold	
Total Solids	114
Loss on Ignition	59
Silicon (SiO_2)	48
Chloride (Cl)	7.6
Sulfate (SO_4)	3.7
Calcium (Ca)	15
Magnesium (Mg)	0.5
Aluminum (Al)	0
Orthophosphates (PO_4)	.15
Metaphosphates $(PO_3)_6$	2
Alkalinity (as $CaCO_3$): Carbonate	0
Bicarbonate	70
Hardness (as $CaCO_3$)	65
Sodium and Potassium (as Na)	34
Iron (Fe)	.33
Manganese (Mn)	0
Fluoride (F)	.1
Carbon Dioxide (CO_2)	2.3

pH 7.8

Remarks _____

PHE-10

STATE ENGINEER
Salem, Oregon

State Well No. 5N/35-1E(2)

County UMATILLA

Application No. U-809

Water Level Record

OWNER: MILTON-FREEWATER OWNER'S NO.

Description of measuring point: MOUNT HOLE ON NE CORNER OF WELL 1.5' ABOVE L.S.D.

Date	Water Level Feet (above) (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks DATE	Remarks WATER LEVEL
11-9-61	101.21	RD&WSB	1-56	80	3-58	95
5-54	65		2	74	4	95
6	83		3	80	7	102
8	85		4	82	8	100
9	67		5	78		
10	73		10	89		
11	76		11	80		
12	72		12	80		
1-55	75		1-57	80		
2	70		2	81		
3	70		3	76		
4	68		4	80		
5	71		9	102		
8	86		10	98		
9	76		11	95		
10	74		12	86		
11	74		1-58	95		
12	82		2	95		

REMARKS:

State Printing 89314

APPENDIX B

Potential Surface Water Intake Location Maps

POTENTIAL SURFACE WATER INTAKE LOCATIONS

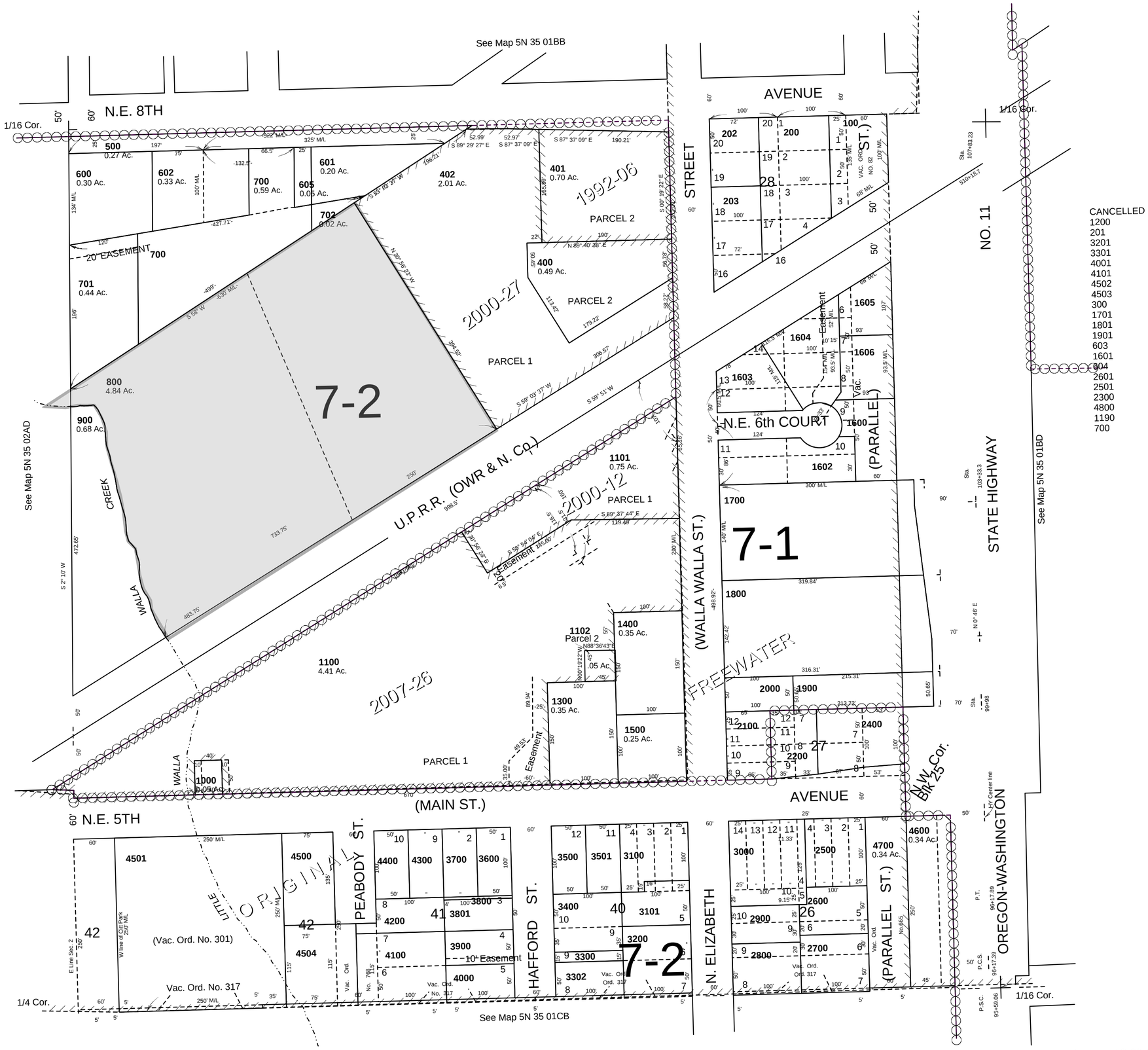
This map was prepared for Assessment & Taxation purposes only and was NOT prepared nor is it suitable for legal, engineering or surveying purposes.

SW1/4 NW1/4 SEC 1 T5N R32E WM
UMATILLA COUNTY, OR

SCALE: 1" = 100'

5N3501BC

AERIAL PHOTO NO 11P-82



Revised: 12-29-15

5N3501BC

APPENDIX C
Direct Stormwater Discharge Location Maps

ASR Project Area

WELL 5

WELL 3

STORMWATER DISCHARGE

WELL 5 DWPA

WELL 3 DWPA

LITTLE WALLA WALLA RIVER

NW 6TH AVE
NW 5TH AVE
NE 5TH AVE
NE 4TH AVE
NE 3RD AVE
NE 2ND AVE
NE 1ST AVE

COWL ST
RUSSELL ST
PEABODY ST
HATFORD ST
N ELIZABETH STREET
ROSE STREET
MILLER STREET
EZORA ST
OREGON HIGHWAY No. 11
N COLUMBIA STREET
WALLA WALLA RIVER

0 200 400

LEGEND

- CURB INLET
- STORM WATER BUBBLER
- UIC (WETWELL) TO BE ABANDONED
- UIC (WETWELL) TO REMAIN
- STORM DRAIN MANHOLE
- INDUSTRIAL SEWER MANHOLE
- DRINKING WATER PROTECTION AREA (DWPA) 2-YEAR TIME OF TRAVEL
- CURB INLET PIPING
- CITY LIMITS
- EXISTING STORM DRAIN
- EXISTING INDUSTRIAL SEWER AND SIZE

SHEET INDEX

ASR Project Area

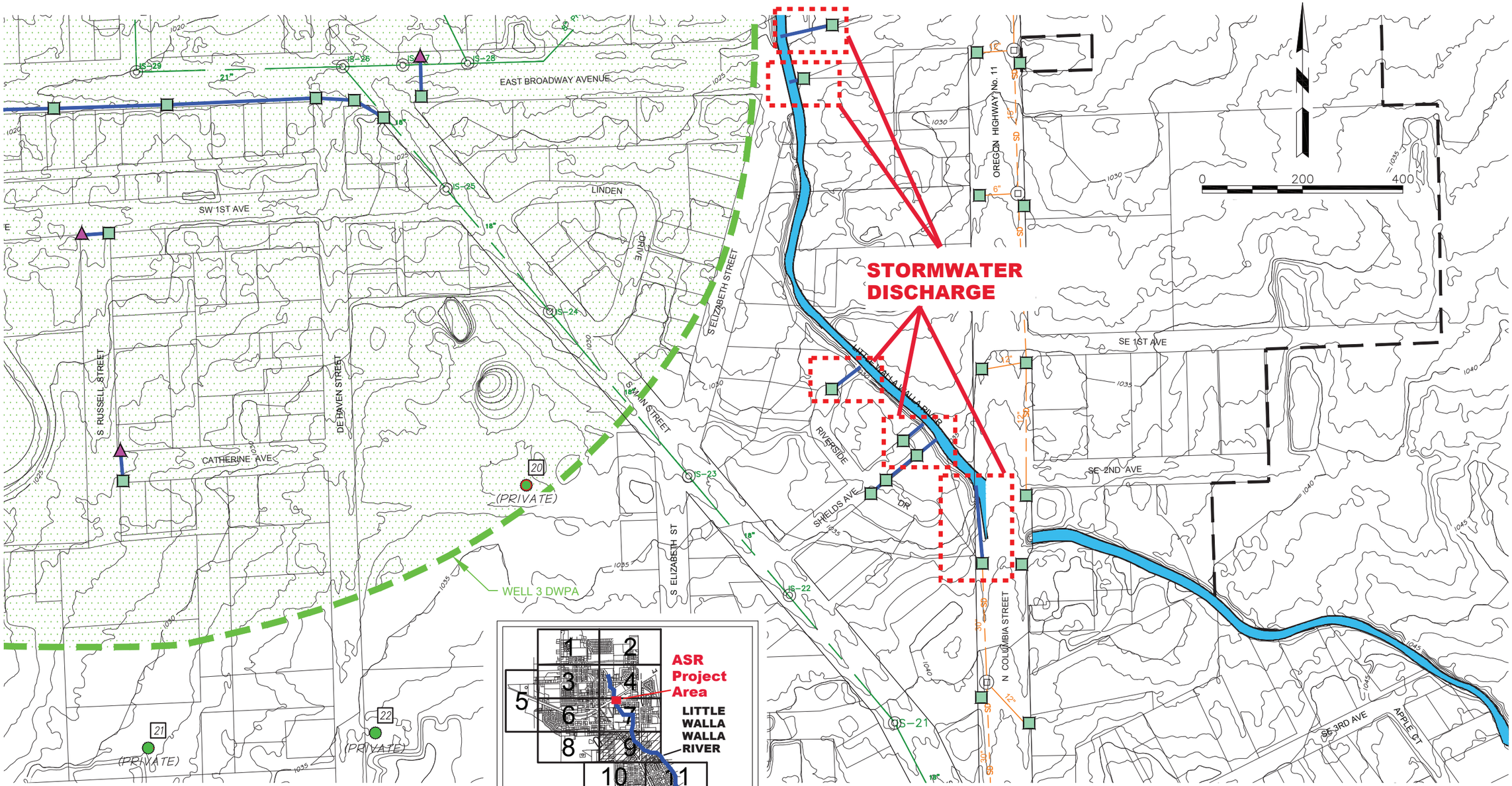
LITTLE WALLA WALLA RIVER

anderson perry & associates, inc.

