WUTC DOCKET: UW-170924
EXHIBIT: SH-33X
ADMIT ☑ W/D ☐ REJECT ☐

SH-Exh-X–30
Docket UW 170924
Sarah Hand

BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

SARAH HAND AND GRETCHEN HAND, a married couple Complainant, v. RAINIER VIEW WATER COMPANY, INC., Respondent.	DOCKET UW 170924 **SARAH HAND'S EXHIBIT 30 TO CROSS EXAMINATION**

EXHIBIT 30

TO CROSS EXAMINATION OF BOB BLACKMAN AND RACHEL STARK

July 25, 2018

APEX Engineering Report dated 12-09-2016

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FIR MEADOWS WELL D (SOURCE 27) TREATMENT FOR THE SOUTHWOOD WATER SYSTEM

RAINIER VIEW WATER COMPANY

DECEMBER 9, 2016

Apex Engineering PLLC

FIR MEADOWS WELL D (SOURCE 27) TREATMENT
FOR THE
SOUTHWOOD WATER SYSTEM

RAINIER VIEW WATER COMPANY

Prepared for:

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File #32646/11
December 9, 2016

12/09/2016

Project Manager: _____
Kimberly Savage, P.E.

Apex Engineering

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SECTION 1 PROJECT DESCRIPTION

The 220-feet (ft) deep Fir Meadows Well D (S27) is located at 6700 204th Street East in Graham, Washington and was drilled in 2006. The Fir Meadows D Well currently produces approximately 650 gallons per minute (gpm) of groundwater on average for customers in the Southwood Water System near Graham, WA. The Southwood Water System is owned, operated, and maintained by Rainier View Water Company (RVWC).

Due to taste and odor complaints received by RVWC, ATEC Systems Associates (ATEC™) performed a series of raw water and pilot testing on the Fir Meadows Well D in August of 2016. ATEC™'s testing determined that the levels of manganese in the well were well above the Secondary Maximum Contamination Levels (SMCLs) set by the United States Environmental Protection Agency (US EPA). Therefore, water treatment for the Fir Meadows Well D is proposed. ATEC™'s Fir Meadows Well D Pilot Memo has been included in Appendix A for further information.

In order to continue to meet Southwood Water System demands and retain water production capacity of the well while treating manganese to achieve SMCL requirements for finished water manganese concentrations, RVWC proposes to install an ATEC™ filtration system. This project report and construction documents are intended to meet the requirements of the December, 2009 Washington State Department of Health's (WSDOH) Water System Design Manual as a project engineering report and also to present adequate pilot test data and conclusions as a predesign study.

SECTION 2 PLANNING

The Fir Meadows Well D serves the Southwood Water System. The installment of the proposed treatment system should not affect the supply water capacity of the Southwood Water System or impact any neighboring water systems. Minor temporary construction and related impacts, such as noise, increased traffic to the site, etc., could affect local residents. Refer to Chapter 2 of the approved 2011 Southwood Water System Plan for Basic Planning Data and Water Demand forecasting of the Southwood Water System.

SECTION 3 ANALYSIS OF ALTERNATIVES

Based on a review of previous and current water quality analyses, a field inspection of the existing water system, and discussion with the RVWC staff, the following water treatment design alternatives were developed to meet project objectives of the drinking water at the Fir

Meadows D Well. Water quality data and well log information used in evaluating alternatives are included in Appendix A of this report. The following three alternatives were considered:

ALTERNATIVE NUMBER ONE: *Greensand Treatment with Chlorine Oxidation*

Under this alternative, the well water would immediately be oxidized with chlorine to precipitate iron and manganese. The water would then pass through the greensand filtration media which supports oxidation of manganese and iron. Greensand treatment's iron removal capability has been proven to be comparable to most water treatment options. This alternative had relatively high operation and maintenance costs because of its detention requirements, large chlorine doses, and sizeable filter footprint.

ALTERNATIVE NUMBER TWO: *ATEC™ Treatment with Recycled Backwash*

Under this alternative, the iron would be oxidized to its insoluble state and filtered while the manganese would be adsorbed on the surface of the Pyrolusite media where it would be secured and oxidized in place. Chlorine would be injected immediately upstream of the filters. The chlorine would be used to oxidize the iron and to maintain the filter bed in an oxidized state. This difference would allow for higher loading rates, a smaller equipment footprint, and lower chlorine doses than Alternative Number One. The filtration media would proceed to be backwashed. This backwashed water would be released into a settling tank for decanting and the sediment removed routinely. This sediment would need to be disposed at an appropriate waste facility. The backwash water would then be pumped back into the system by a submersible pump to be recycled back through the filters. ATEC™ systems are typically more effective at removing manganese than the Greensand treatment systems considered for Alternative Number One. Additionally, RVWC currently operates and maintains several ATEC™ treatment systems within their water systems and has become familiar with the technology.

ALTERNATIVE NUMBER THREE: *ATEC™ Treatment with Disposed Backwash*

Under this alternative, the iron and manganese would be treated in the same process as Alternative Number Two. However, instead of routing the backwash through a settling tank and pumping it back through the system, the backwash would be disposed of via the proposed infiltration trench. This alternative would require less operations and maintenance work and be the most cost effective of the three alternatives. Refer to Appendix B of this report for infiltration trench calculations.

SELECTED ALTERNATIVE

Alternative Number Three was selected by RVWC as it provides required treatment with familiar operation and maintenance requirements and capital costs that fit the project's budget. The treatment system was designed for finished water production of approximately 700 gpm. Refer to Appendix C of this report for a copy of the civil plans which include a layout and details of the system.

The existing Fir Meadows Well D will be installed with an ATEC™ filter and backwash system. The ATEC™ water treatment units will be enclosed within the proposed treatment building. The ATEC™ system will consist of 6, 48-inch diameter filters delivered on a single skid. The 60-inch vertical filters contain 42-inches of AS-741M media (Pyrolusite). This equates to a loading rate of 7.80 gpm/square foot (sf) during production and 10.40 gpm/sf during backwash when 1 filter is out of production. In order for the media to remain charged, a residual chlorine concentration of no less than 0.600 mg/L after filtration should be maintained. Refer to Appendix A for additional system information.

WASTE HANDLING

The filter backwash from the ATEC™ system should be set to cycle once every 24 hours of production for a duration of 5 minutes per filter, or a total time of 20 minutes. This should result in approximately 10,500 gallons of backwash water. The 24 hour cycle time can be adjusted as necessary after several weeks of close observation. Valves have been included in the system's design to set the flow to the required backwash rate of 350 gpm, per ATEC™'s recommendations. During the 20 minutes of backwash, 350 gpm of the 700 gpm produced by the well would be used for backwash and approximately 350 gpm would be provided to the system. Refer to Appendix A for additional system information and Appendix B for backwash rate calculations.

The backwash water is proposed to be conveyed and infiltrated on-site. The small amount of iron and manganese in the backwash water being infiltrated are not of concern because they are considered a secondary constituent by the US EPA. Refer to Appendix A for more information.

AVAILABILITY OF SKILLED OPERATORS

As stated previously, RVWC currently manages several ATEC™ treatment systems within the Southwood Water System and Artondale/Wollochet Heights Water System. Therefore, RVWC staff is familiar with the requirements of ATEC™ facilities and appropriately trained to operate and maintain ATEC™ facilities. RVWC staff typically visit well sites within their water systems daily to assure quality control.

SYSTEM COST

Budgetary construction cost estimates were prepared for this project based on installing an ATEC™ system. In addition, an underground vault for storage of the backwash is necessary. The following tables are an approximate summary of the water treatment system costs. The price of the ATEC™ system listed includes the filters, controller and shipping. However, the price does not include the chemical feed system. Coordination with ATEC™ or an approved estimating service will be necessary should a more accurate cost estimate be required.

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Jan 3, 2017

The existing Fir Meadows Well D will be installed with an ATEC™ filter and backwash system. The ATEC™ water treatment units will be enclosed within the proposed treatment building. The ATEC™ system will consist of 6, 48-inch diameter filters delivered on a single skid. The 60-inch vertical filters contain 42-inches of AS-741M media (Pyrolusite). This equates to a loading rate of 7.80 gpm/square foot (sf) during production and 10.40 gpm/sf during backwash when 1 filter is out of production. In order for the media to remain charged, a residual chlorine concentration of no less than 0.600 mg/L after filtration should be maintained. Refer to Appendix A for additional system information.

WASTE HANDLING

The filter backwash from the ATEC™ system should be set to cycle once every 24 hours of production for a duration of 5 minutes per filter, or a total time of 30 minutes. This should result in approximately 6,000 gallons of backwash water. The 24 hour cycle time can be adjusted as necessary after several weeks of close observation. Valves have been included in the system's design to set the flow to the required backwash rate of 201 gpm, per ATEC™'s recommendations. During the 30 minutes of backwash, 201 gpm of the 700 gpm produced by the well would be used for backwash and approximately 499 gpm would be provided to the system. Refer to Appendix A for additional system information and Appendix B for backwash rate calculations.

The backwash water is proposed to be conveyed and infiltrated on-site. The small amount of iron and manganese in the backwash water being infiltrated are not of concern because they are considered a secondary constituent by the US EPA. Refer to Appendix A for more information.

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As stated previously, RVWC currently manages several ATEC™ treatment systems within the Southwood Water System and Artondale/Wollochet Heights Water System. Therefore, RVWC staff is familiar with the requirements of ATEC™ facilities and appropriately trained to operate and maintain ATEC™ facilities. RVWC staff typically visit well sites within their water systems daily to assure quality control.

SYSTEM COST

Budgetary construction cost estimates were prepared for this project based on installing an ATEC™ system. In addition, an underground vault for storage of the backwash is necessary. The following tables are an approximate summary of the water treatment system costs. The price of the ATEC™ system listed includes the filters, controller and shipping. However, the price does not include the chemical feed system. Coordination with ATEC™ or an approved estimating service will be necessary should a more accurate cost estimate be required.

FIR MEADOWS WELL D WATER TREATMENT FACILITY		
SYSTEM INSTALLATION COSTS		
Item	Construction Cost	
ATEC™ System	$	65,500
Structural	$	24,500
Mechanical	$	9,800
Vault	$	7,000
Site Work	$	8,500
Tax at 9.5%	$	10,954
Total Cost	**$**	**126,254**

FIR MEADOWS WELL D WATER TREATMENT FACILITY	
LIFECYCLE COSTS	
Item	Operation and Management Costs Per Year
Electrical	$ 588
Labor	$ 3,640
Monitoring	$ 1,680
Total Cost per Year	**$ 5,908**

SECTION 4 WATER QUALITY

FINISHED DRINKING WATER REQUIREMENTS

Water treatment requirements are established by the US EPA in accordance with the Federal Safe Drinking Water Act. The requirements are implemented in Washington by the WSDOH. Per these standards, iron and manganese must be less than one-half their SMCLs of 0.300 mg/L and 0.050 mg/L, respectively. The US EPA does not set a maximum standard for the levels of hydrogen sulfide or ammonia at this time. All specifications will meet RVWC's standard specifications and ATEC™'s recommendations unless specified differently on the construction plans.

RAW WATER DATA CONSIDERATIONS

The following table summarizes the raw water quality of the Fir Meadows Well D (provided by ATEC™):

RVWC – FIR MEADOWS WELL D			
RAW WATER QUALITY			
Parameter	Low (mg/L)	High (mg/L)	Average (mg/L)
Iron	NT	-	NT
Manganese	0.118	0.132	0.123
Hydrogen	-	0.014	0.006

Ammonia was at a non-detect. Manganese concentrations at these levels would be the cause of severe problems with taste, odor and staining. Refer to Appendix A for additional information regarding raw water quality for the Fir Meadows Well D.

