JANUARY 2021
(Revised to Address DDW Comments)

City of Healdsburg

Engineering Report for the Production, Distribution and Use of Recycled Water

Prepared by:
LARRY WALKER ASSOCIATES

For compliance with:
State of California Water Resources Control Board
Water Reclamation Requirements for Recycled Water Use
(Order WQ 2016-0068-DDW) and
California Water Recycling Criteria
(CCR Title 22, Chapter 3, Article 7, Section 60323)

Professional Certification

This document entitled "City of Healdsburg Engineering Report for Production, Distribution and Use of Recycled Water" and dated January 2021, was prepared for the City of Healdsburg under the supervision of Patrick Fuss. Patrick Fuss is a Utilities Engineering Manager for the City of Healdsburg and a registered engineer in California. He is experienced in the fields of pollution investigation, pollution prevention, recycled water treatment, and recycled water utilization.

In preparing this report, the City of Healdsburg has employed the expertise of engineers and scientists to ensure that this document accurately reflects the data and operations information available and that it is complete and appropriately interpreted. The data and information in this report and the professional opinions expressed are presented in accordance with generally accepted professional engineering practices.

Reviewed and Approved by:

Patrick Fuss, P.E., RCE #57272
City of Healdsburg

03 FEBRUARY 2021
Date

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1.0 Introduction

1.1 BACKGROUND

The City of Healdsburg (City) owns and operates the City of Healdsburg Water Reclamation Facility (WRF). The WRF provides tertiary treatment of municipal wastewater collected within the City, and currently operates under Order No. R1-2016-0015 (NPDES Permit No. CA0025135). The current Order includes Waste Discharge Requirements (WDRs) and Water Recycling Requirements (WRRs) for discharge of disinfected tertiary recycled water to the Basalt Pond (part of the Russian River) or delivery to authorized recycled water users.

The City prepared a CCR Title 22 Engineering Report in 2010[1] that described the WRF treatment system, recycled water quality, proposed distribution system, and recycled water use for vineyard irrigation and landscape irrigation of golf courses, parks, schools, and cemeteries. Engineering Report Addendums were submitted from 2014 to 2016 to include the following additional recycled water uses:

- 2014 - Trucked uses for soil compaction, dust control, and other construction purposes.[2]
- 2015 – Aggregate processing.[3]
- 2016 – Fire suppression, street sweeping, and sanitary sewer flushing.[4]

The State Water Resources Control Board Division of Drinking Water (DDW) approved the Engineering Report and Addendums by letters dated November 16, 2010; April 16, 2014; July 15, 2015; and May 20, 2016. The North Coast Regional Water Quality Control Board (Regional Water Board) issued a Notice of Applicability (NOA) for the Statewide Water Reclamation Requirements for Recycled Water Use (Order WQ 2016-0068-DDW; General Order) [5] on July 1, 2016. The NOA authorized the City's Recycled Water Program and prescribed a project-specific Monitoring and Reporting Program (Order No. 2015-0068-DDW-R1001; project-specific MRP).

The City is now planning to expand its recycled water system and utilize recycled water for pasture irrigation, cut hay irrigation (ryegrass, alfalfa), cannabis irrigation, orchard irrigation (apple, plum, prune, peach), and vineyard frost protection. The City is submitting this 2018 CCR Title 22 Engineering Report along with a revised Notice of Intent (NOI) to consolidate all previous Engineering Reports, update the WRF description, and request approval for the additional recycled water uses.

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[1] "City of Healdsburg Wastewater Treatment Plant Title 22 Engineering Report," prepared by HDR, Inc., August 2010.
[2] "Title 22 Addendum Request," submitted to Janice Thomas (California Department of Public Health), March 12, 2014.
[3] "Engineering Report Addendum, Use of Recycled Water for Aggregate Processing by Syar Industries, Inc.," Draft submitted to Zachary Rounds (DDW), May 19, 2015.
[4] "City of Healdsburg Recycled Water Program Technical Report and Amended Notice of Intent", prepared by Larry Walker Associates, May 2016.
[5] "Water Reclamation Requirements for Recycled Water Use", Order WQ 2016-0068-DDW, State Water Resources Control Board, June 2016.

1.2 SCOPE

This Engineering Report replaces the previous Engineering Report and Addendums prepared by the City. The format of the Engineering Report is based on guidelines developed by the State Water Resources Control Board Division of Drinking Water (SWRCB-DDW)[6] and how the City's Recycled Water Program will comply with the Water Reclamation Requirements contained in the General Order.

2.0 Recycled Water

2.1 GENERAL

The City owns and operates the WRF and the recycled water pipelines. The City's Municipal Utility Department manages planning, design, and construction of recycled water treatment, distribution, and storage facilities. The City's Municipal Utility Department operates and maintains the WRF and the recycled water system in accordance with applicable law, City ordinances, and User agreements.

2.2 RULES AND REGULATIONS

The City does not have a recycled water ordinance. Recycled Water Use Agreements are secured with each User that receives recycled water through the City's pipelines (metered recycled water users) and permits are issued to each User that obtains recycled water at the WRF and Kinley Drive Fill Stations. Additional information on the Recycled Water Program rules and regulations are provided below and in **Section 4.0** (Use Areas).