CITY OF
MILTON-FREEWATER, OREGON
PHASE 1 UNDERGROUND INJECTION CONTROL
STORMWATER MANAGEMENT PLAN

LOCATION MAP (7 OF 18)

FIGURE
1-7

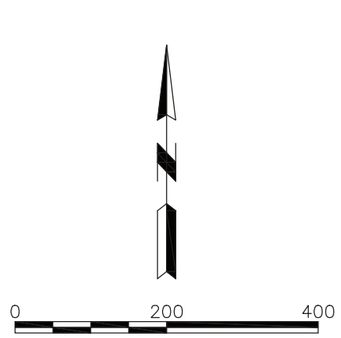


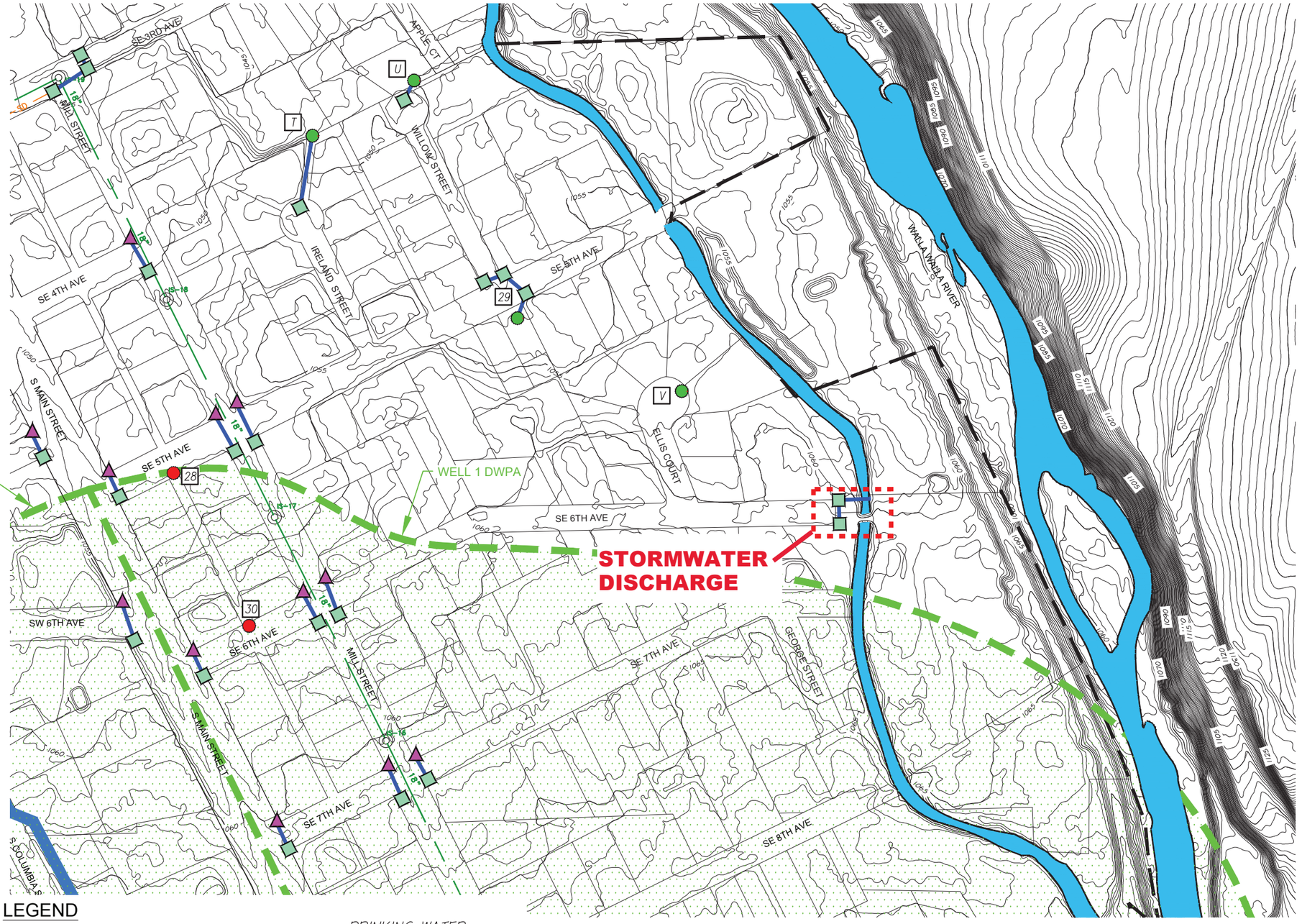
anderson perry & associates, inc.

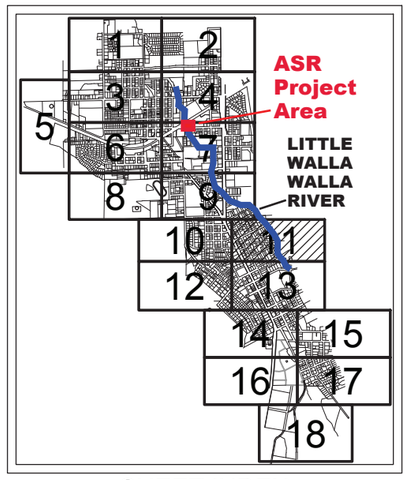
CITY OF
MILTON-FREEWATER, OREGON
PHASE 1 UNDERGROUND INJECTION CONTROL STORMWATER MANAGEMENT PLAN

LOCATION MAP (9 OF 18)

FIGURE
1-9







SHEET INDEX

LEGEND

- CURB INLET
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anderson perry & associates, inc.

CITY OF
MILTON-FREEWATER, OREGON
PHASE 1 UNDERGROUND INJECTION CONTROL STORMWATER MANAGEMENT PLAN

LOCATION MAP (11 OF 18)

FIGURE
1-11

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LITTLE WALLA WALLA RIVER DIVERSION

WELL 2

WELL 1

WELL 2 DWPA

WELL 1 DWPA

S MAIN STREET

S COLUMBIA STREET

MILL STREET

WALNUT STREET

CHESTNUT STREET

COLLEGE STREET

SW 7TH AVE

SW 8TH AVE

SW 9TH AVE

SW 10TH AVE

SE 8TH AVE

SE 9TH AVE

SE 10TH AVE

SE 11TH AVE

SE 12TH AVE

SE 13TH AVE

MILTON DITCH

WALLA WALLA RIVER

15" CONCRETE

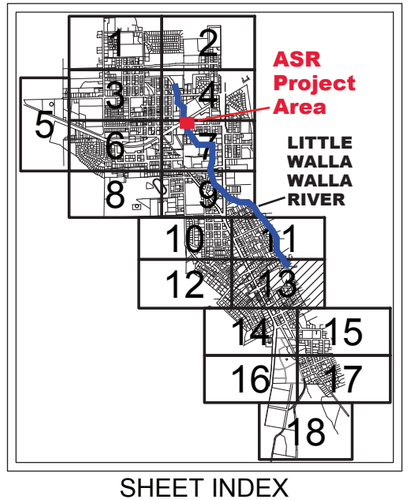
CONNECT TO IS-10

4' CULVERT OUTLET

APPROXIMATE LOCATION OF EXISTING DRAINAGE DITCH

55 LEVEE PENETRATION

0 200 400



SHEET INDEX

LEGEND

- CURB INLET
- STORM WATER BUBBLER
- UIC (WETWELL) TO BE ABANDONED
- UIC (WETWELL) TO REMAIN
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- DRINKING WATER PROTECTION AREA (DWPA) 2-YEAR TIME OF TRAVEL
- CURB INLET PIPING
- CITY LIMITS
- EXISTING STORM DRAIN
- EXISTING INDUSTRIAL SEWER AND SIZE

anderson perry & associates, inc.

CITY OF
MILTON-FREEWATER, OREGON
PHASE 1 UNDERGROUND INJECTION CONTROL STORMWATER MANAGEMENT PLAN

LOCATION MAP (13 OF 18)

FIGURE
1-13

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APPENDIX D

Capital Cost and Operation and Maintenance Estimates and Net Present Worth Analysis

WALLA WALLA BASIN WATERSHED COUNCIL
MILTON-FREEWATER AQUIFER STORAGE AND RECOVERY DESIGN
ENGINEER'S OPINION OF PROBABLE COST
ALTERNATIVE 1 - LITTLE WALLA WALLA DIVERSION, TREATMENT, AND WELLHEAD IMPROVEMENTS

SYSTEM	COMPONENT	SIZE/CAPACITY	ESTIMATED COST	SYSTEM COST ESTIMATE
Little Walla Walla Creek Diversion Structure	Intake Screen System Pumping System	2 MGD	$75,000 75,000	**$150,000**
Ultrafiltration (UF) Treatment System	UF Treatment System Treatment System Building		$650,000 350,000	**$1,000,000**
Ultraviolet Disinfection Unit	UV Treatment Unit		$20,000	**$20,000**
Wellhead Modifications	Piping Modifications 3R Valve		$145,000 105,000	**$250,000**
Land Acquisition (Industrial/ Commercial Zone)		2 Acres	$100,000	**$100,000**
Miscellaneous	Yard Piping Site Work Electrical and Lighting		$50,000 80,000 50,000	**$180,000**
			Construction Subtotal	**$1,700,000**
			Mobilization/Demobilization	**$90,000**
			Construction Total	**$1,790,000**
			Permitting	**$200,000**
			Contingency (20%)	**$360,000**
			Administrative, Legal, and Engineering (20%)	**$360,000**
			TOTAL CONSTRUCTION OPINION OF PROBABLE COST	**$2,710,000**

PRESENT WORTH ANALYSIS (2018 DOLLARS)

Item	Description	Annual Cost
Annual Operation, Maintenance, and Replacement (OM&R)		
1	Operator Wage and Fringe	$60,000
2	Infeed Pump Electricity	$10,000
3	UF Power and Chemicals	$10,500
4	UV Electricity	$500
5	Replacement Parts	$1,000
6	Consumable Materials and Testing	$3,000
	Total Annual OM&R	**$85,000**
	Present Worth OM&R (3.5%, 20 years)	**$1,209,000**
	PRESENT WORTH COST (2018 DOLLARS)	**$3,919,000**

WALLA WALLA BASIN WATERSHED COUNCIL
MILTON-FREEWATER AQUIFER STORAGE AND RECOVERY DESIGN
ENGINEER'S OPINION OF PROBABLE COST
ALTERNATIVE 2 - RIVERBANK FILTRATION WITH DISINFECTION

SYSTEM	COMPONENT	SIZE/CAPACITY	ESTIMATED COST	SYSTEM COST ESTIMATE
Collector Well	Alluvial Wells	2 Wells	$200,000	
	Pumping System	2 MGD Each Well	75,000	
	Electrical		25,000	
				$300,000
Ultraviolet Disinfection Unit	UV Treatment Unit		$20,000	
				$20,000
Wellhead Modifications	Piping Modifications		$145,000	
	Down Hole Well Control Valve		105,000	
				$250,000
Land Acquisition		4.84 Acres	$225,000	
				$225,000
Settling Basin and Infiltration Gallery			$350,000	
				$350,000
Miscellaneous	Yard Piping		$50,000	
	Site Work		75,000	
	Electrical and Lighting		50,000	
				$175,000
			Construction Subtotal	**$1,320,000**
			Mobilization/Demobilization	**$70,000**
			Construction Total	**$1,390,000**
			Permitting	**$200,000**
			Contingency (20%)	**$280,000**
			Administrative, Legal, and Engineering (20%)	**$280,000**
			TOTAL CONSTRUCTION OPINION OF PROBABLE COST	**$2,150,000**

PRESENT WORTH ANALYSIS (2018 DOLLARS)

Item	Description	Annual Cost
Annual Operation, Maintenance, and Replacement (OM&R)		
1	Well Pump Electrical Cost	$15,000
2	UV Electricity	$300
3	Replacement Parts	$2,000
4	Consumable Materials and Testing	$3,500
	Total Annual OM&R	**$20,800**
	Present Worth OM&R (3.5%, 20 years)	**$296,000**
	PRESENT WORTH COST (2018 DOLLARS)	**$2,446,000**