PRE-DESIGN STUDIES

Pilot testing was performed by ATEC™ on February 18, 2016. A total of 6 samples were taken over a period of 2.5 hours. The following table summarizes the pilot testing of the Fir Meadows Well D (provided by ATEC™):

RVWC – FIR MEADOWS WELL D				
PILOT TEST SUMMARY				
Parameter	Low	High	Average	Percent of SMCL (%)
Iron	Non-detect	0.040 mg/L	0.010 mg/L	2.22
Manganese	Non-detect	0.010 mg/L	0.002 mg/L	4.33
Hydrogen Sulfide	Non-detect	Non-detect	Non-detect	-
Loading Rate	8.95 gpm/sf	10.75 gpm/sf	9.77 gpm/sf	-

Chlorine was added to the influent water in varying amounts from a low of 1.56 mg/L to a high of 1.87 mg/L, averaging 1.72 mg/L. Total chlorine concentration in the finish water varied from a low of 1.25 mg/L to a high of 1.58 mg/L, averaging 1.47 mg/L. Chlorine demand averaged 0.25 mg/L.

Refer to Appendix A for additional information regarding the pilot testing for the Fir Meadows Well D.

Hypochlorination will also be needed for this system to properly function. A 0.34 gallons/hour (gph) of 12.5% sodium hypochlorite at 0.7 mg/L is proposed to be utilized at the Fir Meadows Well D. The well will utilize a Total Chlorine Analyzer Model 56 to measure the free chlorine residual on a nonstop basis. This measurement process should be adequate to assure a residual chlorine concentration of no less than 0.600 mg/L after filtration is maintained for the proposed ATEC™ System. The existing SCADA system will be incorporated with alarms as necessary. Refer to the attached hypochlorination checklist and supporting information in Appendix E.

SECTION 5 WATER QUANTITY AND WATER RIGHTS

As previously stated, the proposed ATEC™ water treatment facility does not involve a new water source or an increase in the Southwood Water System's physical capacity. Refer to Chapter 3 of the approved Southwood Water System Plan for a detailed system quantitative analysis.

Due to the fact that the proposed water treatment facility does not affect the Southwood Water System's physical capacity, the facility will not affect the existing water rights in which the system holds. Refer to Appendix B of the approved Southwood Water System Plan for a detailed description of the system's water rights.

SECTION 6 ENGINEERING CALCULATIONS

Refer to Appendix B of this report for infiltration trench and backwash rate calculations. Refer to Chapter 3 of the approved Southwood Water System Plan for all calculations involved with analyzing the Southwood Water System.

SECTION 7 DESIGN/CONSTRUCTION CRITERIA

PERFORMANCE STANDARDS

The goal of this project was to provide a drinking water source to the Southwood Water System with constituents below SMCLs. With the treatment proposed in this report, these goals should be accomplished.

SIZING CRITERIA

The proposed water treatment system was sized in accordance with suggestions made by ATEC™. It is in RVWC's opinion that the sizing recommendations made by ATEC™ are correct and that the system should function properly as designed. Refer to the report included in Appendix A for more information regarding the sizing criteria for the proposed system.

LOCAL DESIGN STANDARDS

Local design standards, including fire flow requirements, have been analyzed and are discussed in the approved Southwood Water System Plan.

CONSTRUCTION MATERIALS AND METHODS

The water treatment system is available to be shipped, finish painted, on a single skid. It will be pre-plumbed and pre-wired with fusion epoxy coated tanks, manifolds, 0.25-inch heads and sidewalls. This includes 4-inch inlet and 6-inch outlet manifolds, 4-inch backwash line, and a 120- VAC automatic controller. If desired, as an extra item of work, ATEC™ can provide, shipped

loose, 4-inch backwash assembly 60-inches long, which has a threaded port for a sight glass, a meter and gate valve to set the backwash at the correct rate of 154 gpm. Refer to Appendix A for more information.

All of RVWC's projects are required to follow the construction procedures established by RVWC's standard specifications and ATEC™'s recommendations unless specified differently on the construction plans. All distributions projects are to be inspected by a representative of RVWC during construction in order to assure that the project conforms to the design and standards of RVWC. A final construction report and as-built are kept on file with RVWC for each project. These as-built plans are the basis for updating the overall system plans.

RVWC currently has allocated budget for this project. The anticipated project schedule is:

Design and Permitting	Current – July 2016
Equipment Procurement	July – August 2016
Construction	July – August 2016

SECTION 8 LEGAL CONSIDERATIONS

WATER SYSTEM OWNER, OPERATOR AND MANAGER

Rainier View Water Company
P.O. Box 44427
Tacoma, WA 98444
(253) 537-6634

No additional inter-local or water supply agreements, restrictive covenants, boundary line adjustments, right-of-way easements, wholesale customer lists, or other legal procedures have been deemed necessary at this time. RVWC will continue to follow local, state and federal guidelines applicable to this system.

STATE ENVIRONMENTAL POLICY ACT

The State Environmental Policy Act (SEPA) was reviewed in regards to this project. Categorical exemptions to the law, according to WAC 197-11-800 were also reviewed, and this project is exempt by 3 categories that are quoted below.

*"(2) **Other minor new construction.** The following types of construction shall be exempt except where undertaken wholly or in part on lands covered by water (unless specifically exempted in this subsection); the exemptions provided by this section shall apply to all licenses required to undertake the construction in question, except where a rezone or any license governing emissions to the air or discharges to water is required:...*

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loose, 4-inch backwash assembly 60-inches long, which has a threaded port for a sight glass, a meter and gate valve to set the backwash at the correct rate of 154 gpm. Refer to Appendix A for more information.

All of RVWC's projects are required to follow the construction procedures established by RVWC's standard specifications and ATEC™'s recommendations unless specified differently on the construction plans. All distributions projects are to be inspected by a representative of RVWC during construction in order to assure that the project conforms to the design and standards of RVWC. A final construction report and as-built are kept on file with RVWC for each project. These as-built plans are the basis for updating the overall system plans.

RVWC currently has allocated budget for this project. The anticipated project schedule is:

Design and Permitting.....Current – March 2017
Equipment Procurement .....March – April 2017
Construction.....March – April 2017

SECTION 8 LEGAL CONSIDERATIONS

WATER SYSTEM OWNER, OPERATOR AND MANAGER

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*"(2) **Other minor new construction.** The following types of construction shall be exempt except where undertaken wholly or in part on lands covered by water (unless specifically exempted in this subsection); the exemptions provided by this section shall apply to all licenses required to undertake the construction in question, except where a rezone or any license governing emissions to the air or discharges to water is required:...*

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... (d) Grading, excavating, filling, septic tank installations, and landscaping necessary for any building or facility exempted by subsections (1) and (2) of this section, as well as fencing and the construction of small structures and minor facilities accessory thereto.
... (g) The installation of impervious underground tanks, having a capacity of 10,000 gallons or less."

"(4) ***Water rights.*** *Appropriations of one cubic foot per second or less of surface water, or of 2,250 gallons per minute or less of groundwater, for any purpose. The exemption covering not only the permit to appropriate water, but also any hydraulics permit, shoreline permit or building permit required for a normal diversion or intake structure, well and pumphouse reasonably necessary to accomplish the exempted appropriation, and including any activities relating to construction of a distribution system solely for any exempted appropriation."*

"(23) ***Utilities.*** *The utility-related actions listed below shall be exempt, except for installation, construction, or alteration on lands covered by water. The exemption includes installation and construction, relocation when required by other governmental bodies, repair, replacement, maintenance, operation or alteration that does not change the action from an exempt class...*
... (b) All storm water, water and sewer facilities, lines, equipment, hookups or appurtenances including, utilizing or related to lines eight inches or less in diameter.

SECTION 9 OPERATIONS AND MAINTENANCE

Operation and maintenance requirements for the water treatment system will consist largely of handling backwash water. Based on RVWC's experience, the filter media has a long lifespan and likely will not need to be replaced for at least 10 years. If any parts need replacement, ATEC™ can typically supply replacements within 24 hours. Ongoing monitoring and maintenance will also confirm that the system's well pumps are functioning properly.

RVWC controls existing ATEC™ treatment systems within in the Artondale/Wollochet Heights Water System and Southwood Water System. These ATEC™ systems function to filter elevated levels of manganese in the well water, are backwashed approximately once every 24 hours of operation, and have backwash water disposed of at the site. The backwash cycle duration is approximately 5 minutes per filter at a flow rate of 154 gpm. Based on successful operation of these existing, similar facilities, the RVWC is familiar with the operational and maintenance requirements of the treatment system.

RVWC staff visits each well site daily. At sites currently equipped with ATEC™ filters, the staff typically spends approximately 30 minutes per day at the site. This is similar to the amount of time spent at other, non-filtered well sites.

Refer to Chapter 6 of the approved Southwood Water System Plan for a comprehensive Operation and Maintenance Program for the Southwood Water System. Refer to Appendix D of this report for ATEC™'s Standard Start Up Plan.

MONITORING IMPORTANCE AND INTENT

The importance of monitoring for the proper functioning of water quality facilities cannot be over-emphasized. The fundamental goals of monitoring activities are to ensure the optimization of chemical feeds and backwash durations for ATEC Systems Associates (ATEC™) facilities.

RESPONSIBLE PARTIES

This Start Up and Monitoring Plan is for the private on-site ATEC™ facilities. These facilities are to be maintained and monitored by the Rainier View Water Company (RVWC). RVWC currently manages several ATEC™ treatment systems within the Southwood Water System and Artondale/Wollochet Heights Water System. Therefore, RVWC staff is familiar with the requirements of ATEC™ facilities and appropriately trained to operate and maintain ATEC™ facilities. RVWC staff typically visit well sites within their water systems daily to assure quality control.

FINISHED DRINKING WATER REQUIREMENTS

Water treatment requirements are established by the US EPA in accordance with the Federal Safe Drinking Water Act. The requirements are implemented in Washington by the WSDOH. Per these standards, iron and manganese must be less than one-half their SMCLs of 0.300 mg/L and 0.050 mg/L, respectively. The US EPA does not set a maximum standard for the levels of hydrogen sulfide or ammonia at this time. All specifications will meet RVWC's standard specifications and ATEC™'s recommendations unless specified differently on the construction plans.

MONITORING PROCEDURE

Refer to ATEC™ Typical Procedures for Startup for detailed information on startup procedures. Refer to the ATEC™ Operation and Monitoring Form for a detailed schedule of when these procedures are to be performed.

The monitoring procedure is as follows:

1. Sample raw water
2. Sample the water several times during the backwash cycle
3. Sample treated water
4. Verify that the treated water meets the removal parameters
5. Verify that breakthrough did not occur
6. Record the results and any suggestions for future treatment procedures on Attachment A of this plan

If samples are not within the removal parameters:

1. Check the backwash rate, frequency and duration
2. Verify the chlorine residual
3. Adjust the frequency or duration of the backwash cycle as required to meet the removal requirements
4. Resample the treated water

FACILITIES REQUIRING MONITORING

Attachment A of this Start Up and Monitoring Plan identifies the ATEC™ treatment system requiring monitoring and its associated treatment parameters.