2.2.1 Metered Users – Pipeline Connections for Recycled Water Use

Potential recycled water Users located near City pipelines or interested in constructing an extension of the City pipeline to reach their property must contact the City to determine procedures. City staff will conduct a site visit to determine connection feasibility, inspect ponds (if planned for storage), and identify any site-specific conditions. A Recycled Water Use Agreement between the User and City will be negotiated and approved before construction or meter installation occurs. The agreements are contracts between the User and the City that specify delivery amounts, pressure, and quality as well as allowable uses, periodic reporting, and regulatory compliance (template agreements are provided in **NOI Attachment B).** The format and content of the templates will be utilized when developing agreements with specific recycled water Users and will include regulatory updates and modifications for site specific conditions as needed.

2.2.2 Recycled Water Fill Station Users – Self-Haulers and Commercial Haulers for Landscape Irrigation

All self-haulers must complete a Recycled Water Fill Station Use Application (Landscape/Garden Irrigation) and receive a permit from the City (**NOI Attachment B**). The information that must be provided in the application includes:

[6] "Guidelines for the Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water," State of California Department of Health Services, March 2001.

- Name of User and driver license number (or other form of identification),
- Location(s) where recycled water will be applied and whether the location is a home or business,
- Whether the User will obtain recycled water through pick-up at the fill station (self-hauler) or by delivery from commercial haulers, and
- License plate number(s) of the vehicle(s) that will be used to pick-up recycled water at the fill station, if applicable.

The name listed on the permit will be contacted by the City or the Regional Water Board when questions arise pertaining to recycled water use guidelines and regulatory compliance. The contact person must have knowledge of all WRF Fill Station pick-ups, deliveries, and onsite recycled water applications. The contact person must also be available to response to emergencies or calls for assistance from the City.

Commercial haulers must submit a Recycled Water Fill Station Use Application (Commercial Hauler), receive a permit from the City (**NOI Attachment B**), and follow the commercial hauler program guidelines (**NOI Attachment D**). The procedures for obtaining a permit and hauling recycled water are presented in **Table 1.** The information to be disclosed in the permit application includes:

- Name of trucking company,
- Name of contact person,
- Vehicle registration and insurance coverage,
- General area where recycled water will be distributed, and
- Capacity of truck tanks or hauled containers.

The name listed on the permit application will be contacted by the City or the Regional Water Board when questions arise pertaining to recycled water use guidelines and regulatory compliance. The commercial hauler contact person must have knowledge of all truck activities and will be responsible for submitting a recycled water hauling log and inspection report (for deliveries greater than 300 gallons/visit/site) at the end of each month (**NOI Attachment E)**. The contact person must also be available to respond to emergencies or calls for assistance from the City. When a truck picks up recycled at the fill station, it must have an affixed sign issued by the City and/or a Recycled water Notice Sticker on each container. Each truck driver is required to carry a copy of the Commercial Hauler Permit when picking up and delivering recycled water.

Table 1. Procedures to Obtain and Use Recycled Water from WRF Fill Station - For Irrigation

Procedures to Obtain Recycled Water—WRF Fill Station (Self-Haulers)	Procedures to Obtain Recycled Water—Delivery by Commercial Haulers
1. Users must complete and sign a Recycled Water Fill Station Use Application and Agreement, available online or in person at the WRF. 2. City staff will be on duty during open hours at the WRF. Users will be served on a drop-in basis. 3. Users must bring their own water-tight, sealable containers, minimum volume of 1 gallon and maximum volume of 300 gallons. 4. During the first visit, staff will verify the Recycled Water Fill Station Use Application and Agreement has been completed and signed. The information will be entered into the Recycled Water User Database and the User will be given a brief training presentation about proper use of recycled water. Recycled Water Notice Stickers will be provided for the User's collection and storage containers. 5. Returning Users will be checked in, and staff will verify that containers are appropriately labeled before directing Users to the fill station. 6. Staff will oversee filling of containers and ensure that all containers are sealed and secured for transport prior to leaving the facility. 7. At each visit, staff will record the volume of recycled water collected per resident per visit (using driver's license number, vehicle license number, or other form of identification) and the location where recycled water will be applied. The information will be entered in the Recycled Water User Database.	8. Users must complete and sign a Recycled Water Fill Station Use Application and Agreement, available online or in person at the WRF. 9. Commercial haulers will have access to the fill stations 24 hours/day, 7 days/week. 10. The commercial haulers must provide their own water-tight, sealable containers or utilize a tanker truck. City staff will verify integrity during the first visit to fill station and commercial haulers must conduct periodic inspections/testing of their containers to preserve integrity. 11. The commercial haulers must maintain a log to record the amount of recycled water picked up and the amount and location of each delivery. At the end of each calendar month, the information will be provided to the City and entered into the Recycled Water User Database. 12. Commercial haulers must ensure Recycled Water Notice Stickers are attached to User's onsite storage containers and visible at the time of delivery. 13. When delivering more than 300 gallons per visit to a particular site or User, the commercial hauler will act as a "Distributor." The Distributor's responsibilities include a once per month site inspection to ensure no connections exist between the recycled water and domestic water supply systems, look for evidence of over-application and runoff, and evaluate whether stored recycled water is being used within 2 to 4 days.