APPENDIX E
Little Walla Walla River Water Quality

Table 1: Milton-Freewater ASR Receiving and Source Water Analytical Results

	Sample Location:		**Well #5 Groundwater**				**Surface Water @ Point of Diversion on Walla Walla River**				**Surface Water @ Little Walla Walla River behind Well #5**				**Surface Water @ Little Walla Walla River behind Well #5**				**Notes**
	Sample ID:		*MF-ASR-W5-030118*				*MF-ASR-WWR-030118*				*MF-ASR-LWWR-1*				*MF-ASR-LWWR-2*				
	Sample Date/Time:		3/1/18 9:45 AM				3/1/18 11:20 AM				3/15/18 10:55 AM				4/5/2018 14:40:00 PM [1]				
	Batch:		180302017				180302020				180316032				180410059				
	Lab Name:		*Anatek Laboratorties*				*Anatek Laboratorties*				*Anatek Laboratorties*				*Anatek Laboratorties*				
ANALYTE GROUP / Analyte	**Units**	**Drinking Water Standard MCL/SMCL**	**MDL**	**RDL**	**Result**	**Q**	**MDL**	**RDL**	**Result**	**Q**	**MDL**	**RDL**	**Result**	**Q**	**MDL**	**RDL**	**Result**	**Q**	
GENERAL CHEMISTRY (GC)																			Groundwater & Surface water
Alkalinity (total)	mg CaCO3/L	NA	2	2	**80**		2	2	**30.0**		2	2	**26.0**		2	2	**28**		[b]
Temperature	degrees Fahrenheit		——	——	——		——	——	——		——	——	——		——	——	——		
Chloride	mg/L	/250	0.01	0.1	**6.46**		0.01	0.1	**0.500**		0.01	0.1	**0.420**		0.01	0.1	**0.416**		
Fluoride	mg/L	4.0/2.0	0.071	0.1	**0.123**		0.071	0.1	ND		0.071	0.1	ND		0.071	0.1	ND		
Hardness	mg CaCO3/L	/250	0.1	1	**82.2**		0.1	1	**23.8**		0.1	1	**21.0**		0.1	1	**22.1**		
Nitrate+Nitrite (total N)	mg/L as N	10	0.01	0.1	**0.493**		0.01	0.1	ND		0.01	0.1	ND		0.01	0.1	ND		
Nitrate-N	mg/L as N	10	0.076	0.1	**0.493**		0.076	0.1	ND		0.076	0.1	ND		0.076	0.1	ND		
Nitrite-N	mg/L as N	1	0.063	0.1	ND		0.063	0.1	ND		0.063	0.1	ND		0.063	0.1	ND		
Orthophosphate as P	mg/L	NA	0.042	0.1	ND		0.042	0.1	ND		0.042	0.1	ND		0.042	0.1	ND		
Oxidation-Reduction Potential	millivolts	NA	——	——	-41		——	——	-18.5		——	——	-38.3		——	——	-28.6		
pH	pH units	/6.5-8.5	1	——	7.85		1	——	7.29		1	——	7.30		1		7.41		
Specific Conductance	µS/cm	/700	1	1	**235**		1	1	**65.0**		1	1	**55.2**		1	1	**63.8**		
Sulfate	mg/L	/250	0.057	0.1	**10.6**		0.057	0.1	**0.822**		0.057	0.1	**0.648**		0.057	0.1	**0.609**		
Total Dissolved Solids	mg/L	/500	30	50	**129**		30	50	**47**		30	50	**76.0**		30	50	**74.0**		
Turbidity	NTU	1	0.01	0.1	**0.56**		0.01	0.1	**1.30**		0.01	0.1	**5.11**		0.01	0.1	**1.99**		
Total Kjeldahl nitrogen	mg/L	NA	0.357	0.5	ND		0.357	0.5	ND		0.464	0.5	ND		0.464	0.5	ND		
TOTAL METALS (M)																			Groundwater & Surface water
Arsenic	mg/L	0.010	0.001	0.001	ND		0.001	0.001	ND		0.001	0.001	ND		0.001	0.001	ND		[a]
Calcium	mg/L	NA	0.03	0.1	**19.6**		0.01	0.1	**5.71**		0.03	0.1	**5.12**		0.03	0.1	**5.37**		[c]
Copper	mg/L	1.3*	0.001	0.001	0.00100		0.001	0.001	ND		0.001	0.001	**0.00125**		0.001	0.001	ND		[a,c]
Iron	mg/L	/0.3	0.0018	0.01	ND		0.0018	0.01	**0.168**		0.0018	0.01	**0.941**		0.0018	0.01	**0.241**		[c]
Iron (dissolved)	mg/L	NA	0.01	0.01	ND		0.01	0.01	**0.0315**		0.01	0.01	**0.138**		0.01	0.01	**0.0176**		[c]
Lead	mg/L	0.015 (AL)	0.001	0.001	ND		0.001	0.001	ND		0.001	0.001	ND		0.001	0.001	ND		[a,b,c]
Magnesium	mg/L	NA	0.001	0.1	**8.06**		0.001	0.1	**2.24**		0.001	0.1	**1.99**		0.001	0.1	**2.11**		[c]
Manganese	mg/L	/0.05	0.01	0.01	ND		0.01	0.01	ND		0.01	0.01	**0.0121**		0.01	0.01	ND		[c]
Manganese (dissolved)	mg/L	NA	0.01	0.01	ND		0.01	0.01	ND		0.01	0.01	ND		0.01	0.01	ND		[c]
Mercury	mg/L	0.002	0.00001	0.0001	ND		0.00001	0.0001	ND		0.00001	0.0001	ND		0.00001	0.0001	ND		[a,b,c]
Potassium	mg/L	NA	0.05	0.1	**3.70**		0.05	0.1	**1.48**		0.05	0.1	**1.37**		0.05	0.1	**1.49**		[c]
Sodium	mg/L	20**	0.05	0.1	**8.96**		0.05	0.1	**2.7**		0.05	0.1	**2.15**		0.05	0.1	**2.64**		[c]
Zinc	mg/L	/5	0.001	0.001	**0.00372**		0.001	0.001	**0.00128**		0.001	0.001	**0.00198**		0.001	0.001	ND		[c]
MISCELLANEOUS (MISC)																			Groundwater & Surface water
Corrosivity	Standard units	/non-corrosive	——	——	-0.134		——	——	-1.07		——	——	-1.14		——	——	-0.994		
BACTERIOLOGICALS (BAC)																			Surface water only
Total Coliform (Presence/Absence)	cfu/100mL		——	——	——		1	1	Present	[4]	1	1	Present	[5]	1	1	Present	[5]	
SYNTHETIC ORGANIC CHEMICALS (SOC)																			Surface water only
Chlordane, Technical	µg/L	2	——	——	——		0.0288	0.2	ND		0.0288	0.2	ND		0.0288	0.2	ND		[a,b]
Glyphosate [2]	µg/L	700	——	——	——		3.2	5	ND		3.2	5	ND		3.2	5	ND		[a]
Heptachlor Epoxide	µg/L	0.2	——	——	——		0.0165	0.02	ND		0.0165	0.02	ND		0.0165	0.02	ND		[a,b]
Hexachlorobenzene	µg/L	1	——	——	——		0.0066	0.1	ND		0.0066	0.1	ND		0.0066	0.1	ND		[a,b]
Hexachlorocyclopentadiene	µg/L	50	——	——	——		0.011	0.1	ND		0.011	0.1	ND		0.011	0.1	ND		[a,b]
Lindane (BHC - GAMMA)	µg/L	0.2 as total PAH's	——	——	——		0.0152	0.04	ND		0.0152	0.04	ND		0.0152	0.04	ND		[a,c]
Aroclor 1016 (PCB)	µg/L	0.5 as total PCB's	——	——	——		0.08	0.08	ND		0.08	0.08	ND		0.08	0.08	ND		[a,b]
Aroclor 1221 (PCB)	µg/L	0.5 as total PCB's	——	——	——		0.5	1	ND		0.5	1	ND		0.5	1	ND		[a,b]
Aroclor 1232 (PCB)	µg/L	0.5 as total PCB's	——	——	——		0.1	0.5	ND		0.1	0.5	ND		0.1	0.5	ND		[a,b]
Aroclor 1242 (PCB)	µg/L	0.5 as total PCB's	——	——	——		0.1	0.3	ND		0.1	0.3	ND		0.1	0.3	ND		[a,b]

Table 1: Milton-Freewater ASR Receiving and Source Water Analytical Results

			Sample Location:	Well #5 Groundwater				Surface Water @ Point of Diversion on Walla Walla River				Surface Water @ Little Walla Walla River behind Well #5				Surface Water @ Little Walla Walla River behind Well #5				Notes
			Sample ID:	*MF-ASR-W5-030118*				*MF-ASR-WWR-030118*				*MF-ASR-LWWR-1*				*MF-ASR-LWWR-2*				
			Sample Date/Time:	3/1/18 9:45 AM				3/1/18 11:20 AM				3/15/18 10:55 AM				4/5/2018 14:40:00 PM [1]				
			Batch:	180302017				180302020				180316032				180410059				
			Lab Name:	*Anatek Laboratorties*				*Anatek Laboratorties*				*Anatek Laboratorties*				*Anatek Laboratorties*				
ANALYTE GROUP / Analyte	**Units**	**Drinking Water Standard MCL/SMCL**		**MDL**	**RDL**	**Result**	**Q**	**MDL**	**RDL**	**Result**	**Q**	**MDL**	**RDL**	**Result**	**Q**	**MDL**	**RDL**	**Result**	**Q**	
Aroclor 1248 (PCB)	µg/L	0.5 as total PCB's		——	——	——		0.1	0.1	ND		0.1	0.1	ND		0.1	0.1	ND		[a,b]
Aroclor 1254 (PCB)	µg/L	0.5 as total PCB's		——	——	——		0.1	0.1	ND		0.1	0.1	ND		0.1	0.1	ND		[a,b]
Aroclor 1260 (PCB)	µg/L	0.5 as total PCB's		——	——	——		0.1	0.2	ND		0.1	0.2	ND		0.1	0.2	ND		[a,b]
Total PCB	µg/L			——	——	——		0.095	0.5	ND		0.095	0.5	ND		0.095	0.5	ND		
Pentachlorophenol	µg/L	1		——	——	——		0.04	0.04	ND		0.04	0.04	ND		0.04	0.04	ND		[a,b]
Malathion [3]	µg/L			——	——	——		0.1	0.2	ND		0.1	0.2	ND		0.1	0.2	ND		
Chlorpyrifos [3]	µg/L			——	——	——		0.0165	0.2	ND		0.0165	0.2	ND		0.0165	0.2	ND		
Azinphos-methyl [3]	µg/L			——	——	——		0.1	0.1	ND		0.1	0.1	ND		0.1	0.1	ND		
VOLATILE ORGANIC CHEMICALS (VOC)																				Surface water only
Benzene	µg/L	5		——	——	——		0.1	0.5	ND		0.1	0.5	ND		0.1	0.5	ND		
Ethylbenzene	µg/L	700		——	——	——		0.1	0.5	ND		0.1	0.5	ND		0.1	0.5	ND		
Toluene	µg/L	1000		——	——	——		0.1	0.5	ND		0.1	0.5	ND		0.1	0.5	ND		
Total Xylenes	µg/L	10000		——	——	——		0.1	0.5	ND		0.1	0.5	ND		0.1	0.5	ND		

Notes:

[1] - Chain of custody has the wrong date written on it. Sample was collected on 4/5/2018.

[2] - Glyphosphate was chosen as a herbicide proxy.

[3] - Chosen as a pesticide proxy as it is a common organophosphate based on conversation with WA DEQ, will analyzed using EPA Method 8141 for water, not drinking water.

[4] - Anatek Lab analyzed this sample accidentally and are not certified in Oregon to meet drinking water standards.

[5] - Table Rock Analytical Laboratories analyzed for total coliform as they are certified to meet drinking water standards in Oregon.

BOLD = Result detected above method RDL.

Data Sources used to reduce analytical list:

[a] - Listed in OAR 330-061-0030.

[b] - Anderson Petty & Associates, 2011. City of Milton-Freewater, Oregon Water Management and Conservation Plan Update Addendum. May. p.16.

[c] - GeoSystems Analysis, Inc., 2016. Surface Water and Groundwater Monitoring and Reporting Plan. May. Table 5.

* Action Level set by the EPA

** Guideline level recommended by the EPA

MCL = Maxiumim Contaminant Level

SMCL = Secondary Maximum Contaminant Level

MDL = Method Detection Limit

RDL = Representative Detection Limit

Q = Qualifier

pCi/L = Picocuries per liter

PCB = Polychlinated biphenyl

mg CaCO3/L = milligram of calcium carbonate per liter

µg/L = Micrograms per liter

µS/cm = Micro-Siemens per centimeter

mg/L = Milligrams per liter

NTU = Nephelometric turbidity unit

MV = Millivolts

ND = Not detected

333-061-0030

Maximum Contaminant Levels and Action Levels

(1) MCLs and action levels (ALs) for inorganic chemicals apply to all community and NTNC water systems and are listed in Table 1, except the MCL for fluoride which applies only to community water systems and the MCL for nitrate which applies to all water systems.

Table 1

Contaminant	MCL/AL in mg/l
Antimony	0.006
Arsenic	0.010
Asbestos[1]	7 MFL
Barium	2
Beryllium	0.004
Cadmium	0.005
Chromium	0.1
Copper[2]	1.3
Cyanide	0.2
Fluoride	4.0
Lead[2]	0.015
Mercury	0.002
Nitrate (as N)	10
Nitrite (as N)	1
Total Nitrate + Nitrite (as N)	10
Selenium	0.05
Thallium	0.002

1 MFL = million fibers per liter longer than 10 µm

2 Action Level (AL)

(a) Compliance with the MCLs for inorganic contaminants is calculated pursuant to OAR 333-061-0036(2)(h).

(b) Exceeding the secondary contaminant level for fluoride as specified in section (6) of this rule requires a special public notice as specified in OAR 333-061-0042(7).