Designed Operating Range for Iron: non-detect - 0.040
Designed Operating Range for Manganese: non-detect - 0.010
Flow rate at injection point: 700 gpm
Backwash Frequency: 24 hours
Backwash Duration: 30 minutes
Designed Backwash Rate: 201 gpm
Designed Hypochlorination Amount: 0.34 gallons/hour of 12.5% sodium hypochlorite at 0.7 mg/L
Designed Chlorine Demand: 0.25 mg/L

Samples										
Date	Time	Sample Number	Chlorine Dose (mg/L)	Backwash Frequency (hr) and Duration (min)	Backwash Rate (gpm)	Total Iron (Fe) (mg/l)	Manganese (mg/l)	Chlorine (mg/L)	Did Breakthrough Occur?	Comments / Suggestions

APPENDIX A

ATEC™ Systems Associates Fir Meadows
Well D Pilot Memo
and Fir Meadows Well D well log

Table 1
Pilot Test Equipment Characteristics

Pilot Filters[1]	
Sidewall Height (inches)	48 to 60
Overall Height (inches)	62 to 74
Diameter (inches)	6
Filter Surface Area (each) ($ft.^2$)	0.1964
Total Filter Surface Area (ft^2)	0.7854
Underdrain	Stainless Steel Wedgewire, 0.01" slots
Media Support	¾" minus crushed granite, 4"
Source Water Connections	¾" Standard Hose
Recommended Minimum/Maximum Working Pressure	20/90 psi
Filter Media[2]	
Depth in Filters (inches)	36 to 48
Volume in Filters (ft^3)	2.36 to 3.15
Approximate Weight in Filters (lbs.)	285
Weight (lbs./ft^3)	120.5
Physical Size (mm)	0.32 –to-0.85
Maximum Removal Capacity	
Iron Removal (mg/L)	10
Manganese Removal (mg/L)	10
Hydrogen Sulfide Removal (mg/L)	5
Non-Adsorptive Removal (microns)	>20

Chemical Dosing Equipment[3]

Stenner Peristaltic Solution Metering Pumps (up to 17.0 gpd @ 100 psi)
LMI Solution Metering Pumps (various capacities)

Analytical Equipment

See following page.

1/ The pilot filter plant consists of four, 6" filter columns connected by common manifolds for influent, effluent and backwash water. Each filter is controlled by a three-way ball valve. The system is set up to closely mimic a full-scale filter system in terms of media depth, application rates in terms of both area (gpm/ft^2 of filter area) and volume (gpm/ft^3 of media), and backwash characteristics to the extent possible. Source water is metered using a totalizing flow meter. Pressure is measured on the influent and effluent manifold to determine headloss. Chemical injection points are located as close to the filter as possible to simulate actual operation. In cases where extended contact time is desired before the source water enters the filters, a pipe section of pre-determined volume is placed between the chemical injection points and the filters to provide accurate contact time measurement. Sidewall height is variable to a maximum of 60" without modification, allowing a maximum media bed depth of 48".

2/ AS-721M and AS-741M Filter Media, 0.85 to 2.36mm and 0.42mm to 0.85mm, respectively, are both granular manganese dioxide media, derived from naturally occurring pyrolusite, and are certified to ANSI/NSQFT Standard 61.

3/ Solution metering pumps are available for the injection of up to three chemicals, if needed. Normally, the only chemical injected is chlorine. And in the case of arsenic, ferric chloride. There are, however, provisions for special circumstances, such as pH adjustment for corrosion control or the treatment of water at fish hatcheries that do not permit chlorine.

Table 2 Analytical Equipment

The following analytical equipment is normally carried on our pilot trailers.

Spectrophotometer, Model DR/2800, Hach Co., Loveland, CO
Digital Titrator, Hach Co., Loveland, CO
pH Meter, Model 266, Orion Co., Boston, MA
Stir Plate, Hach Co., Loveland, CO
0.45-Micron Filter, Nalgene

Glassware—beakers, flasks, columns, sample cells, 10 and 25 ml

Although not normally carried in each trailer, a turbidity meter is available.

Reagents for the following field tests:

Spectrophotometer

Free Chlorine, DPD, Method 8021 and 10059 (300 tests)
Total Chlorine, DPD, Method 8167 or 10060 (300 tests)

Iron, FerroZine Method, Method 8147 (500 tests)
Iron, Total, FerroVer Method, Method 8008 (300 tests)

Manganese, Low Range, PAN Method, Method 8149 (500 tests)

Nitrogen, Ammonia, Salicylate Method, Method 8155 (100 tests)

Sulfide, Methylene Blue Method, Method 8131 (100 tests)

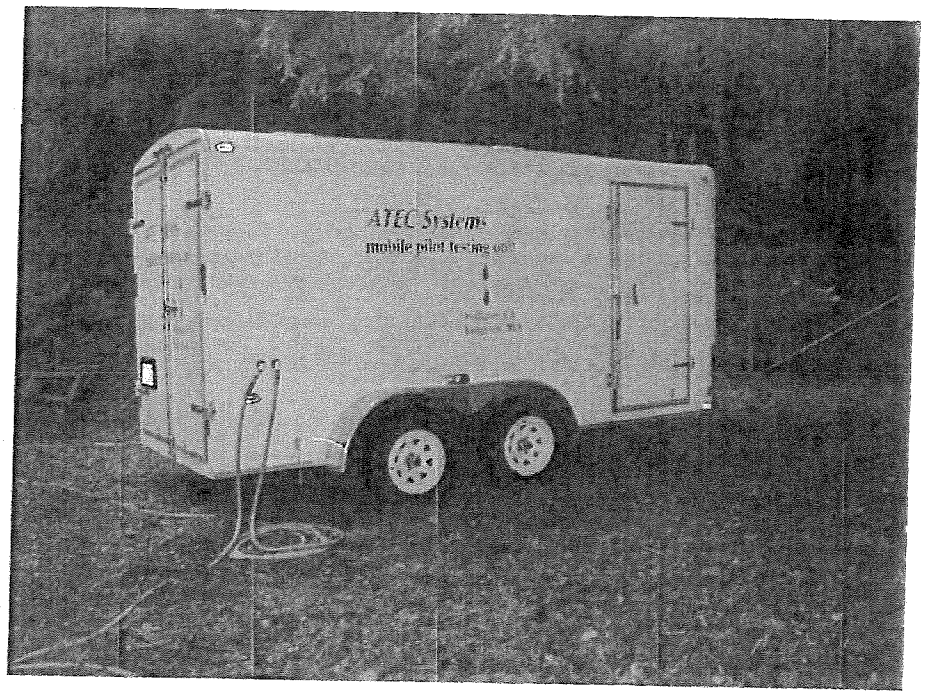
Silica, Molybdate Method, Method 8282 (100 tests)

Digital Titrator

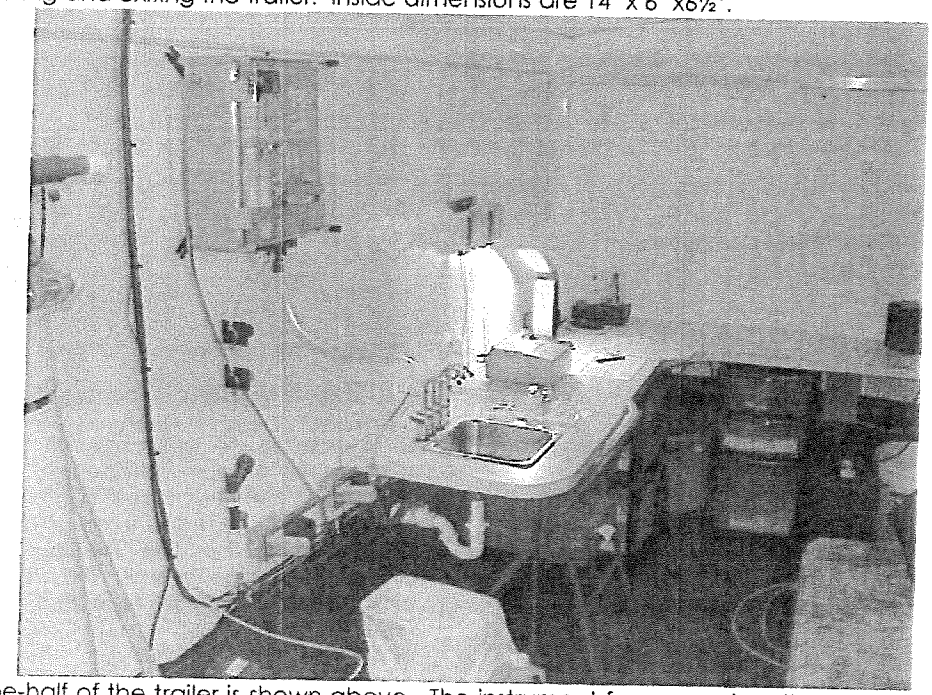
Alkalinity, Phenolphthalein and Total Method, Method 8203 (100 tests)
Hardness, Phenolphthalein and Total Method, Method 8203 (100 tests)
Total Chlorine, Iodometric Method, Method 8209 (100 tests)

Field tests not listed above may be available. Please note that we send all tests for arsenic and other contaminants that require digestion or distillation to a commercial laboratory.

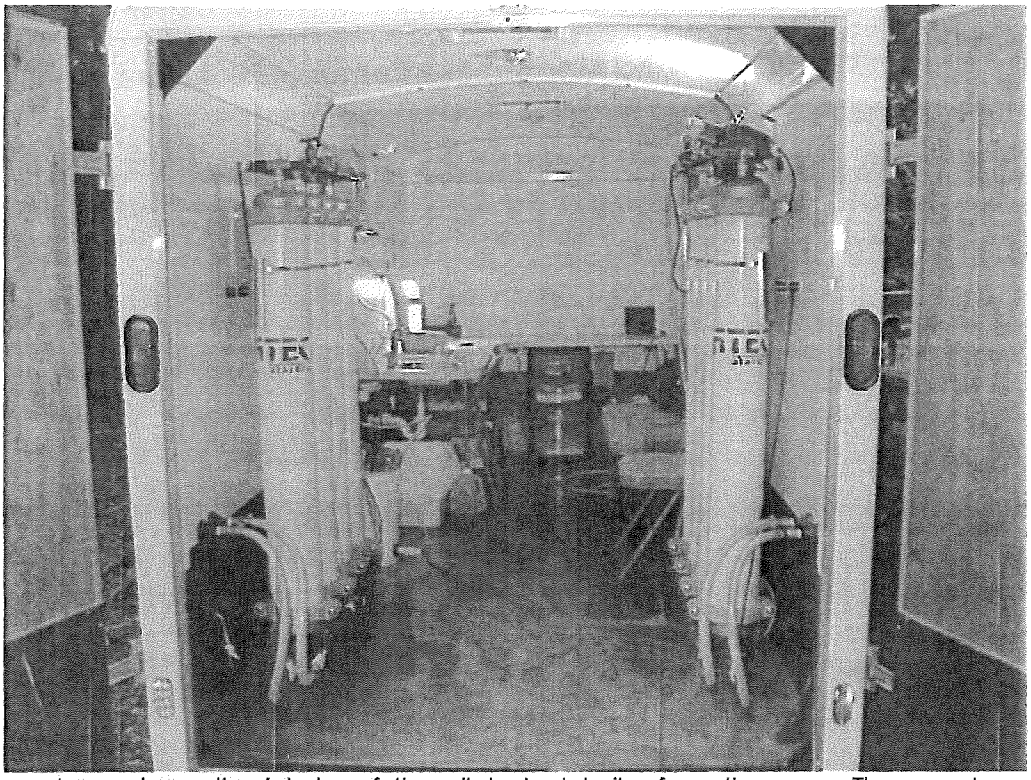
ATEC Iron and Manganese Removal Pilot Plant



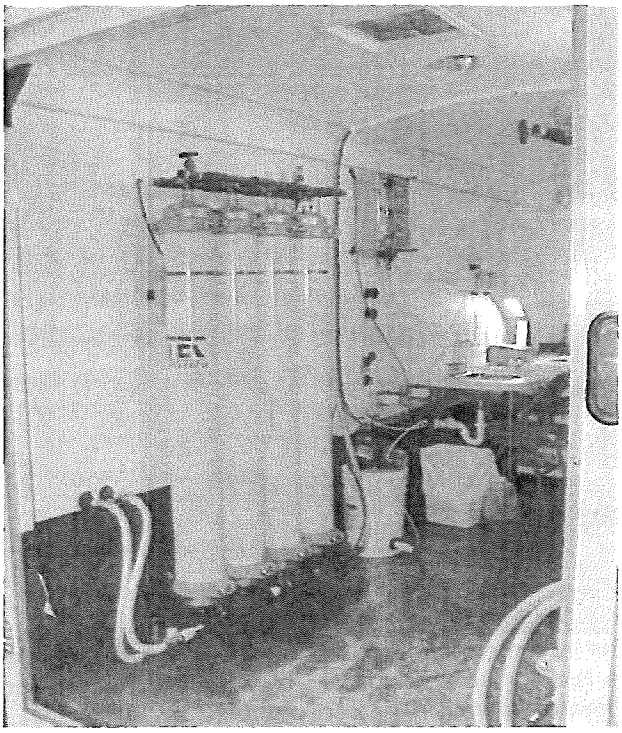
The exterior of ATEC Systems' pilot trailer is shown above. The source and product water connections are shown entering and exiting the trailer. Inside dimensions are 14' x 6' x6½'.