(c) The lead action level is exceeded if the concentration of lead in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with OAR 333-061-0036(10)(a) through (e) is greater than 0.015 mg/L (that is, if the "90th percentile" lead level is greater than 0.015 mg/L). The copper action level is exceeded if the concentration of copper in more than 10 percent of tap water samples collected during any monitoring period conducted in accordance with OAR 333-061-0036(10)(a) through (e) is greater than 1.3 mg/L (that is, if the "90th percentile" copper level is greater than 1.3 mg/L).

(A) The 90th percentile lead and copper levels shall be computed as follows: The results of all lead or copper samples taken during a monitoring period shall be placed in ascending order from the sample with the lowest

concentration to the sample with the highest concentration. Each sampling result shall be assigned a number, ascending by single integers beginning with the number 1 for the sample with the lowest contaminant level. The number assigned to the sample with the highest contaminant level shall be equal to the total number of samples taken. The number of samples taken during the monitoring period shall be multiplied by 0.9. The contaminant concentration in the numbered sample yielded by this calculation is the 90th percentile contaminant level.

(B) For water systems serving fewer than 100 people that collect five samples per monitoring period, the 90th percentile is computed by taking the average of the highest and second highest concentrations. For a water system allowed by the Authority to collect fewer than five samples the sample result with the highest concentration is considered the 90th percentile value.

(2) MCLs for organic chemicals:

(a) The MCLs for synthetic organic chemicals are shown in Table 2 and apply to all community and NTNC water systems. Compliance with MCLs shall be calculated pursuant to OAR 333-061-0036(3)(a)(H) and (I).

Table 2

Contaminant	MCL in mg/l
Alachlor	0.002
Atrazine	0.003
Benzo(a) pyrene	0.0002
Carbofuran	0.04
Chlordane	0.002
Dalapon	0.2
Dibromochloropropane	0.0002
Dinoseb	0.007
Dioxin(2,3,7,8-TCDD)	0.00000003
Diquat	0.02
Di(2-ethylhexyl) adipate	0.4
Di(2-ethylhexyl) phthalate	0.006
Endothall	0.1
Endrin	0.002
Ethylene Dibromide	0.00005
Glyphosate	0.7
Heptachlor	0.0004
Heptachor epoxide	0.0002
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.04

Oxamyl(Vydate)	0.2
Picloram	0.5
Polychlorinated Biphenyls	0.0005
Pentachlorophenol	0.001
Simazine	0.004
Toxaphene	0.003
2,4-D	0.07
2,4,5-TP Silvex	0.05

(b) The MCLs for disinfection byproducts are shown in Table 3 and apply to all community and NTNC water systems that add a disinfectant (oxidant) to the water supply at any point in the treatment process or deliver water in which a disinfectant has been added to the water supply.

Table 3

Disinfection Byproduct	MCL in mg/l
TTHM	0.080
HAA5	0.060
Bromate	0.010
Chlorite	1.0

(A) Compliance with the MCLs for TTHM and HAA5 shall be calculated as a LRAA according to OAR 333-061-0036(4)(c).

(B) Compliance with the MCL for bromate shall be calculated as a running annual average pursuant to OAR 333-061-0036(4)(h).

(C) Compliance with the MCL for chlorite shall be calculated as a running annual average pursuant to OAR 333-061-0036(4)(g).

(c) The MCLs for volatile organic chemicals are indicated in Table 4 and apply to all community and NTNC water systems. Compliance with MCLs shall be calculated pursuant to OAR 333-061-0036(3)(b)(H) and (I).

Table 4

Contaminant	MCL in mg/l
Benzene	0.005
Carbon tetrachloride	0.005
cis-1,2-Dichloroethylene	0.07
Dichloromethane	0.005
Ethylbenzene	0.7
Monochlorobenzene	0.1
o-Dichlorobenzene	0.6
p-Dichlorobenzene	0.075
Styrene	0.1
Tetrachloroethylene(PCE)	0.005
Toluene	1
trans-1,2-Dichloroethylene	0.1
Trichloroethylene (TCE)	0.005

Vinyl chloride	0.002
Xylenes(total)	10
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
1,2-Dichloroethane	0.005
1,2-Dichloropropane	0.005
1,2,4-Trichlorobenzene	0.07

(d) When the Authority has reason to believe that a water supply has been contaminated by a toxic organic chemical, it will determine whether a public health hazard exists and whether control measures must be carried out;

(e) The Authority may establish MCLs for additional organic chemicals as deemed necessary when there is reason to suspect that the use of those chemicals will impair water quality to an extent that poses an unreasonable risk to the health of the water users;

(f) Persons who apply pesticides within watersheds above surface water intakes of public water systems shall comply with federal and state pesticide application requirements. (Safe Drinking Water Act (EPA), Clean Water Act (EPA), Federal Insecticide, Fungicide and Rodenticide Act (EPA), ORS 536.220 to 536.360 (Water Resources), 468B.005 (DEQ), 527.610 to 527.990 (DOF), 634.016 to 634.992 (Department of Agriculture)). Any person who has reasonable cause to believe that his or her actions have led to organic chemical contamination of a public water system shall report that fact immediately to the water supplier.

(3) MCLs for turbidity are applicable to all public water systems using surface water sources or groundwater sources under the direct influence of surface water in whole or in part. Compliance with MCLs shall be calculated pursuant to OAR 333-061-0036(5).

(a) Turbidity at water systems where filtration treatment is not provided cannot exceed 5 NTU in representative samples of the source water immediately prior to the first or only point of disinfectant application unless:

(A) The Authority determines that any such event was caused by circumstances that were unusual and unpredictable; and

(B) As a result of any such event, there have not been more than two such events in 12 months when water was served to the public, or more than five events in 120 months the system served water to the public, in which the turbidity level exceeded 5 NTU. An "event" is a series of consecutive days during which at least one turbidity measurement each day exceeds 5 NTU. Turbidity measurements must be collected as required by OAR 333-061-0036(5)(a)(B).

(b) The MCLs for turbidity in drinking water, measured at a point representing filtered water prior to any storage, are as follows:

(A) Conventional filtration treatment or direct filtration treatment.
  (i) At water systems where conventional filtration or direct filtration treatment is used, the turbidity level of representative samples of a system's filtered water, measured as soon after filtration as possible and prior to any storage, must be less than or equal to 0.3 NTU in at least 95 percent of the measurements taken each month, measured as specified in OAR 333-061-0036(5).
  (ii) At water systems where conventional filtration or direct filtration treatment is used, the turbidity level of representative samples of a system's filtered water, measured as soon after filtration as possible and prior to any storage, must at no time exceed 1 NTU measured as specified in OAR 333-061-0036(5).

(B) Slow sand filtration.
  (i) At water systems where slow sand filtration is used, the turbidity level of representative samples of filtered water, measured as soon after filtration as possible and prior to any storage, must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month, measured as specified in OAR 333-061-0036(5)(b), except that if the Authority determines there is no significant interference with disinfection at a higher turbidity level, the Authority may substitute this higher turbidity limit for that system.
  (ii) The turbidity level of representative samples of filtered water must at no time exceed 5 NTU, measured as specified in OAR 333-061-0036(5)(b).

(C) Diatomaceous earth filtration.
  (i) At water systems where diatomaceous earth filtration is used, the turbidity level of representative samples of filtered water, measured as soon after filtration as possible and prior to any storage, must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month, measured as specified in OAR 333-061-0036(5)(b).
  (ii) The turbidity level of representative samples of filtered water must at no time exceed 5 NTU, measured as specified in OAR 333-061-0036(5)(b).

(D) Other filtration technologies. At water systems where filtration technologies other than those listed in paragraphs (3)(b)(A) through (C) of this rule are used, the turbidity level must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month and at no time exceed 5 NTU, as specified in OAR 333-061-0036(5)(b)(A). The Authority may substitute a lower turbidity value(s) if it is determined that the above limit(s) cannot achieve the required level of treatment. The water supplier must demonstrate to the Authority that the alternative

filtration technology in combination with disinfection treatment as specified in OAR 333-061-0032 and monitored as specified by OAR 333-061-0036 consistently achieves 99.9 percent removal or inactivation of *Giardia lamblia* cysts and 99.99 percent removal or inactivation of viruses, and 99 percent removal of *Cryptosporidium* oocysts.

(4) The MCL for *E. coli* applies to all public water systems as specified in this section.

(a) A water system exceeds or violates the MCL for *E. coli* if any of the conditions identified in paragraphs (4)(a)(A) through (4)(a)(D) of this rule occur.

(A) An *E. coli*-positive repeat sample follows a total coliform-positive routine sample.

(B) A total coliform-positive repeat sample follows an *E. coli*-positive routine sample.

(C) All required repeat samples are not collected following an *E. coli*-positive routine sample.

(D) Any repeat sample is not analyzed for *E. coli* when it tests positive for total coliform.

(b) Exceeding the MCL for *E. coli* may pose an acute risk to health and requires the distribution of public notification as specified in OAR 333-061-0042.

(5) MCLs for radionuclides are applicable only to community water systems and are indicated in Table 5:

Table 5

Contaminant	MCL
Gross Alpha (including Radium-226 but not Radon and Uranium)	15 pCi/L
Combined Radium-226 and Radium-228	5 pCi/L
Uranium	30 µg/L
Beta/Photon emitters	4 mrem/yr

(a) The average annual concentration of beta particle and photon radioactivity from man-made sources, including all radionuclides emitting beta particles or photons listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, National Bureau of Standards Handbook 69, except the daughter products of Thorium-232, Uranium-235 and Uranium-238, shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem per year. If two or more radionuclides are present, the sum total of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year.

(A) The average annual concentration of tritium assumed to produce a total body dose of 4 mrem/year is 20,000 pCi/L;

(B) The average annual concentration of strontium-90 assumed to produce a bone marrow dose of 4 mrem/year is 8 pCi/L.

(b) Compliance with the MCLs shall be calculated pursuant to OAR 333-061-0036(7)(c).

(6) Contaminant levels for secondary contaminants are applicable to all public water systems. These are indicated in Table 6. (Also note OAR 333-061-0036(8)).

Table 6

Secondary Contaminant:	Level in mg/l where applicable
Color	15 color units
Corrosivity	Non-corrosive
Foaming agents	0.5
PH	6.5-8.5
Hardness (as CaCO3)	250
Odor	3 threshold odor number
Total dissolved solids(TDS)	500
Aluminum	0.05-0.2
Chloride	250
Copper	1
Fluoride	2.0
Iron	0.3
Manganese	0.05
Silver	0.1
Sulfate	250
Zinc	5

(a) Exceeding the secondary contaminant level for fluoride requires a special public notice as specified in OAR 333-061-0042(7).

(b) Exceeding the MCL for fluoride as specified in section (1) of this rule requires public notification as specified in OAR 333-061-0042(2)(b)(A).

(7) Acrylamide and Epichlorohydrin. For every public water system, the water supplier must certify annually to the state in writing, using third party certification approved by the state or manufacturer's certification, that when acrylamide and epichlorohydrin are used in drinking water systems, the combination, or product, of dose and monomer level does not exceed the levels specified as follows:

(a) Acrylamide: 0.05 percent dosed at 1 ppm or equivalent.

(b) Epichlorohydrin: 0.01 percent dosed at 20 ppm or equivalent.

Stat. Auth.: ORS 448.131
Stats. Implemented: ORS 448.131, 448.150 & 448.273

333-061-0031
Maximum Residual Disinfectant Levels

MRDLs are enforceable in the same manner as maximum contaminant levels and are specified in Table 7:

Table 7

Disinfectant Residual:	MRDL in mg/l:
Chlorine	4.0 (as Cl_2)
Chloramines	4.0 (as Cl_2)
Chlorine dioxide	0.8 (as ClO_2)

The MRDL for chlorine and chloramines shall be calculated as a running annual average according to OAR 333-061-0036(4)(i). The MRDL for chlorine dioxide is determined by follow-up monitoring according to OAR 333-061-0036(4)(i).

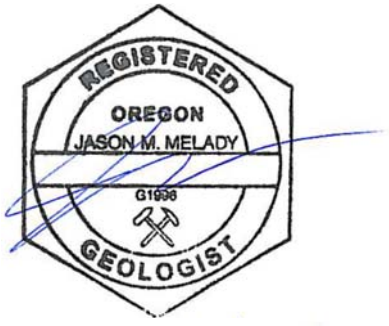
Stat. Auth.: ORS 448.131
Stats. Implemented: ORS 448.131, 448.150 & 448.273

APPENDIX F

GSI Water Solutions, Inc. Draft Technical Memorandum, Summary of Aquifer Testing of the City of Milton-Freewater's Water Supply Well 5 and Water Rights Discussion

GSI Water Solutions, Inc.

Technical Memorandum



Expires 06/01/2019

To: John Wells, PE – Anderson Perry & Associates, Inc.
Michael Blasy PE – Anderson Perry & Associates, Inc.

From: Jason Melady, RG, CWRE – GSI Water Solutions, Inc. (GSI)
Rodrigo Prugue – GSI
Kim Grigsby - GSI

Date: October 30, 2018

Re: **Summary of Aquifer Testing of the City of Milton-Freewater's Water Supply Well 5 and Water Rights Discussion**

City of Milton-Freewater Well 5 Aquifer Testing

Background

The City of Milton-Freewater's (City) is evaluating implementation of Aquifer Storage and Recovery (ASR) at one of the City's drinking water supply well, Well 5 (UMAT 3909), located adjacent to the Little Walla Walla River near NE 5th Avenue (Figure 1). To assess aquifer characteristics necessary to evaluate ASR potential a constant rate aquifer test was conducted at Well 5 in September, 2018 and is described in this document. A nearby-unused former industrial well referred to as the Key Well (UMAT 3908) served as the primary observation well during the test. Additional City wells including Well 2 (UMAT 3962), Well 3 (UMAT 3930), and Well 6 (UMAT 3929) (see Figure 1) were monitored by staff from Oregon Water Resources Department (OWRD).

The City's Well 5 was constructed in 1936 and is completed to a total depth of 502 feet below ground surface (ft bgs) within the Columbia River Basalt Group (CRBG). The water well log for Well 5 indicates it is cased from the ground surface to 202 feet deep into the CRBG, but does not describe the location of a well seal. The Key Well was constructed in 1945 and is completed to a total depth of 528 ft bgs, also within the CRBG. The water well log for the Key Well indicates it is cased and sealed to a depth of 109 ft bgs. The Key Well is located approximately 600 feet from Well 5. Wells 2 and 3 were constructed in the 1945 and 1946, respectively, and Well 6 was constructed in 1950; all completed within the CRBG. Wells 2 and 6 are completed to a total depth of 902 ft bgs and 952 ft bgs, respectively, and are located 5,600 feet and 3,300 feet from Well 5, respectively. Well 3 is completed to a total depth of 550 ft bgs and is located approximately 1,200 feet from Well 5.

Aquifer Test

Aquifer testing at Well 5 consisted of a constant-rate aquifer test, with the Key Well, Well 2, Well 3, and Well 6 serving as observation wells during the test. A step rate aquifer test was attempted prior to initiation of the constant rate test, but valve configuration at the wellhead did not allow for reduction in flow rate below approximately 750 gallons per minute (gpm). Constant rate aquifer testing was completed using an existing line-shaft turbine in Well 5. Water levels were measured at Well 5 using an existing airline measurement system. Installation of a pressure transducer and measurements with an electronic water level meter were attempted, but access into the well was not possible for either measurement method. An additional calibrated pressure gauge was added to the airline by GSI to confirm accuracy of the City's pressure gauge during the test. Flow from Well 5 was measured with a calibrated digital totalizing flow meter. Water levels at the Key Well, Well 2, Well 3, and Well 6 were measured using an electronic water level indicator.

Constant Rate Aquifer Test. A 22-hour constant-rate aquifer test was completed at Well 5 from September 11 to 12, 2018. The average pumping rate over the 22-hour period was 943 gpm. Table 1 outlines the pumping schedule for all City wells in the days preceding and following the aquifer test. City drinking water demands necessitated operation of Wells 6 and 8 up until approximate 4 hours prior to initiation of the constant rate aquifer test at Well 5. Figure 2 show drawdown observed at Well 5 and all observation wells. Figure 3 shows drawdown at only the observation wells. Figure 3 shows increasing water level measurements (shown as negative drawdown) from Wells 2, 3, and 6 during aquifer testing at Well 5, suggesting that these wells were recovering from pumping at Wells 6 and 8 prior to the constant rate test. As a result, aquifer test analysis using observations from these wells is not possible and was therefore not completed. As previously indicated, water level measurement from Well 5 was completed with an existing airline and pressure gauge (supplemented with a second gauge to confirm air pressure readings), which only permitted readings with an accuracy of approximately 0.5 psi, representing a potential error of over 1 foot. Unfortunately, this error makes detailed analysis of the data from Well 5 difficult, but in general, the total drawdown of approximately 23 feet over the aquifer test suggests a very transmissive aquifer.

Figure 4 shows drawdown measurements at the Key Well during the aquifer test, which observed a total of approximately 2 feet of drawdown over 22 hours of pumping at Well 5. A Cooper-Jacob straight line aquifer test analysis (1946) was used to estimate aquifer transmissivity and aquifer storativity. Two drawdown trends were observed in the Key Well data and analyses were completed for each trend. At approximately 600 minutes into the aquifer test, a slope change in drawdown can be observed in Figure 4, marking the start of the second trend, possibly suggesting the presence of a negative aquifer boundary (fault or geologic structure) or potential interference from irrigation wells in the area. Figure 4 shows aquifer transmissivity and storativity values calculated from these two drawdown trends, which range between approximately 250,000 gallons per day per foot (gpd/ft) to 92,000 gpd/ft and 0.009 and 0.01, respectively.

Figure 5 shows residual drawdown measurements at all of the wells during recovery following completion of the aquifer test, which was only available for collection for approximately 6 hours until the City required restarting pumping at Wells 3, 6, and 8. Figure 6 shows residual drawdown at the Key Well and includes additional Cooper-Jacob straight line analysis, focused on the later time recovery data on the plot (shown on Figure 6 as a lower elapsed time/time since recovery started [t/t']). Aquifer transmissivity based on recovery data at the Key Well is approximately 250,000 gpd/ft, which is in agreement with the initial trend observed during pumping. Given the relatively short recovery observation time, it is uncertain if a similar steeper trend may have been observed later in the recovery period reflecting what may have been an aquifer boundary observed in the pumping data.

Figure 7 shows specific capacity changes observed at Well 5 during the aquifer test. Specific capacity is the pumping rate of the well divided by the observed drawdown and is a general measure of well performance. A high well specific capacity measurement suggests a productive aquifer. Water supply wells completed in CRBG aquifers throughout the region can range in specific capacity between less than 1 gpm/ft to 100 gpm/ft or more, but specific capacity over 10 gpm/ft is indicative of high well yield (dependent on available well drawdown), and in many cases, potentially high well recharge potential. Specific capacity varies with time and projected specific capacity for Well 5 shown in Figure 7 is estimated at 30 gpm/ft after 60 days of pumping (or recharge).

At the conclusion of the aquifer test, field parameters (pH, temperature, and ORP) were collected and are shown in Table 2. Issues with calibration of the field meter did not allow for full calibration, but in general, the data appear reasonable with regard to typical pH, temperature, and ORP values.

Aquifer Testing Summary

The following summarizes information obtained from aquifer testing completed at the City's Well 5:

- Well 5 typically operates for drinking water supply at a rate of approximately 1,000 gpm without issues with excessive drawdown.
- Aquifer testing completed over a 22-hour period at 943 gpm resulted in a total drawdown of 23 feet in Well 5, which represents a well specific capacity of 41 gpm/ft and projected specific capacity at 60 days is estimated at 30 gpm/ft.
- City wells impart interference despite differences in well construction, with residual drawdown from operational pumping Wells 6 and 8 preceding the aquifer test observed at Wells 2 and 3, obscuring the ability to analyze aquifer characteristics at these wells from aquifer testing at Well 5.
- Aquifer testing analysis from the Key Well indicates an aquifer transmissivity ranging between approximately 250,000 gpd/ft to 92,000 gpd/ft and an aquifer storativity between 0.009 and 0.01.
- A negative aquifer boundary, suggesting the presence of a geologic structure or fault, appears to have been observed in the aquifer response observed in the Key Well during aquifer testing at Well 5. The effects of this boundary, if present, may negatively impact long term drawdown, although anecdotal observations from City staff do not indicate operational impacts at Well 5.
- In general, aquifer testing at the City's Well 5 indicate productive aquifer characteristics that are likely supportive of use for ASR.

Aquifer Storage and Recovery Permitting

Based on our general understanding of the project at this time, the goals of this project are to store water below ground during periods of higher stream flow and low demand, and to increase stream flows during periods of low flow and high demand by protecting "natural flow" water rights instream. To meet this goal, the City will develop an aquifer storage and recovery (ASR) project to store water below ground using an existing surface water right. The stored water would be recovered and used for irrigation at the City's golf course, and several of the City's existing surface water rights currently used for irrigation would be protected instream. The water rights mechanisms necessary to implement this approach are described below.

OWRD is the lead agency that permits and oversees ASR projects in the State of Oregon; however, OWRD consults with the Oregon Department of Environmental Quality (DEQ) and the Oregon Health Authority (OHA) Drinking Water Program on various aspects of ASR projects. To develop an ASR project,

a water right authorizing the use of water for the project is required. ASR is an inherent (authorized) use of water under any existing water right in Oregon, meaning that any existing water right could be used as a source for an ASR project. The water right's use of water, however, must be consistent use for which the recovered stored water will be used. All proposed ASR project proponents must also seek authorization from OWRD for an "ASR limited license" for ASR pilot testing.

Water Right for ASR Source Water

Storing water under the ASR process would require a water right authorizing the ultimate use of the water and a limited license to authorize ASR testing. Based on discussion with City staff for this project, the stored water will be used for irrigation purposes. The City is proposing to use its water right Certificate 12920, which authorizes the use of up to 7.24 cubic feet per second (cfs) for domestic and municipal purposes. Since municipal use includes the use of water for irrigation purposes, Certificate 12920 could provide the needed water right authorization for an ASR project that would provide stored water for irrigation purposes.

The City's proposed ASR project includes diverting water from the Little Walla Walla River (which diverts water from the Walla Walla River), treating the water, and then injecting the treated water into Well 5. The City's Certificate 12920 authorizes the use of water from the Walla Walla River, but it is not clear that the currently authorized point of diversion is consistent with the proposed project. The authorized point of diversion for Certificate 12920 is not very clear. OWRD's on-line water right information does not include a map for this water right and the location is not included in the certificate. Certificate 12920 was issued as the result of the Walla Walla River Decree, and the decree provides the following description of the location of the City's point of diversion: "about one and one-fourth miles above the bank building on Main Street in the said City." Based on information provided by the City, this authorized location is upstream from the point where the Little Walla Walla River diverts water from the Walla Walla River. Under these circumstances, the City should be able to file a water right transfer application for Certificate 12920 that would add a point of diversion for this water right at the Little Walla Walla River near Well 5. OWRD would review the transfer application to determine whether the requested change would cause injury to other existing water rights or enlargement of Certificate 12920. Since the new point of diversion would downstream from the authorized point of diversion, OWRD should be able to approve the transfer application. The transferred water right would allow diversion of water from the Walla Walla River into the Little Walla Walla River, and re-diversion from the canal near Well 5.

Limited License for ASR Testing

As previously described, the City would also need to obtain a limited license to authorize ASR testing. To approve an ASR limited license, OWRD must determine that the ASR testing will not impair or be detrimental to the public interest, that testing will produce adequate information regarding resulting groundwater water quality and water quantity, and the proposed use will not expand the use under the original water right.

The primary objectives of ASR pilot testing are to (1) confirm the findings from the ASR feasibility study though data collection and observation, and (2) allow incremental development of the ASR system over time up to the limits allowed by the ASR limited license. An ASR limited license is issued for a 5-year period and can be renewed for additional 5-year periods if prolonged testing is needed to fully develop the project (e.g., if multiple wells are proposed). Once testing has been completed, the applicant can apply to OWRD for an ASR permit.

Protect Existing Irrigation Rights Instream through an Instream Transfer

A third transaction would be required to protect the City's existing irrigation rights instream. According to the City, it currently uses water right Certificates 89164, 89166 and 89168 to irrigate the City golf course. These water rights authorize the use of up to 0.16 cfs, 0.64 cfs, and 0.59 cfs, respectively, from the Walla Walla River for irrigation purposes. These existing natural flow water rights could be protected instream (in the Walla Walla River) using an instream transfer. Instream transfers can be permanent or time-limited. The water rights could also be protected instream through an instream lease, which can protect water rights instream for up to 5 years. At the end of a time-limited transfer or an instream lease, the water right reverts back to its original place of use. A permanent transfer likely could not be reverted back. Under such a transfer or lease, the priority date of the water rights remains unchanged while the water is protected instream.