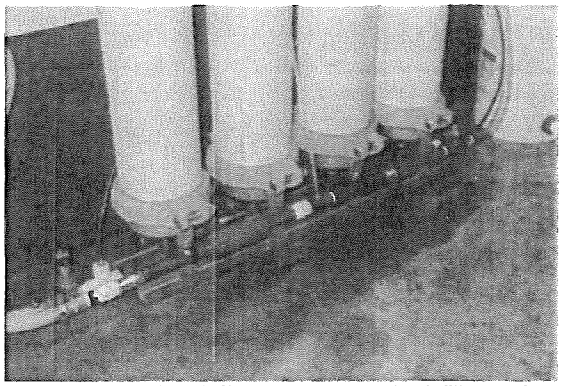


The front one-half of the trailer is shown above. The instrument foreground on the wall is an in-line chlorine analyzer. The smaller boxes on the wall above the light are electronic flow meters used to monitor cumulative as well as instantaneous flow for each treatment train in the pilot plant.



Picture above shows the interior of the pilot plant trailer from the rear. The sample outlets and the analytical equipment are on the desk in the front of the trailer.





The picture on the left shows one set of filters. Source water enters through the hose inlet in the wall, passes through a flow meter, past a chlorine injection point, through an in-line static mixer, into the inlet manifold, down through the filter media. Product water is discharged through the wall. The pail holding the sodium hypochlorite solution can be seen to the right of the filter vessels and the in-line chlorine analyzer is on the wall above the NaOCl container. The sample ports and analytical equipment is forward of the chlorine analyzer. A second container of Ferric Chloride solution and feed pump is provided for pilot testing for arsenic removal.

FILE ORIG & FIRST COPY - DEPT OF ECOLOGY
SECOND COPY - OWNER, THIRD COPY - DRILLER

WATER WELL REPORT
STATE OF WASHINGTON

START CARD NO W176098
UNIQUE WELL ID AHL644
WATER RIGHT PERMIT NO.

(1) OWNER NAME: RAINIER VIEW WATER COMPANY — ADDRESS: P.O. BOX 44427, TACOMA, WA 98444
(2) LOCATION OF WELL: County PIERCE
(2a) STREET ADDRESS OF WELL (or nearest address): 6700 204TH ST E, GRAHAM
SE 1/4 SE 1/4 SEC 6 TWP 18N R 4E

(3) PROPOSED USE: DOMESTIC
(4) TYPE OF WORK: DEEPENING
METHOD: ROTARY

(5) DIMENSIONS: Diameter of well 12 inches
Drilled 221 feet — Depth of completed well 221 ft.

(6) CONSTRUCTION DETAILS
Casing installed: 12 " Diam From +1 ft to 150 ft
Welded ☑ " Diam From ft to ft
Liner ☐ " Diam From ft to ft
Threaded ☐

Perforations: Yes ☐ No ☑
Type of perforator used
Size of perforations in by in.
perforations from ft to in.
perforations from ft to in.
perforations from ft to in.

Screens: Yes ☑ No ☐
Manufacturer's Name: JOHNSON
Type STAINLESS Model No
Diam 12 Slot size 80 from 150' ft 215' ft.
Diam Slot size from ft to ft

Gravel packed: Yes ☐ No ☑ Size of gravel?
Gravel packed from ft to ft

Surface seal: Yes ☑ No ☐ To what depth? 18 ft.
Material used in seal BENTONITE CHIPS
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of Strata ft.
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type H.P.

(8) WATER LEVELS: Surface elev above mean sea level ft.
Static level 44' below top of well Date 04/01/04
Artesian pressure lbs. Per sq. in. Date
Artesian pressure is controlled by

(9) WELL TESTS: Pump test made? By Whom
Yield gal./min with ft. drawdown after hrs.
Yield gal./min with ft. drawdown after hrs.
Yield gal./min with ft. drawdown after hrs.
Recovery data
Time Wtr Lvl Time Wtr Lvl Time Wtr Lvl

Date of test
Bailer test gal./min with ft. drawdown after hrs.
Airtest 650 gal./min stem set at 70 ft for 1 hrs.
Artesian flow gal./min Date
Temperature of water Was chemical analysis made? NO

(10) WELL LOG OR DECOMMISSIONING PROCEDURE DESCRIPTION

MATERIAL	FROM	TO
GREY CLAY	132	135
BROWN SILTY SAND, GRAVELS, COBBLES	135	160
BROWN SAND, GRAVELS	160	215
GRAVELS, CLAY STONE	215	221
CUT SHOE OFF AT 215 FEET		
SET UP JACKS PULL CASING BACK TO EXPOSE SCREENS		

Work Started 03/12/04 Completed: 04/01/04

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Name: RICHARDSON WELL DRILLING COMPANY INC.
Address: P. O. BOX 44427 TACOMA, WA 98444
(Signed) Jason Wilds (Well Driller) Lic No 2688T
Contractor's Registration No RICHAW*3210B DATE 1/13/06

FILE ORIG. & FIRST COPY - DEPT. OF ECOLOGY
SECOND COPY - OWNER, THIRD COPY - DRILLER

WATER WELL REPORT
STATE OF WASHINGTON

START CARD NO. W172639
UNIQUE WELL ID AHL644
WATER RIGHT PERMIT NO

(1) OWNER NAME: RAINIER VIEW WATER COMPANY ADDRESS P.O. BOX 44427, TACOMA, WA 98444
(2) LOCATION OF WELL: County PIERCE
(2a) STREET ADDRESS OF WELL (or nearest address) 6700 204TH ST E, GRAHAM
SE 1/4 SE 1/4 SEC 6 TWP 18N R 4E

(3) PROPOSED USE: DOMESTIC
(4) TYPE OF WORK: NEW WELL
METHOD: ROTARY

(5) DIMENSIONS: Diameter of well 12 inches
Drilled 135 feet Depth of completed well 132 ft

(6) CONSTRUCTION DETAILS
Casing installed: 12 " Diam From +1 ft. to 76' 11" ft.
Welded ☑ " Diam From ft. to ft.
Liner ☐ " Diam From ft. to ft.
Threaded ☐

Perforations: Yes ☐ No ☑
Type of perforator used
Size of perforations in by in.
perforations from ft to in
perforations from ft to in.
perforations from ft to in

Screens Yes ☑ No ☐
Manufacturer's Name JOHNSON
Type STAINLESS Model No
Diam 12 Slot size 80 from 70' 8" ft 131' 4" ft.
Diam Slot size from ft. to ft

Gravel packed Yes ☐ No ☑ Size of gravel?
Gravel packed from ft to ft

Surface seal Yes ☑ No ☐ To what depth? 18 ft
Material used in seal BENTONITE CHIPS
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of Strata ft.
Method of sealing strata off

(7) PUMP Manufacturer's Name
Type H.P.

(8) WATER LEVELS: Surface elev above mean sea level ft.
Static level 31' 5" below top of well Date 05/02/03
Artesian pressure lbs. Per sq. in. Date
Artesian pressure is controlled by

(9) WELL TESTS: Pump test made? By Whom
Yield gal./min with ft. drawdown after hrs.
Yield gal./min with ft. drawdown after hrs.
Yield gal./min with ft. drawdown after hrs.
Recovery data
Time Wtr Lvl Time Wtr Lvl Time Wtr Lvl

Date of test
Bailer test gal./min with ft. drawdown after hrs.
Airtest 200 gal/min stem set at ft. for 16 hrs.
Artesian flow gal/min Date
Temperature of water Was chemical analysis made? NO

(10) WELL LOG OR DECOMMISSIONING PROCEDURE DESCRIPTION

MATERIAL	FROM	TO
BROWN SAND, GRAVEL, COBBLES	0	50
BROWN SAND, GRAVEL, COBBLES, WATER	50	90
TIGHT FORMATION OF SAND GRAVEL	90	94
BROWN SAND, GRAVEL, COBBLES, WATER	94	132
GREY CLAY	132	135

Work Started 04/28/03 Completed 05/02/03

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Name: RICHARDSON WELL DRILLING COMPANY INC.
Address: P. O. BOX 44427 TACOMA, WA 98444

(Signed) (Well Driller) Lic No 2246
Contractor's Registration No. RICHAW*3210B DATE 1/13/06

Table 3
Summary of Pilot Study Test Conditions
Rainier View, Fir Meadows Well
August 9, 2016

Date	Sample Number	Time	Meter Reading (Gallons)	Average Flow (gpm)	Loading Rate (gpm/ft^2)	Loading Rate (gpm/ft^3)	Media Contact Time (Minutes)	Cl_2 Dose (mg/L)	Temp °C
0/9	Start	9:00	-	9.70	12.35	3.53	2.12	1.60	10.3
	1	9:30	287.3	9.58	12.19	3.48	2.15	1.62	10.1
	2	10:00	491.1	6.79	8.65	2.47	3.03	1.71	10.1
	3	10:30	754.2	8.77	11.17	3.19	2.34	1.33	10.2
	4	11:00	1,001.6	8.25	10.50	3.00	2.49	1.41	10.2
	5	11:30	1,246.2	8.15	10.38	2.97	2.52	1.43	10.2
	6	12:00	1,479.6	7.78	9.91	2.83	2.64	1.49	10.3
	7	12:30	1,730.6	8.37	10.65	3.04	2.46	1.39	10.3
	8	13:00	2,018.9	9.61	12.24	3.50	2.14	1.21	10.2
	9	13:30	2,303.3	9.48	12.07	3.45	2.17	1.23	10.3
	10	14:00	2,587.9	9.49	12.08	3.45	2.17	1.23	10.3
	Total or Average		**2,587.90**	8.72	11.11	3.17	2.38	1.42	10.2

NA, indicates Not Applicable for this test
Not Dosed, (ND) indicating the period of the test
Not Tested, (NT) indicating no value entered because there was no sample to test
Media contact time = Empty bed contact time

700 gpm, 110 psi, Pumped at 500 gpm
Used 42" AS-741 media
Sodium Hypochlorite titrated @ 9301.8
BW start and end of the test
Used Rochelle Salts

Table 4
Summary of Pilot Test Results
Rainier View, Fir Meadows Well
August 9, 2016

Sample Number	Source Water pH (Units)	Fe (mg/L)	Mn (mg/L)	H_2S (mg//L)	Ammonia (mg//L)	Silica (mg/L)	PSI	Product Water pH (Units)	Cl_2 (F) (mg/L)	Cl_2 (T) (mg/L)	Fe (mg/L)	Mn (mg/L)	H_2S (mg//L)	Ammonia (mg//L)	Silica (mg/L)	PSI
Start	7.38	-	0.121	0.014			26									
1	7.39	-	0.118		-	11.60	28	7.32	1.45	1.52	-	0.006	-			24
2	7.27	-	0.124	0.002			28	7.32	1.39	1.47	-	0.008		-	11.60	24
3	7.36	NT	0.121		-	12.00	26	7.29	1.22	1.38	-	0.008	-			24
4	7.35	NT	0.121	0.001			25	7.33	1.23	1.31	NT	0.007		-	12.00	20
5	7.36	NT	0.129				25	7.31	1.18	1.24	NT	0.006	-			20
6	7.35	NT	0.132				25	7.30	1.19	1.26	NT	0.008				20
7	7.34	-	0.122				25	7.33	1.22	1.37	NT	0.007				20
8	7.33	NT	0.119				20	7.33	1.12	1.23	-	0.008				20
9	7.33	NT	0.124				20	7.30	1.04	1.19	NT	0.002				15
10	7.28	NT	0.120				20	7.34	1.09	1.20	NT	0.003				15
								7.29	1.07	1.19	NT	0.002				15
Total or Average	7.34	-	0.123	0.006	-	11.80	24	7.31	1.20	1.31	-	0.006	-	-	11.80	20
Average as Percent of MCL		*0.0%*	*245.6%*								*0.00%*	*11.82%*				
Average Removal Rate											*#DIV/0!*	*95.19%*				

Non Detect, indicating the absence of a metal or chemical at or above the method detection limit is shown as "-" and calculated in the total or average as zero.