OWRD will review an application for an instream transfer to determine whether it will cause "injury" to existing water rights or enlargement of the right to be transferred. Under an instream transfer, the water protected instream could be protected throughout the irrigation season on a continuous basis, which is different than how water is typically used for irrigation. Although we would not expect OWRD to consider this "injury," downstream junior irrigators could receive less water after an instream transfer than when the rights were used for irrigation. The potential for this result and potential "harm" to downstream irrigators could be evaluated during the first years that the project is implemented.

References

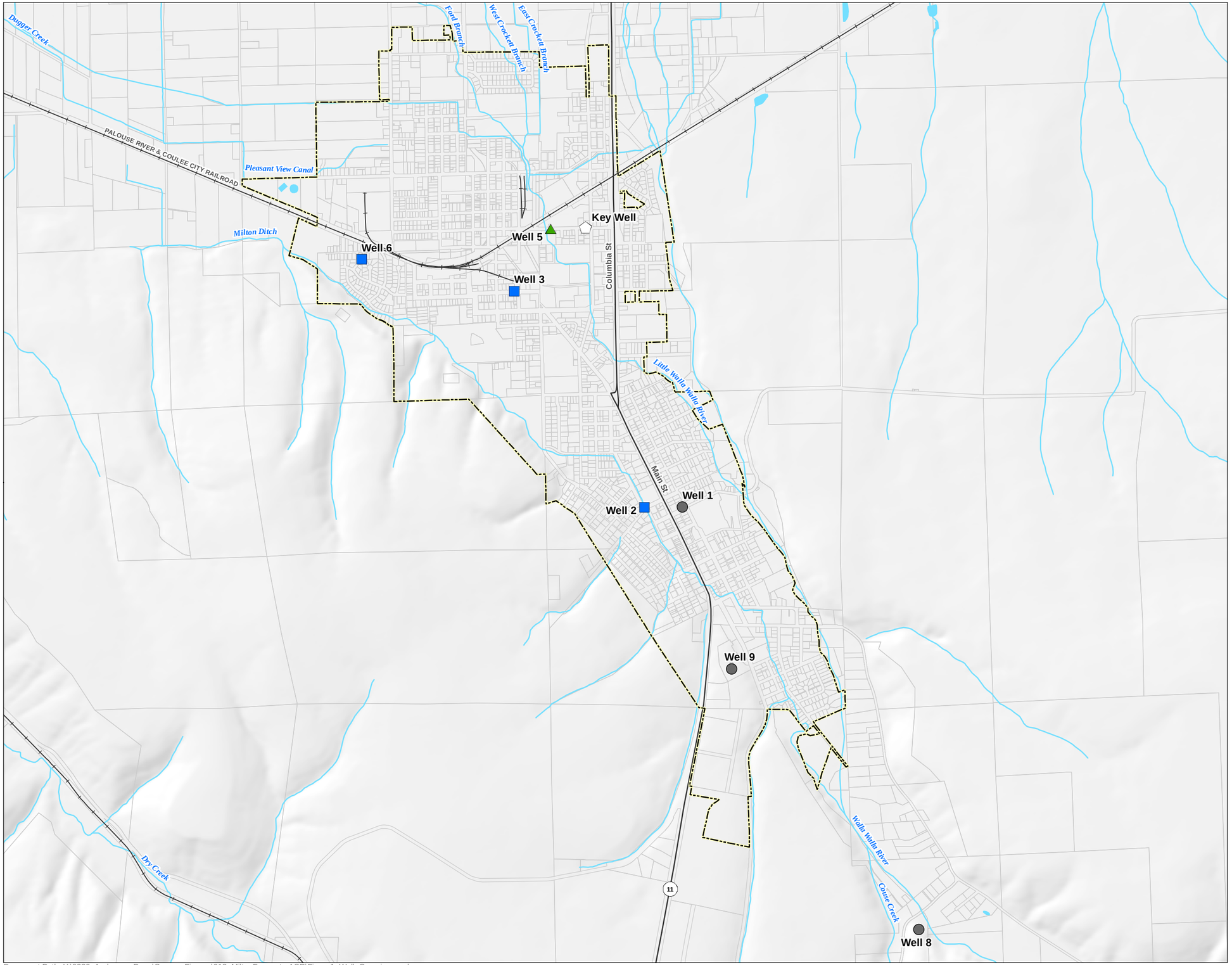
Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

Murrysmith and Northwest Geologic Services, 2018, Draft Technical Memorandum, Milton-Freewater Aquifer Storage and Recovery Feasibility Study Project-Investigation of Water Treatment Alternatives (Task 3).

FIGURE 1

City Well Overview

Milton-Freewater, Oregon



LEGEND

City Well Locations

- Active, Pumping Well During Testing
- Active, Observed During Testing
- Active, Not Observed During Testing
- Monitoring Well Observed During Testing

All Other Features

- City Boundary
- Tax Lot
- Railroad
- Major Road
- Watercourse
- Waterbody

NOTE:
Well 4 not included in overview map since it is abandoned and not applicable to assessment.

N

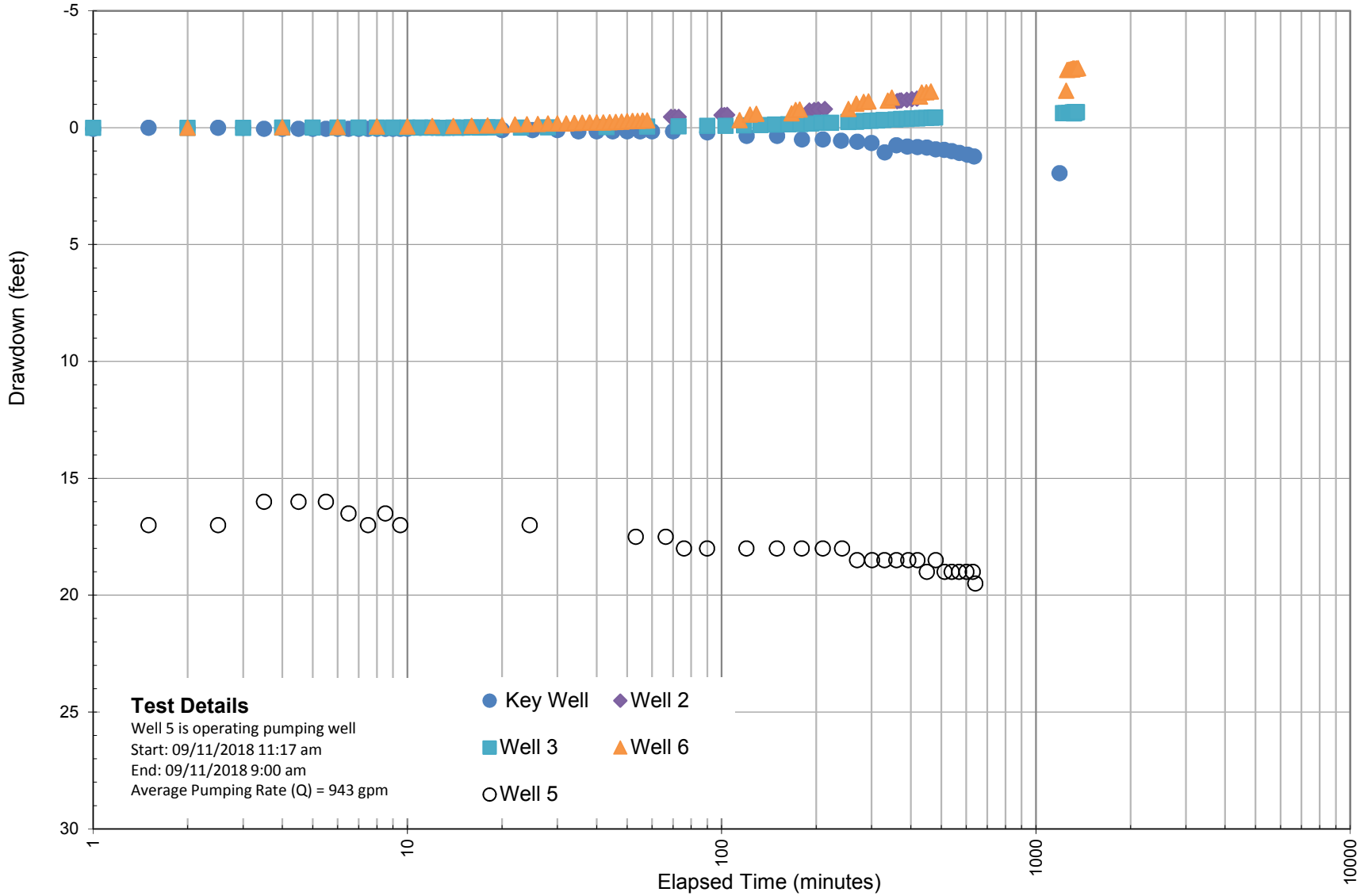
0 850 1,700 2,550
Feet

Date: October 30, 2018
Data Sources: OGIC, ESRI, USGS, Umatilla Co.

GSI Water Solutions, Inc.

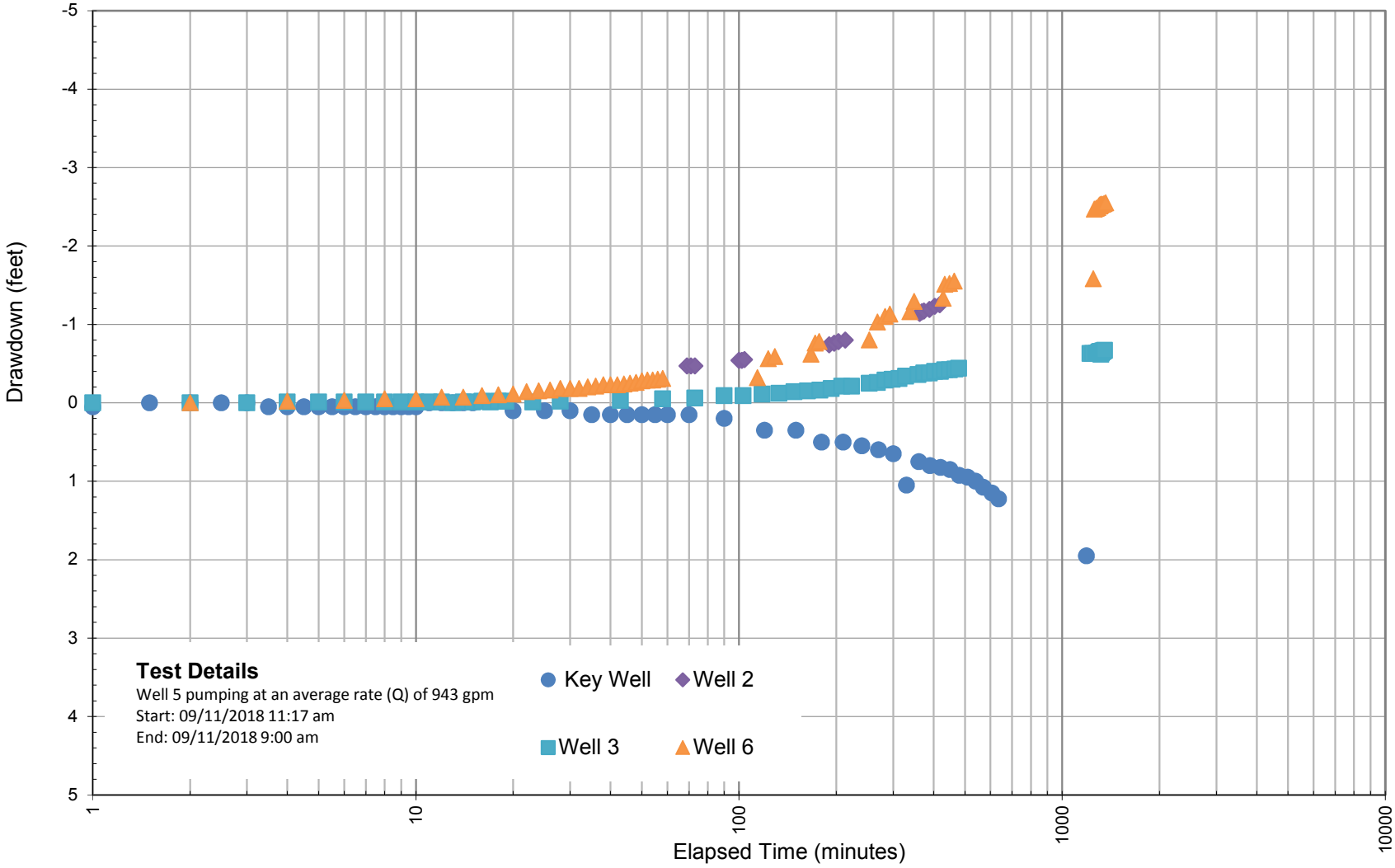
Document Path: Y:\0339_Anderson_Perry\Source_Figures\013_MiltonFreewaterASR\Figure1_Well_Overview.mxd

Figure 2. Drawdown at All Monitored Wells During Constant Rate Aquifer Test
City of Milton-Freewater



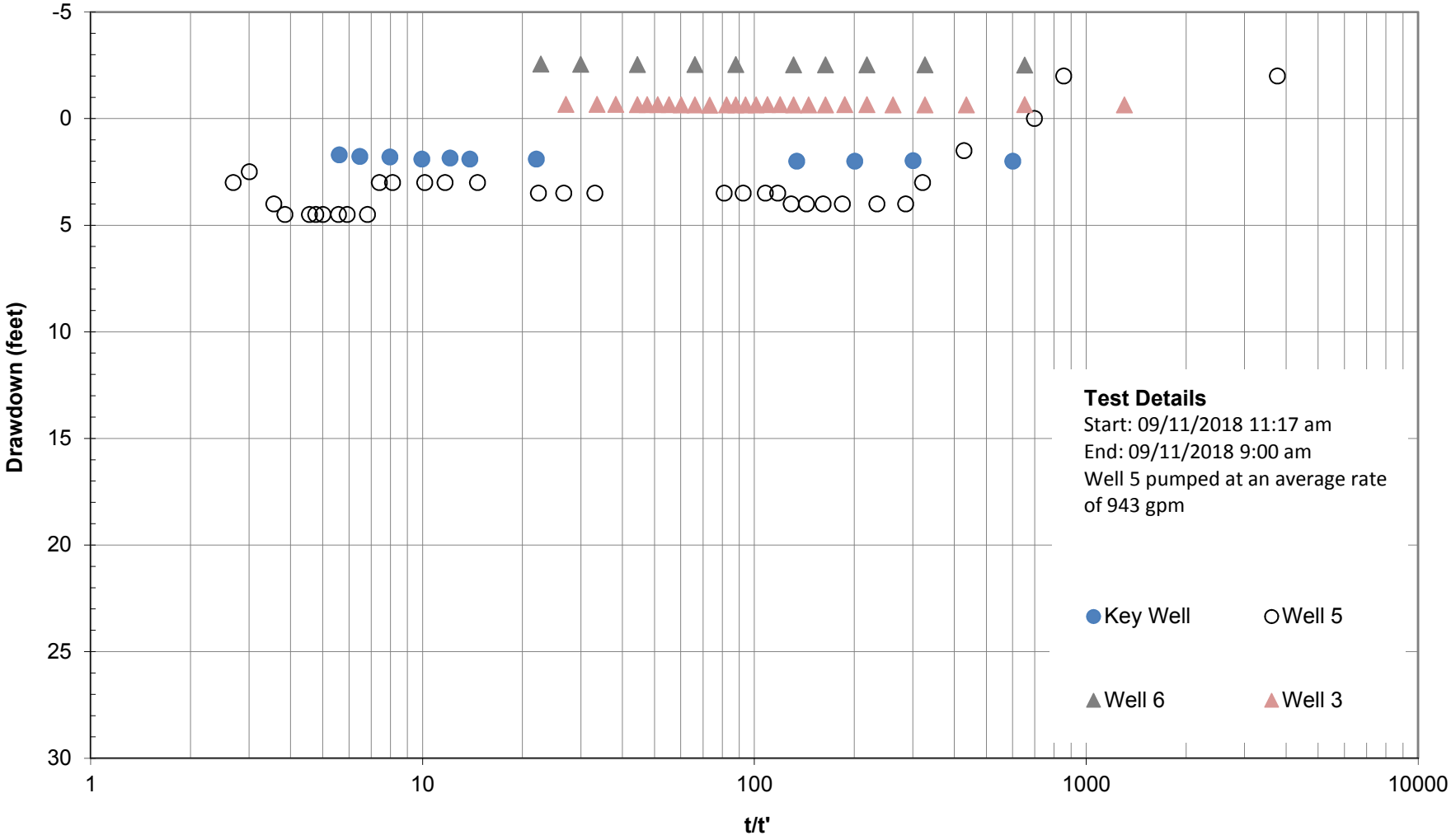
GSI Water Solutions, Inc.

Figure 3. Drawdown at Observation Wells During Constant Rate Aquifer Test
City of Milton-Freewater



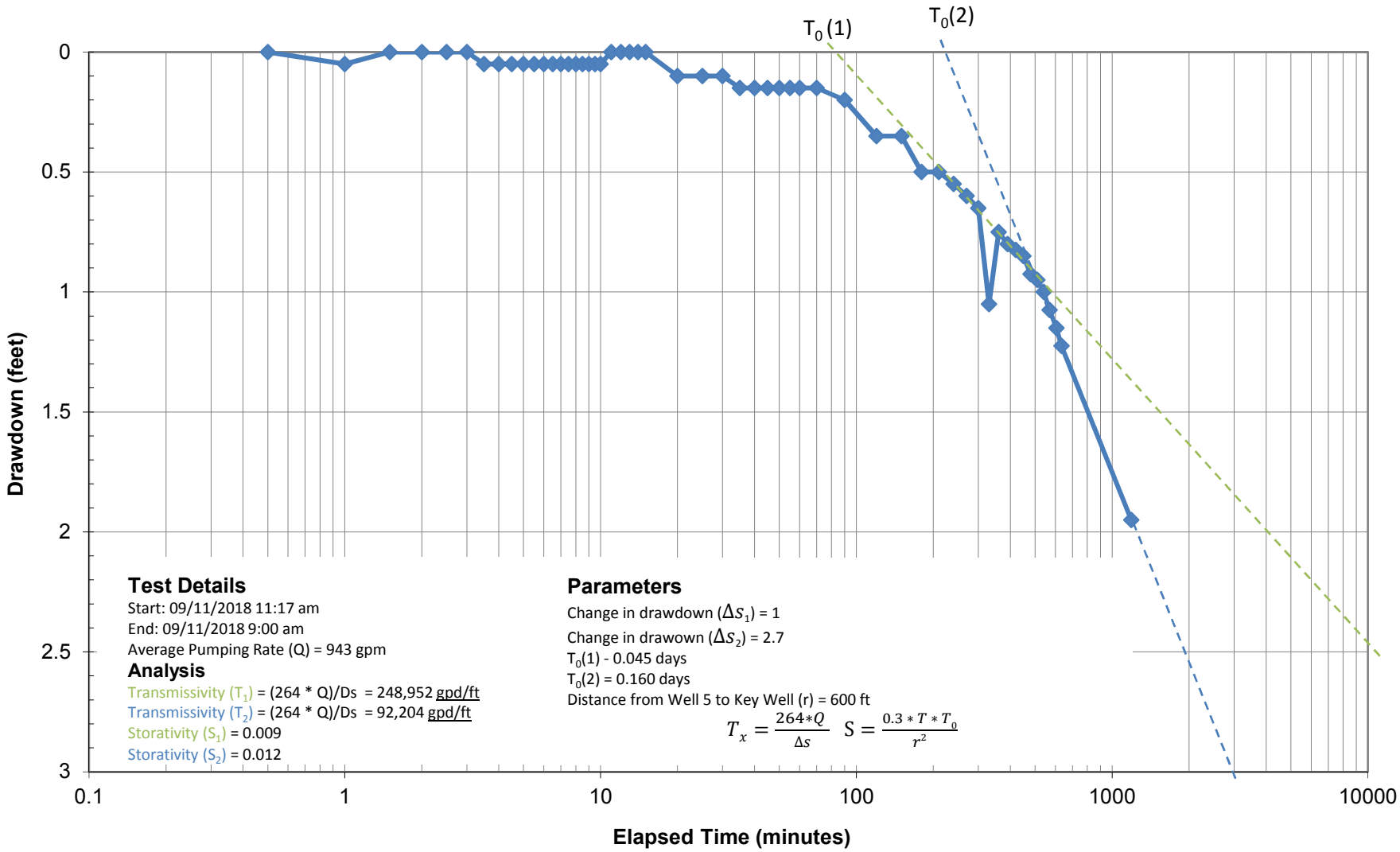
GSI Water Solutions, Inc.

Figure 4. Residual Drawdown Following Constant Rate Aquifer Test
City of Milton-Freewater



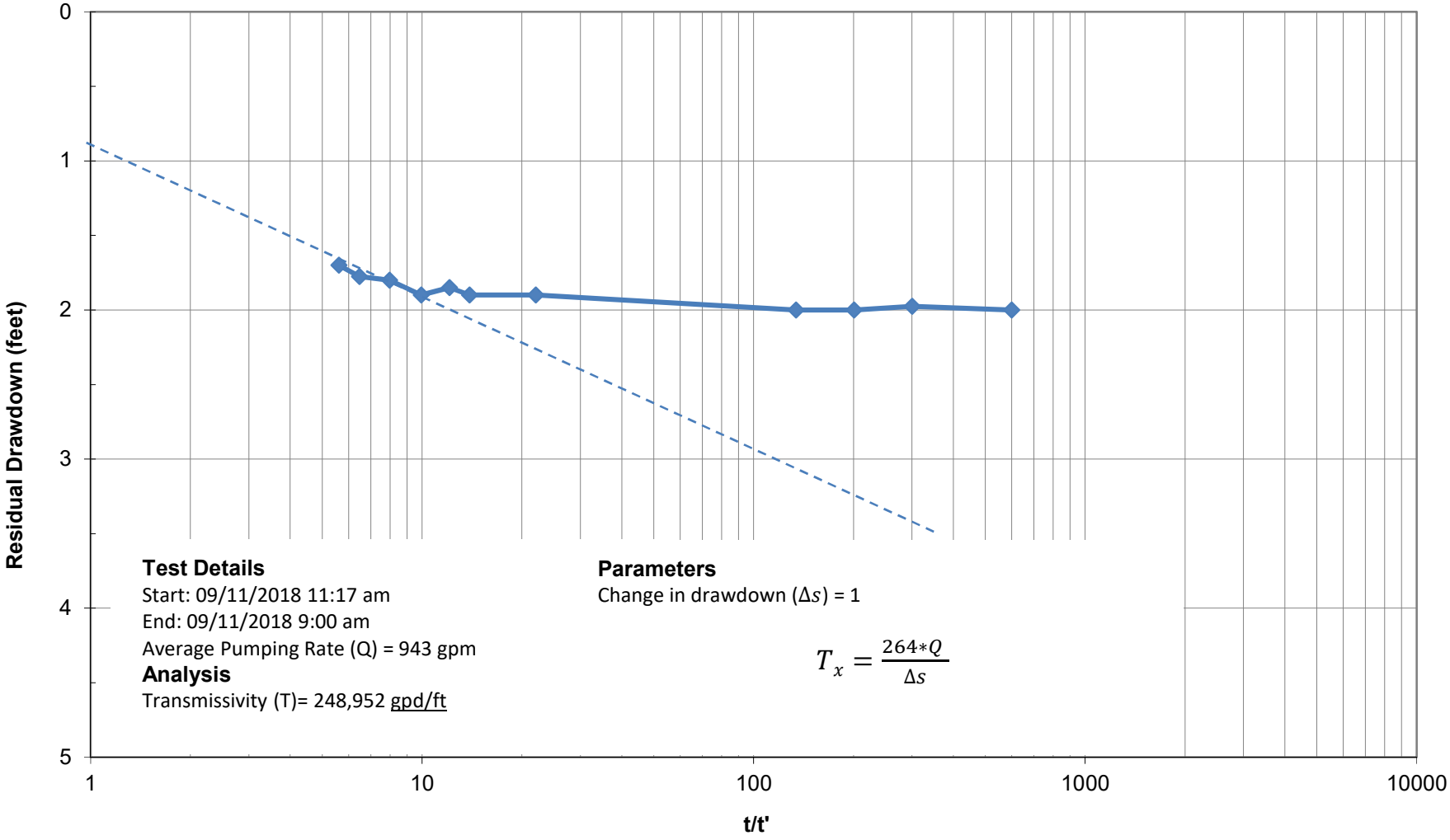
GSI Water Solutions, Inc.