Figure 1
Pilot Test Results
Chlorine Dosage and Free Residual Concentrations
Rainier View, Fir Meadows Well
August 9, 2016

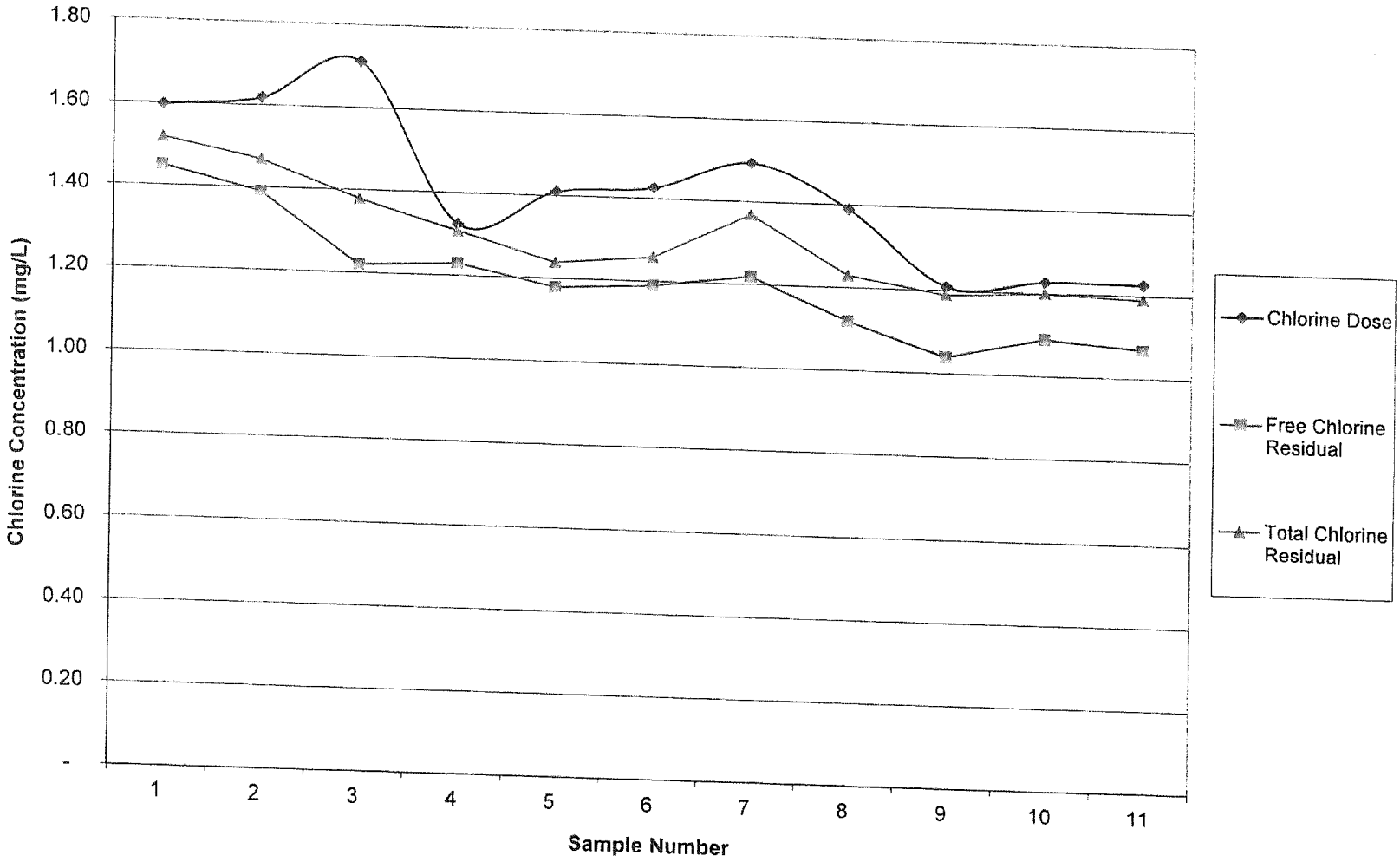


Figure 2
Pilot Test Results
Manganese Removal Using AS-741M Filter Media
Rainier View, Fir Meadows Well
August 9, 2016

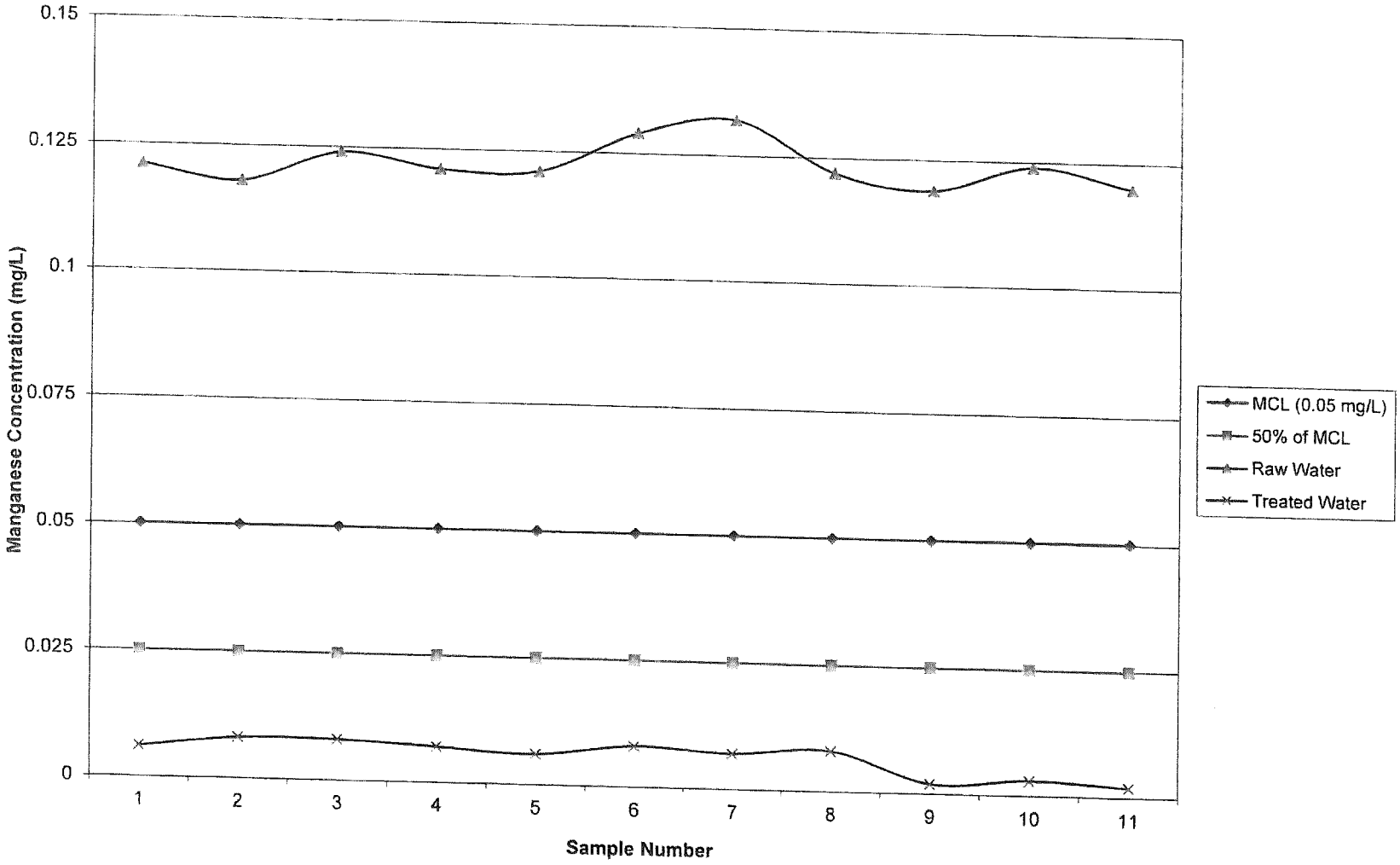
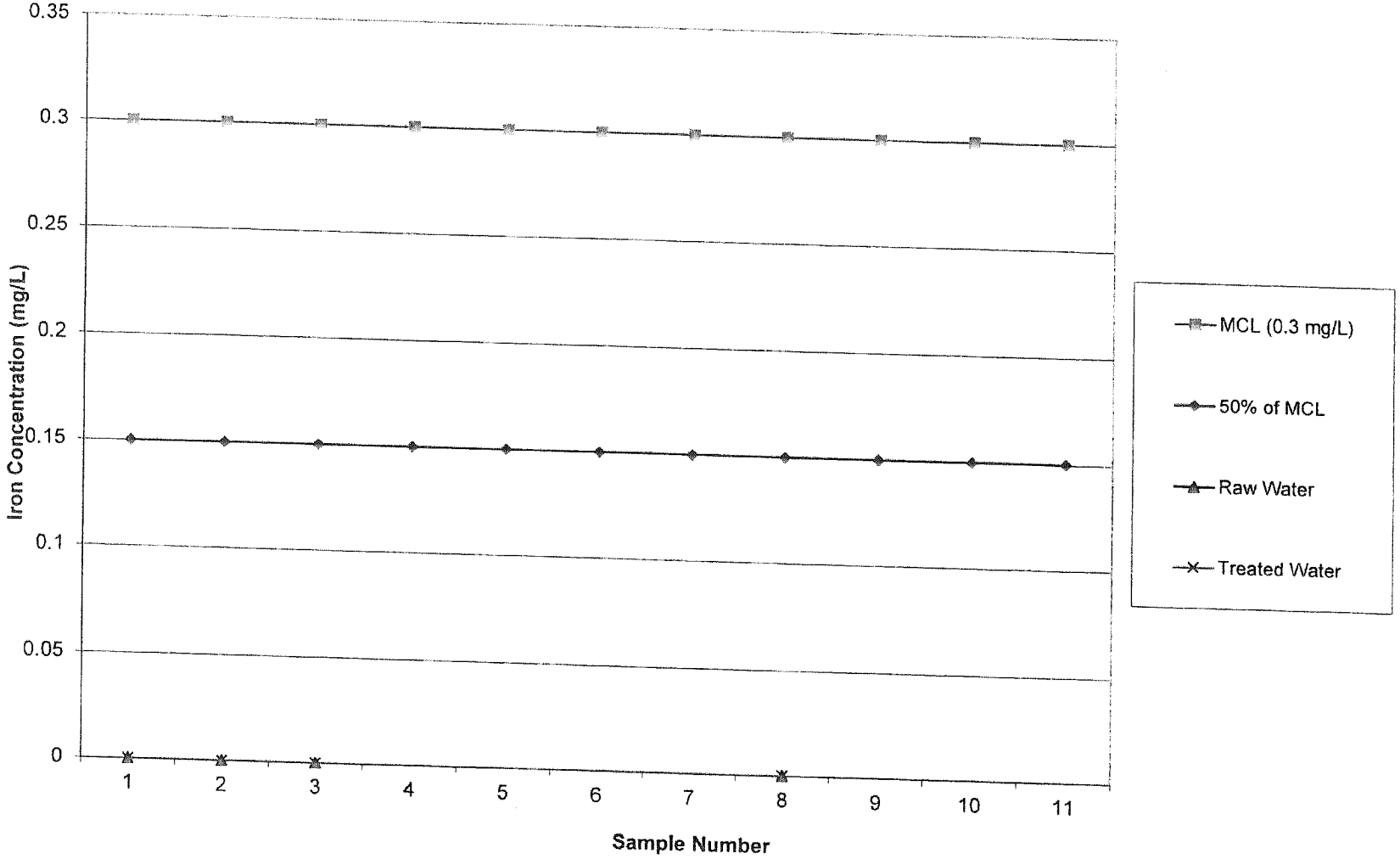