Figure 5. Drawdown in Key Well During Constant Rate Pump Test
City of Milton-Freewater



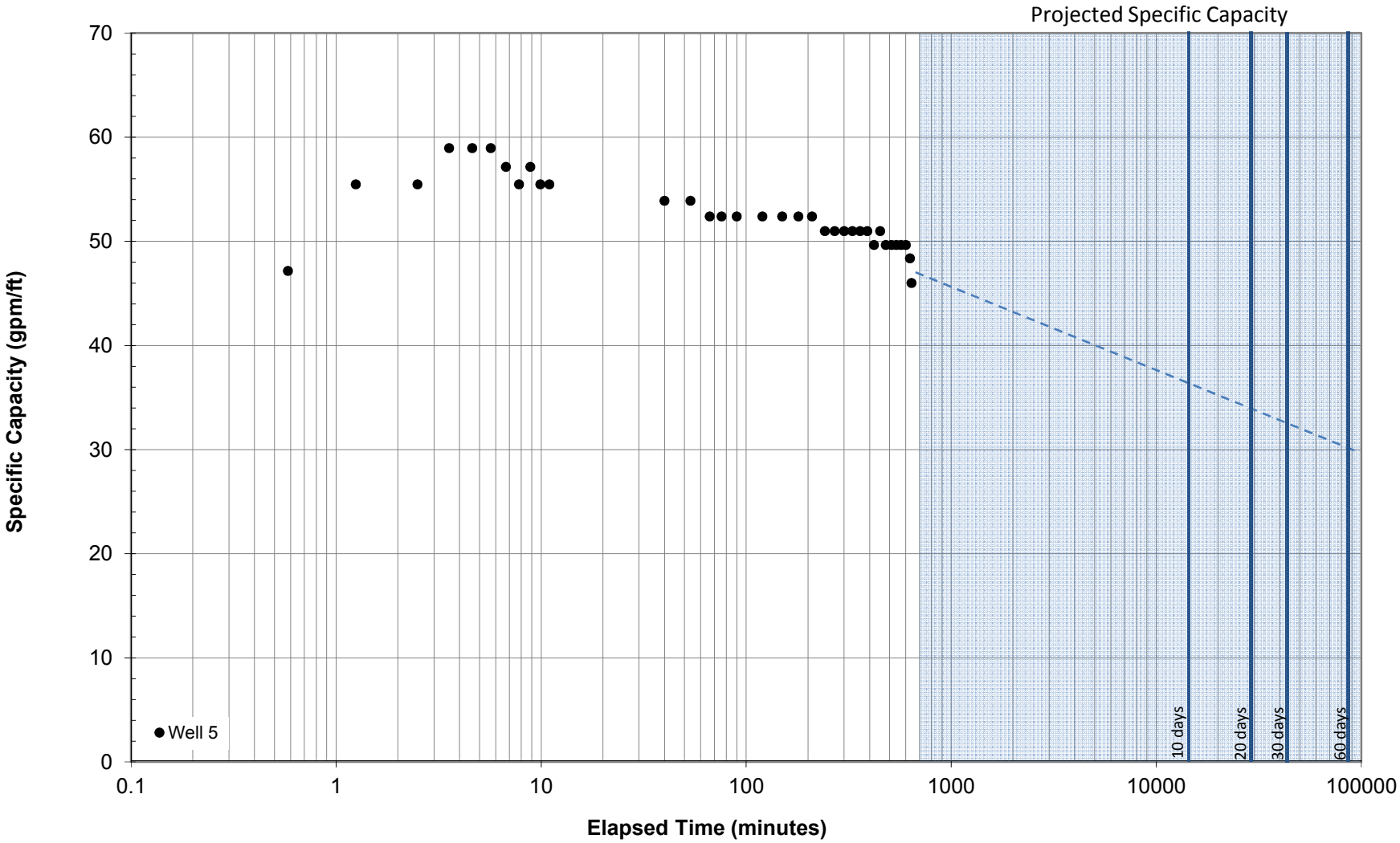
GSI Water Solutions, Inc.

Figure 6. Residual Drawdown in Key Well Following Constant Rate Aquifer Test
City of Milton-Freewater



GSI Water Solutions, Inc.

Figure 7. Specific Capacity During Constant Rate Pump Test
City of Milton-Freewater



GSI Water Solutions, Inc.

Table 1. Milton-Freewater Well Operational Data

Well ID	9/8/2018		9/9/2018		9/10/2018				9/11/2018						9/12/2018			
	Pump Started	Pump Stopped	Pump Started	Pump Stopped	Pump Started	Pump Stopped	Pump Started	Pump Stopped	Pump Started	Pump Stopped	Pump Started	Pump Stopped	**Aquifer Test Start**	**Aquifer Test Stop**	Operating	Shutdown	Operating	Shutdown
Well 1					8:32 AM	3:33 PM												
Well 2	1:33 AM					3:33 PM												
Well 3			12:26 PM	10:53 PM	1:03 AM	11:26 AM	1:39 PM	9:46 PM							3:36 PM	8:08 PM		
Well 5													**11:16 AM**	**9:00 AM**				
Well 6					7:57 PM					3:10 AM	5:15 AM	8:02 AM			3:40 PM	7:55 PM		
Well 8					2:37 PM	3:33 PM	5:05 PM			2:32 AM	4:39 AM	7:21 AM			3:39 PM	6:21 PM	9:08 PM	10:55 PM
Well 9	Not Operating																	

GSI Water Solutions, Inc.

Table 2.
Field Parameter Summary
Well 5
City of Milton-Freewater

Date/Time	Temperature (Celsius)	DO (mg/L)	Specific Conductance (µS/m)	pH	ORP (mV)
9/12/2018 8:50 am	13.9	2.1	186.80	6.44	-22.40
9/12/2018 8:55 am	13.9	2.07	186.60	6.53	-17.90
9/12/2018 8:58 am	13.9	2.09	186.70	6.56	-15.70

Notes

Multi-parameter probe used to measure field parameters (Model: YSI 556).

Multi-paramter probe was not calibrated prior to test.

APPENDIX G
Engineer's Estimate

WALLA WALLA BASIN WATERSHED COUNCIL
CITY OF MILTON-FREEWATER WELL NO. 5
AQUIFER STORAGE AND RECOVERY DEMONSTRATION PROJECT
ENGINEER'S ESTIMATE
October 31, 2018

NO.	ITEM	UNIT	UNIT PRICE	QTY	TOTAL PRICE
General					
1	Mobilization/Demobilization	LS	$ 18,200	All Req'd	$ 18,200
2	Temporary Protection and Direction of Traffic/Project Safety	LS	9,750	All Req'd	9,750
3	Clearing and Grubbing	LS	6,500	All Req'd	6,500
4	Potholing All Connections and Known Utility Crossings	LS	6,500	All Req'd	6,500
5	Additional Potholing	HR	200	2	400
6	Electrical	LS	39,000	All Req'd	39,000
7	Ancillary Controls	LS	19,500	All Req'd	19,500
River Intake System					
8	Intake Screen	EA	13,000	1	13,000
9	2-In. Schedule 40 PVC Pipe	LF	10	30	300
10	2-In. EPDM Discharge Hose	LF	20	10	200
11	12-In. Flexible PVC Suction Hose	LF	80	10	800
12	12-In. Steel Pipe (Direct Bury Infeed)	LF	80	50	4,000
13	Suction Intake Connection	EA	13,000	1	13,000
14	12-In. Silent Check Valve	EA	5,000	1	5,000
15	Infeed Pump Station with VFD	EA	45,500	1	45,500
Backwash Waste Conveyance System					
16	6-In. SDR 35 PVC Sewer Pipe	LF	60	160	9,600
17	Manhole	EA	6,500	2	13,000
Wellhead Improvements					
18	12-In. D.I. Pipe	LF	80	5	400
19	8-In. D.I. Pipe	LF	80	10	800
20	4-In. D.I. Pipe	LF	80	10	800
21	8-In. Control Valve	EA	6,500	1	6,500
22	4-In. Angled Control Valve Salvage and Reinstallation	EA	4,550	1	4,550
23	4-In. Altitude Valve	EA	4,550	1	4,550
24	12-In. Swing Check Valve	EA	9,750	1	9,750
25	Down Hole Well Control Valve with Controls	EA	162,500	1	162,500
				Capital Cost Subtotal	**$ 394,100**
				Ultrafiltration Membrane Treatment System Trailer Rental	**$ 205,000**
				Ultraviolet Disinfection Unit Rental	**$ 20,000**
				15,000-Gallon Filtered Water Storage Tank Rental	**$ 25,000**
				Operator Wage and Fringe	**$ 60,000**
				Infeed Pump Electricity	**$ 10,000**
				UF Power and Chemicals	**$ 10,500**
				UV Electricity	**$ 500**
				Consumable Materials and Testing	**$ 3,500**
				Bid-Ready Document Preparation Engineering	**$ 30,000**
				Construction Assistance	**$ 30,000**
				Indirect Cost Subtotal	**$ 394,500**
				TOTAL ASR DEMONSTRATION PROJECT	**$ 788,600**

APPENDIX H

Oregon Water Resources Department
Aquifer Storage and Recovery
Limited License Application

ASR Limited License No. _____
(ASSIGNED AFTER FILING)

OREGON WATER RESOURCES DEPARTMENT

APPLICATION FOR AQUIFER STORAGE AND RECOVERY (ASR) LIMITED LICENSE

Applicant: _____
Mailing Address: _____
Phone and Email: _____

Authorized Agent: _____
Mailing Address: _____
Phone and email: _____

1. DATE(S) OF PRE-APPLICATION CONFERENCE(S): _____

INFORMATION REGARDING ASR TESTING UNDER A LIMITED LICENSE

2. SOURCE OF INJECTION WATER for ASR: _____

a tributary of _____

2.5 WATER RIGHTAUTHORIZATIONS (Permit or Certificate numbers): _____

_____

3. MAXIMUM DIVERSION RATE: _____

4. MAXIMUM INJECTION RATE AT EACH WELL(S): _____

_____

_____

Table 1. ASR WELLS (attach additional pages as needed)

ASR Well Name	ASR Well Log ID (e.g. UMAT 12345, if not yet drilled= "proposed")	ASR Well Tag Number (e.g. L 123456)	ASR Well Location (metes and bounds from public land survey corner)

5. MAXIMUM STORAGE VOLUME:_____

6. MAXIMUM STORAGE DURATION:_____

7. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S):_____

8. LICENSE TERM OR DURATION SOUGHT (5 year maximum):_____

9. PROPOSED USE OR DISPOSAL OF RECOVERED WATER:_____

10. IF CONTINGENCIES PRECLUDE THE USE IN ITEM 9, SPECIFY AN ALTERNATE USE OR DISPOSAL OF THE RECOVERED WATER:_____

INFORMATION REGARDING THE ULTIMATE ASR PROJECT
AS CURRENTLY ANTICIPATED

11. SOURCE OF INJECTION WATER for ASR: _____
a tributary of _____

11.5 WATER RIGHT AUTHORIZATION (Application, Permit or Certificate numbers):_____

12. MAXIMUM DIVERSION RATE:_____

13. MAXIMUM INJECTION RATE AT EACH WELL(S):_____

14. MAXIMUM STORAGE VOLUME:_____

15. MAXIMUM STORAGE DURATION:_____

16. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S):_____

_____

_____

NOTE: The materials required by rule for an ASR limited license are extensive. The items on this sheet consist of those outlined in OAR 690-350-020(2) and (3)(a)(A-E). Please consult the rule and provide as attachments to this form the other requirements in OAR 690-350-020, including:

- **ASR Test Program (3)(b)(A)**
- **Proposed System Design (3)(b)(B)**
- **Groundwater Information (3)(b)(C)**
- **Quality of source water, aquifer water and compatibility assessment (3)(b)(D-G)**
- **Water Availability Statement Water Right Holder Agreement (as necessary) (3)(a)(F-G)**
- **Legal Land Use Form (3)(a)(H)**
- **Site Map (3)(a)(I)**
- **OHA DWS Plan Review Acknowledgement (public supply systems only) (3)(a)(J)**
- **ASR LL Application Fee. Consult current fee schedule at: http://www.oregon.gov/owrd/pages/pubs/forms.aspx#fees**
- **Submit one hard copy in person or by mail to: Oregon Water Resources Department, 725 Summer St NE, Suite A, Salem, OR 97301**
- **Submit a digital copy to: Jennifer.L.Woody@oregon.gov**
- **Questions? Contact Jen Woody, OWRD Hydrogeologist, at 503-986-0855**

Signature of Applicant_____ **Date**_____

Title of Applicant_____