Figure 3
Pilot Test Results
Iron Removal Using ATEC AS-741M Filter Media
Rainier View, Fir Meadows Well
August 9, 2016



APPENDIX B

Engineering Calculations

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409
(253) 473-4494
Fax: (253) 473-0599

FOR: FIR MEADOWS WELL 1		FILE NO. 32646 TASK NO.
PREPARED BY: KAS	DATE: 12/16	PAGE / OF
CHECKED BY:	SCALE:	

BACKWASH RATE

$$16\ \text{GPM/SF} \times \left[\pi \left(\frac{4}{2}\right)^2\right] = 201.06\ \text{GPM}$$

BACKWASH PRODUCTION

5 MIN / FILTER * No. FILTERS * RATE

$\Rightarrow$ 5 * 6 * 201 = 6,030 GAL.

Fir Meadows D

Infiltration Trench Calculations

Job # 32646/11

Date 11/29/2016

Assumptions:

1 Soil Type (Per Well Log Dated 3/23/1982): Gravels

2 Infiltration Rate: 10 in/hr = 0.01389 ft/min

Atec Filter Parameters:

Surface Area/Filter:	12.56	sf	= π*(2.5-ft/2)^2
Number of Filters:	6		
Backwash Time:	20	min	= (5 min/filter)*4 filters
Design Rate:	700	gpm	

Atec Filter Backwash Parameters:

Backwash Rate:	200.96	gpm	= 10.49 cf/min
Backwash Volume:	6,029	gpd	= 209.89 cf/day

Infiltration Trench Parameters:

Surface Area:	367.50	sf
Voids:	0.30	
Trench Pipe Diameter:	6.0	in

Infiltration Trench Stage Storage Table:

Stage (ft)	Storage (cf)
0.0	0.00
0.5	55.13
1.0	110.25
1.5	167.78
2.0	225.31
2.5	280.43
3.0	335.56
3.5	390.68
4.0	445.81

Backwash Cycle Volumes:

Time (min)	Volume In (cf) = (time) x (backwash rate)	Volume Out (cf) = (time) x (inf. rate) x (trench surface area)	Volume Difference (cf)
0	0.00	0.00	0.00
1	26.86	5.10	21.76
2	53.73	10.21	43.52
3	80.59	15.31	65.28
4	107.46	20.42	87.04
5	134.32	25.52	108.80
6	161.19	30.63	130.56
7	188.05	35.73	152.32
8	214.91	40.83	174.08
9	241.78	45.94	195.84
10	268.64	51.04	217.60
11	295.51	56.15	239.36
12	322.37	61.25	261.12
13	349.24	66.35	282.88
14	376.10	71.46	304.64
15	402.96	76.56	326.40
16	429.83	81.67	348.16
17	456.69	86.77	369.92
18	483.56	91.88	391.68
19	510.42	96.98	413.44
20	537.29	102.08	435.20

Max. Daily Volume Out (cf): 7,350.00 =(1.92 cf/min) x (60 min/hr) x (24 hr)

Engineering Checks:

1. Required Volume (cf) < Available Volume (cf)
   435.20 < 445.81 **TRUE**
2. Daily Volume In (cf) < Max. Daily Volume Out (cf)
   209.89 < 7,350.00 **TRUE**

Minimum time between backwash cycles (if more than one cycle per day is needed):

= 20 min + [(Required Volume, cf) / (Volume Out, cf/min)]

= 20 min + [(171.54 cf) / (1.92 cf/min)]

= 105 min

Maximum number of backwash cycles (if more than one cycle per day is needed):

= (1,440 min/day) / (Minimum time between backwash cycles)

= 14 cycles/day

APPENDIX C

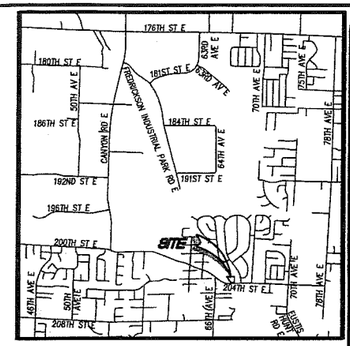
Civil Plans

FIR MEADOWS WELL TREATMENT

COVER SHEET

A PORTION OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 4 EAST, W.M.
PIERCE COUNTY, WASHINGTON

GRAPHIC SCALE
30 0 15 30 60
(IN FEET)
1 inch = 30 ft.



VICINITY MAP
SCALE: 1"=1/2 MILE

NORTH

PARCEL NUMBER
3848003060

SITE ADDRESS
6301 199TH ST. CT. E.
SPANAWAY, WA 98387

PROPERTY DESCRIPTION
A PORTION OF TRACT A WITHIN THE PLAT OF FIR MEADOWS.

NOTE
THE BOUNDARY AND SITE LAYOUT INFORMATION SHOWN HERON WAS TAKEN FROM PUBLIC AND PRIVATE DOCUMENTS AND SHOULD NOT BE RELIED ON FOR ACCURACY.

SHEET INDEX

1. COVER SHEET
2. SITE PLAN
3. TREATMENT SITE PLAN
4. TREATMENT SITE PLAN
5. PROCESS AND INSTRUMENTATION DIAGRAM

LEGEND
- PROPERTY BOUNDARY
- ADJACENT PROPERTY
- EX. WATER
- PROPOSED WATER
- EX. WELL
- WATER METER
- WATER VALVE
- WATER TEE
- CATCH BASIN

Know what's below.
Call before you dig.

REV NO	REVISION DESCRIPTION	DATE	BY

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

TITLE FIR MEADOWS WELL TREATMENT
WELL TREATMENT
COVER SHEET

CLIENT RAINIER VIEW WATER COMPANY
P.O. BOX 44427
TACOMA, WASHINGTON 98448
(253) 537-6634

DATE SEALED 12/09/2016

KIMBERLY ANN SAVAGE
STATE OF WASHINGTON
47018
REGISTERED PROFESSIONAL ENGINEER

PROJECT MANAGER KIM A. SAVAGE P.E.
DESIGN K.S.
DRAWN R.B.
CHECKED K.S.
SEC 6 T 18 N R 4 E
FILE NO 32646/11
DATE 12-06-16
SCALE 1" = 30'

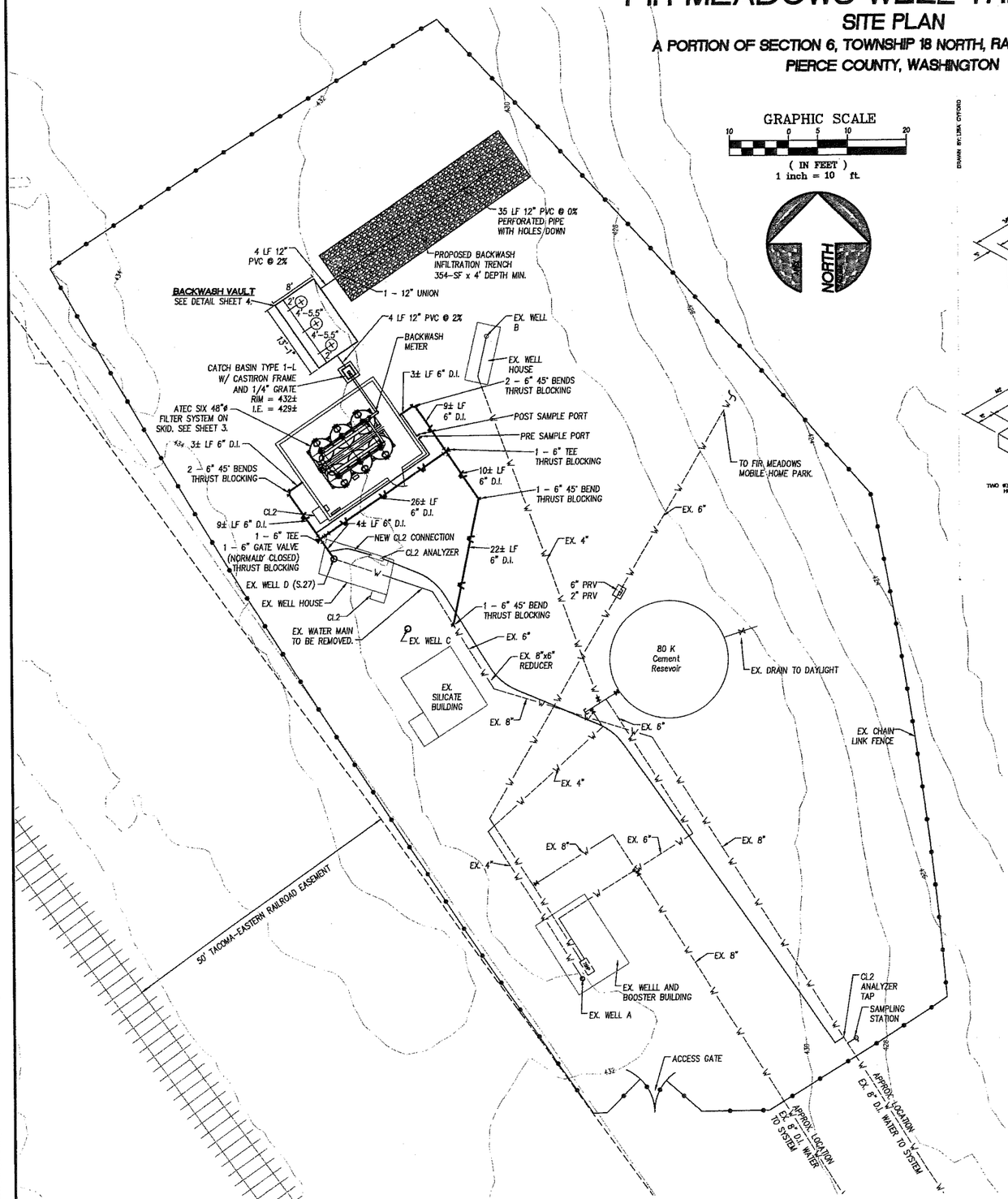
SHEET 1 OF 5
FILE NO 32646

L:\32646\Work\PlotSheet\Fir Meadows ATEC System\32646-11-PLN.dwg

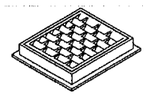
FIR MEADOWS WELL TREATMENT

SITE PLAN

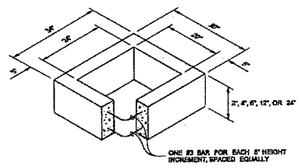
A PORTION OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 4 EAST, W.M.
PIERCE COUNTY, WASHINGTON



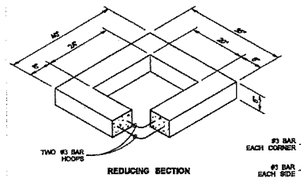
DRAWN BY: LISA CYFORD



FRAME AND VANED GRATE



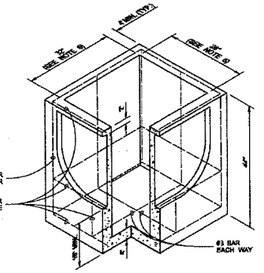
RECTANGULAR ADJUSTMENT SECTION



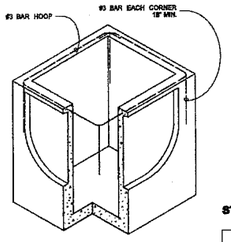
REDUCING SECTION

PIPE ALLOWANCES	
PIPE MATERIAL	MAXIMUM INSIDE DIAMETER
REINFORCED OR PLAIN CONCRETE	18"
ALL METAL PIPE	21"
CPSSD * (STD. SPEC. 9-05.20)	18"
SOLID WALL PVC (STD. SPEC. 9-05.12(1))	21"
PROFILE WALL PVC (STD. SPEC. 9-05.12(2))	21"

* CORRUGATED POLYETHYLENE STORM SEWER PIPE



PRECAST BASE SECTION



ALTERNATIVE PRECAST BASE SECTION

NOTES

1. As acceptable alternatives to the rebar shown in the PRECAST BASE SECTION, fibers (placed according to the Standard Specifications), or wire mesh having a minimum area of 0.12 square inches per foot, shall be used with the minimum required rebar shown in the ALTERNATIVE PRECAST BASE SECTION. Wire mesh shall not be placed in the knockouts.
2. The knockout shall not be greater than 26", in any direction. Knockouts shall have a wall thickness of 2" minimum to 2.5" maximum. Provide a 1.5" minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar in accordance with Standard Specification 9-04.3.
3. The maximum depth from the finished grade to the lowest pipe invert shall be 6'.
4. The frame and grate may be installed with the flange down or integrally cast into the adjustment section with flange up.
5. The Precast Base Section may have a rounded floor, and the walls may be sloped at a rate of 1:24 or steeper.
6. The opening shall be measured at the top of the Precast Base Section.
7. All pickup holes shall be grouted full after the basin has been placed.

CASEY M. KRAMER STATE OF WASHINGTON 19015 REGISTERED PROFESSIONAL ENGINEER

CATCH BASIN TYPE 1L

STANDARD PLAN B-5.40-01

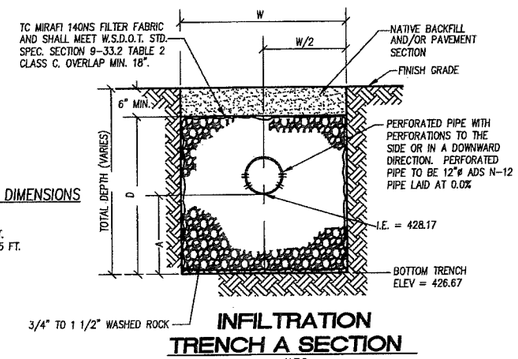
SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

Pasco Bakotich III 06-16-11

STATE DESIGN ENGINEER DATE

Washington State Department of Transportation



TRENCH DIMENSIONS
D = 4 FT.
A = 2 FT.
W = 9.5 FT.
W/2 = 4.75 FT.

INFILTRATION TRENCH A SECTION
N.T.S.

NOTES:

1. CONTRACTOR TO VERIFY THE LOCATION AND DEPTH OF EXISTING LINE AND THE FITTINGS REQUIRED FOR CONNECTION PRIOR TO CONSTRUCTION.
2. CONTRACTOR REQUIRED TO LOCATE EXISTING BURIED UTILITIES AND STRUCTURES IN THE AREA OF CONSTRUCTION PRIOR TO DIGGING
3. PROPOSED WATER SHALL BE CLASS 52 D.I. PIPE UNLESS OTHERWISE NOTED. SIZE PER PLAN.
4. ALL MATERIALS AND CONSTRUCTION PRACTICES SHALL FOLLOW RVWC STANDARD SPECIFICATIONS, UNLESS OTHERWISE NOTED.

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

REV NO	REVISION DESCRIPTION	DATE	BY

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

TITLE FIR MEADOWS WELL TREATMENT
WELL TREATMENT
SITE PLAN

CLIENT RAINIER VIEW WATER COMPANY
P.O. BOX 44427
TACOMA, WASHINGTON 98448
(253) 537-6634

DATE SEALED 12/07/2016

KIMBERLY ANN SAVAGE STATE OF WASHINGTON 37015 REGISTERED PROFESSIONAL ENGINEER

PROJECT MANAGER KIM A SAVAGE P.E.

DESIGN	K.S.
DRAWN	R.B.
CHECKED	K.S.
SEC 6	T 18 N R 4 E
FILE NO	32646/11
DATE	12-06-16
SCALE	1" = 10'

SHEET 2 OF 5

FILE NO 32646

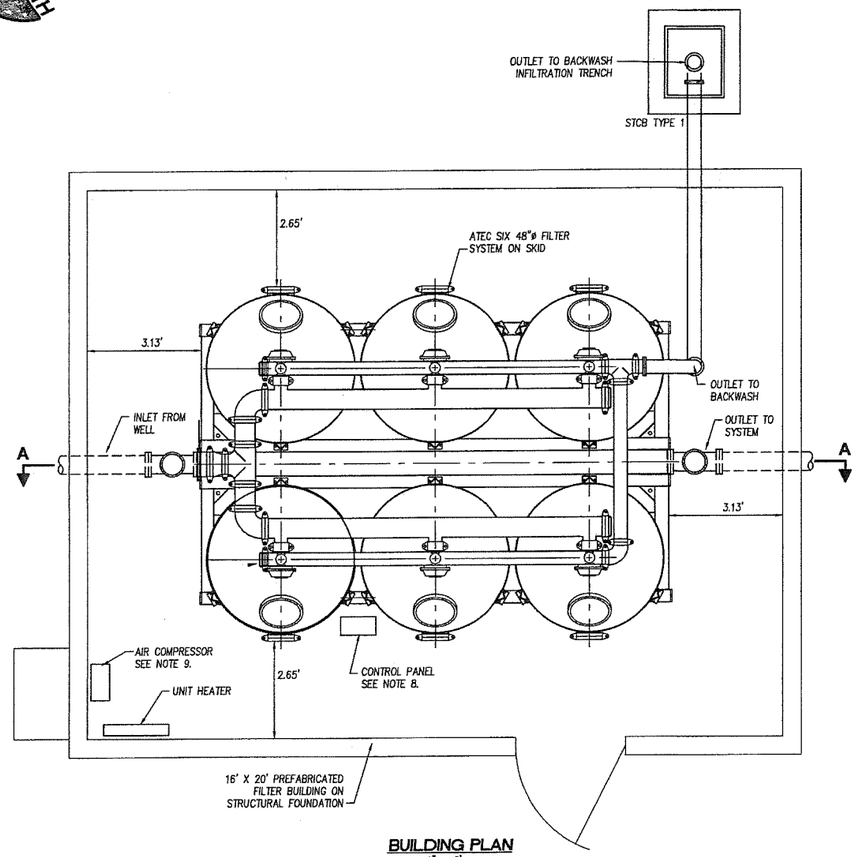
FIR MEADOWS WELL TREATMENT

TREATMENT SITE PLAN

A PORTION OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 4 EAST, W.M.
PIERCE COUNTY, WASHINGTON

NORTH

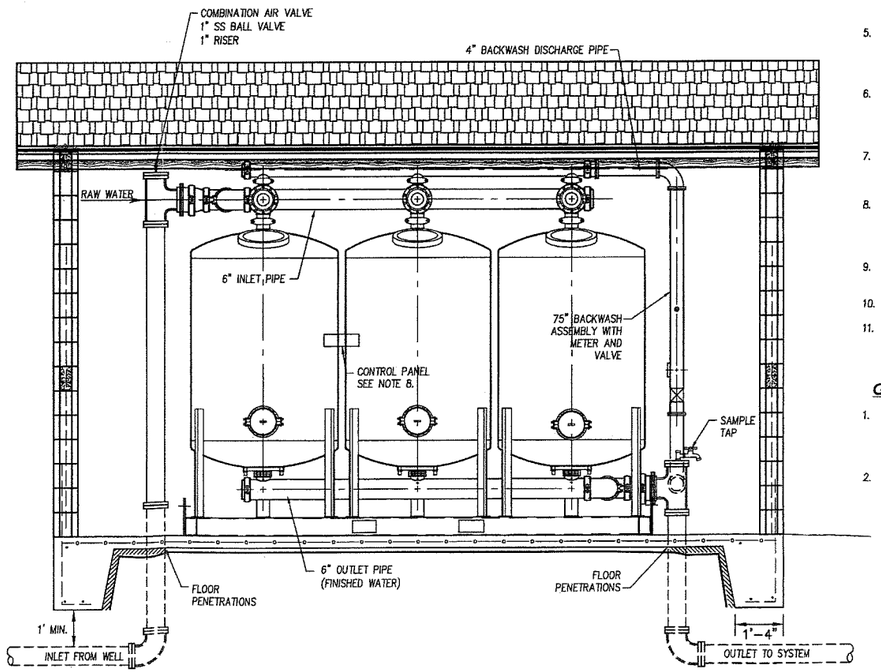
GRAPHIC SCALE
2 0 1 2 4
(IN FEET)
1 inch = 2 ft.



BUILDING PLAN
1" = 2'

ATEC FILTER SYSTEM INFORMATION:

CAPACITY	700 GPM
FE	0.000 MG/L
MN	0.123 MG/L
BACKWASH	350 GPM
MEDIA	PRE-WASHED



NOTES:

1. CONTRACTOR TO FIELD VERIFY ALL PIPE AND STRUCTURE INFORMATION AND NOTE THIS INFORMATION ON CONSTRUCTION DRAWINGS.
2. CONTRACTOR SHALL LOCATE EXISTING BURIED UTILITIES PRIOR TO CONSTRUCTION AND NOTIFY ENGINEER OF ANY CONFLICTS.
3. CONTRACTOR SHALL REMOVE VEGETATION WITHIN PROJECT LIMITS AND DISPOSE OFFSITE.
4. TOP OF FLOOR SLAB SHALL BE SLOPED FROM EACH CORNER OF THE BUILDING AND FROM THE CENTER TO THE NEAREST FLOOR DRAIN, TO FACILITATE DRAINAGE.
5. FLOOR DRAINS SHALL BE WATTS FD 1200-B WITH ROUND HEAVY DUTY STAINLESS STEEL STRAINER, EPOXY COATED CAST IRON BODY WITH ANCHOR FLANGE, WEEP HOLES AND NO HUB OUTLET OR APPROVED EQUAL.
6. ALL INTERIOR PIPES SHALL BE SHOP PRIMED AND THEN PAINTED AFTER INSTALLATION TO MATCH THE REQUIRED COLOR USED TO IDENTIFY THE LIQUID CARRIED BY THE PIPE.
7. CONTRACTOR SHALL USE 1" IRON PIPE TO CONNECT AIR COMPRESSOR TANK OUTLET TO CONTROL PANEL OF ATEC TREATMENT SYSTEM.
8. BOLT AIR COMPRESSOR DIRECTLY TO FLOOR PER MANUFACTURER'S RECOMMENDATIONS. PROVIDE UNION OR OTHER QUICK CONNECT TO ALLOW REPLACEMENT OF AIR COMPRESSOR.
9. ALL NEW PIPES AND ATEC WATER SYSTEM MUST BE DISINFECTED FOLLOWING AWWA STANDARD C651-92.
10. CHLORINATED WATER MUST BE DISPOSED OF PROPERLY.
11. BACTERIOLOGICAL TEST RESULTS MUST BE PROVIDED TO THE OFFICE OF DRINKING WATER.

GENERAL NOTES:

1. CONTRACTOR TO: SUPPLY AND INSTALL ALL TEES, NON-SHRINK GROUT IN ALL PIPES, FILL WITH CLEAN WATER PRIOR TO "START-UP" OF SYSTEM, VERIFY ALL BLOCKOUT SIZES AND LOCATIONS.
2. ALL PIPE CONNECTIONS AND ACCESS POINTS SHALL BE WATER TIGHT.

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Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

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WELL TREATMENT
TREATMENT SITE PLAN

CLIENT
RAINIER VIEW WATER COMPANY
P.O. BOX 44427
TACOMA, WASHINGTON 98448
(253) 537-8634

DATE SEALED 12/09/2016

KIMBERLY ANN SAVAGE
STATE OF WASHINGTON
21615
REGISTERED PROFESSIONAL ENGINEER

PROJECT MANAGER KIM A SAVAGE P.E.
DESIGN K.S.
DRAWN R.B.
CHECKED K.S.
SEC 6 T 18 N R 4 E
FILE NO 32646/11
DATE 12-06-16
SCALE 1" = 2'

SHEET 3 OF 5
FILE NO 32646

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FIR MEADOWS WELL TREATMENT

TREATMENT SITE PLAN

A PORTION OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 4 EAST, W.M.

PIERCE COUNTY, WASHINGTON

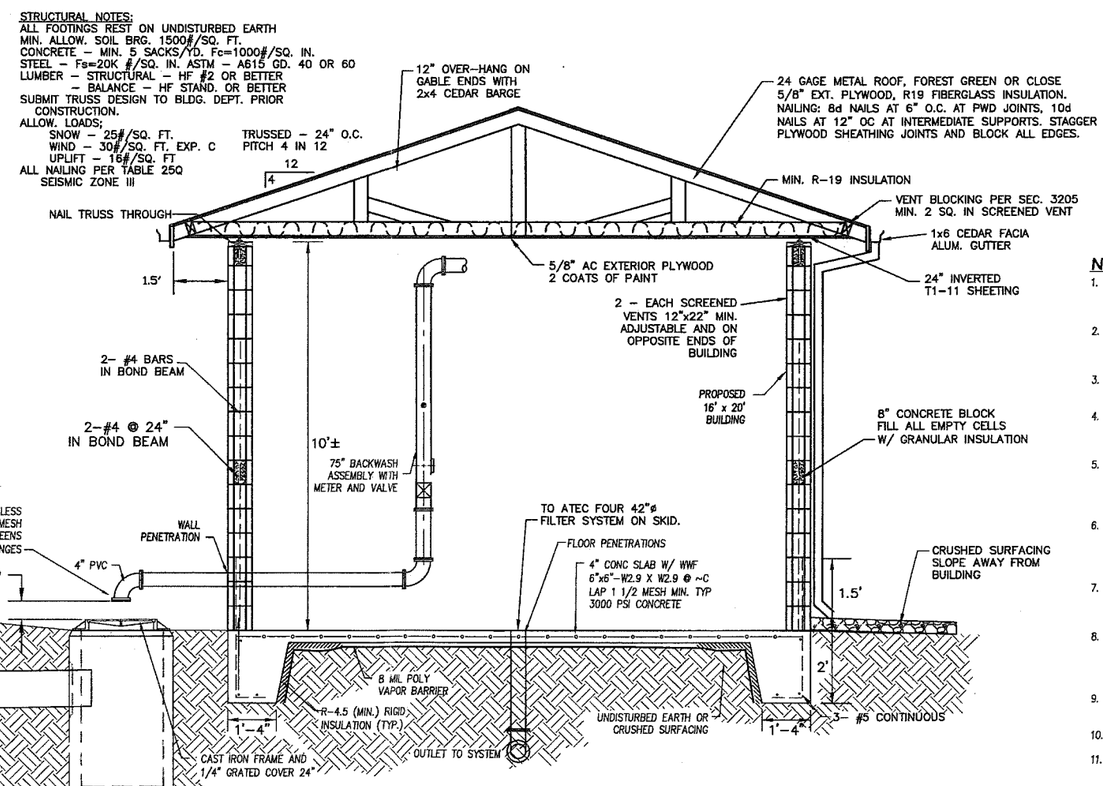
GRAPHIC SCALE

2 0 1 2 4

(IN FEET)
1 inch = 2 ft.

STRUCTURAL NOTES:
ALL FOOTINGS REST ON UNDISTURBED EARTH
MIN. ALLOW. SOIL BRG. 1500#/SQ. FT.
CONCRETE – MIN. 5 SACKS/YD. Fc=1000#/SQ. IN.
STEEL – Fs=20K #/SQ. IN. ASTM – A615 GD. 40 OR 60
LUMBER – STRUCTURAL – HF #2 OR BETTER
– BALANCE – HF STAND. OR BETTER
SUBMIT TRUSS DESIGN TO BLDG. DEPT. PRIOR CONSTRUCTION.
ALLOW. LOADS;
SNOW – 25#/SQ. FT.
WIND – 30#/SQ. FT. EXP. C
UPLIFT – 16#/SQ. FT
ALL NAILING PER TABLE 25Q
SEISMIC ZONE III

TRUSSED – 24" O.C.
PITCH 4 IN 12



BACKWASH VAULT DETAIL
1" = 2'

NOTES:

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(253) 537–6634

DATE SEALED 12/09/2016

KIMBERLY ANN SAVAGE — STATE OF WASHINGTON — 37005 — REGISTERED PROFESSIONAL ENGINEER

PROJECT MANAGER
KIM A SAVAGE P.E.

DESIGN	KS
DRAWN	RB
CHECKED	KS
SEC	6
T	18 N
R	4 E
FILE NO	32646/11
DATE	12-06-16
SCALE	1" = 2'

SHEET 4 OF 5
FILE NO 32646

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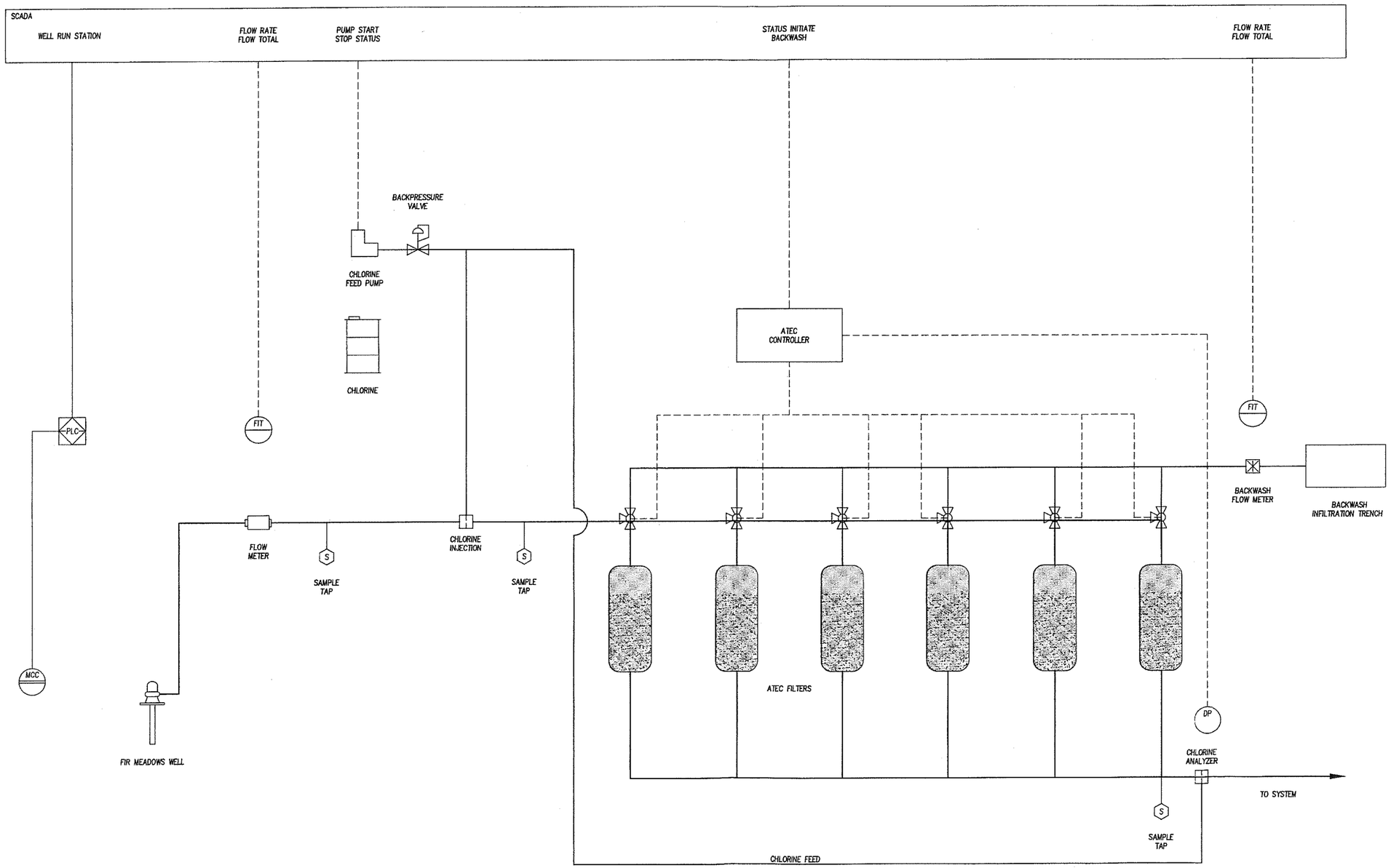
FIR MEADOWS WELL TREATMENT

PROCESS AND INSTRUMENTATION DIAGRAM

A PORTION OF SECTION 6, TOWNSHIP 18 NORTH, RANGE 4 EAST, W.M.
PIERCE COUNTY, WASHINGTON



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(253) 473-4494 FAX: (253) 473-0599

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WELL TREATMENT
PROCESS AND INSTRUMENTATION DIAGRAM

CLIENT RAINIER VIEW WATER COMPANY
P.O. BOX 44427
TACOMA, WASHINGTON 98448
(253) 537-4634

DATE SEALED 12/09/2016

KIMBERLY ANN SAVAGE — STATE OF WASHINGTON — 22983 — REGISTERED PROFESSIONAL ENGINEER

PROJECT MANAGER
KIM A SAVAGE P.E.

DESIGN K.S.
DRAWN R.B.
CHECKED K.S.
SEC 6 T 18 N R 4 E
FILE NO 32646/11
DATE 12-06-16
SCALE AS NOTED

SHEET 5 OF 5
FILE NO 32646