2.2.3. Recycled Water Fill Station Users – Truck Haulers for Non-Irrigation Uses

Customers that plan to use recycled water at construction sites, for fire suppression, for sanitary sewer cleaning, or for street sweeping must submit a Recycled Water Fill Station Use Application (Truck Program), receive a permit from the City (**NOI Attachment B**), and follow the trucked program guidelines (**NOI Attachment C**). The information to be disclosed in the permit application includes:

- Name of trucking company,
- Name of contact person,

- Vehicle registration and insurance coverage,
- Application method (tank truck, spray, wash water),
- General area where recycled water will be distributed, and
- Capacity of truck tanks or hauled containers.

The name listed on the permit application will be contacted by the City or the Regional Water Board when questions arise pertaining to recycled water use guidelines (**NOI Attachment C**) and regulatory compliance. The contact person must have knowledge of all truck activities and will be responsible for submitting the recycled water hauling log and inspection form at the end of each month (**NOI Attachment E**). This person must also be available to respond to emergencies or calls for assistance from the City. An air gap is required on each truck and decals or magnetic recycled water signs issued by the City must be affixed to each truck. Each truck driver is required to carry a copy of the Recycled Water Use Permit when picking up and delivering recycled water.

2.3 PRODUCER – DISTRIBUTOR – USER

The City is the recycled water "Producer," recycled water "Distributor," and the recycled water program "Administrator." City departments, residents, agricultural irrigators, commercial businesses, and industries that use recycled water are designated as recycled water "Users." Commercial haulers that deliver more than 300 gallons per visit are also designated as recycled water "Distributors."

2.4 RAW WASTEWATER

The WRF receives influent wastewater generated by commercial, industrial, institutional, and residential customers connected to the City's collection system. Residential customers generate about 50 percent of the wastewater by volume. The primary type of industries located in the City are viticulture-related.

The City is required to monitor influent TSS, BOD_5, and flow. The influent wastewater characteristics based on the monitoring results from January 2015 to December 2017 are shown in **Table 2**.

Table 2. Chemical Quality of the WRF Influent (January 2015 – December 2017).

Parameter	Minimum	Average	Maximum
Influent Flow (Daily Average; MGD)	0.15	1.09	5.97
BOD_5 (mg/L)	72	451	878
TSS (mg/L)	60	296	1035

The City regulates and imposes restrictions, limitations, responsibilities, and pretreatment requirements for discharges to the WRF through City Ordinance 763. Furthermore, the City implements a source control program under the terms of Ordinance 763 and the City's NPDES permit. The industrial user programs include:

- Certified Unified Program Agency (CUPA) inspection program, which covers 150 businesses within the City.

- Restaurant and food-related business inspection program, geared toward identifying and eliminating oil and grease discharges to the collection system.
- Industrial user permitting system with sampling requirements for potential dischargers of high levels of compatible pollutants and pretreatment requirements for one-time groundwater remediation projects.

2.5 TREATMENT PROCESSES

The WRF is designed to treat 1.4 million gallons per day (mgd) (average dry weather flow) and 4.0 mgd (maximum sustained peak wet-weather flow) and produce "disinfected tertiary recycled water[7]." The WRF location is shown in **Figure 1**. The WRF was upgraded in 2008 to include advanced wastewater treatment processes. The City is in the process of reconfiguring and refurbishing the WRF equalization and storage facilities (scheduled to finish in 2019). When complete, the WRF will have two Equalization Basins with a total volume of 9.5 mgal (Equalization Pond #1 = 5 mgal; Equalization Pond #2 = 4.5 mgal). The equalization basins will be used to modulate influent flowrates and, if needed, to hold inadequately treated recycled water prior to retreatment. In addition, the WRF will have two recycled water storage ponds with a total volume of 39.6 mgal (Recycled Storage Pond #1 = 25 mgal; Recycled Water Storage Pond #2 = 14.6 mgal). The Equalization Basins and the Recycled Water Storage Ponds will be lined (HDPE, 60 mil liner) to prevent infiltration to groundwater.

The WRF site plan is shown in **Figure 2**. Wastewater treatment is accomplished by influent screening and grit removal; biological removal of biochemical oxygen demand (BOD) and nitrogen in aerobic, anoxic, and pre-anoxic basins; membrane bioreactor (MBR) filtration; and ultraviolet (UV) light disinfection. The combination of membrane filtration and UV disinfection is designed to inactivate and/or remove 99.999 percent of F-specific bacteriophage, MS2, or polio virus (i.e. 5-log credit). Filtered and UV disinfected effluent flows by gravity to the Recycled Water Storage Ponds or to the Basalt Pond. The WRF flow schematic is provided as **Figure 3**.

[7] CCR Title 22 Section 60301.230

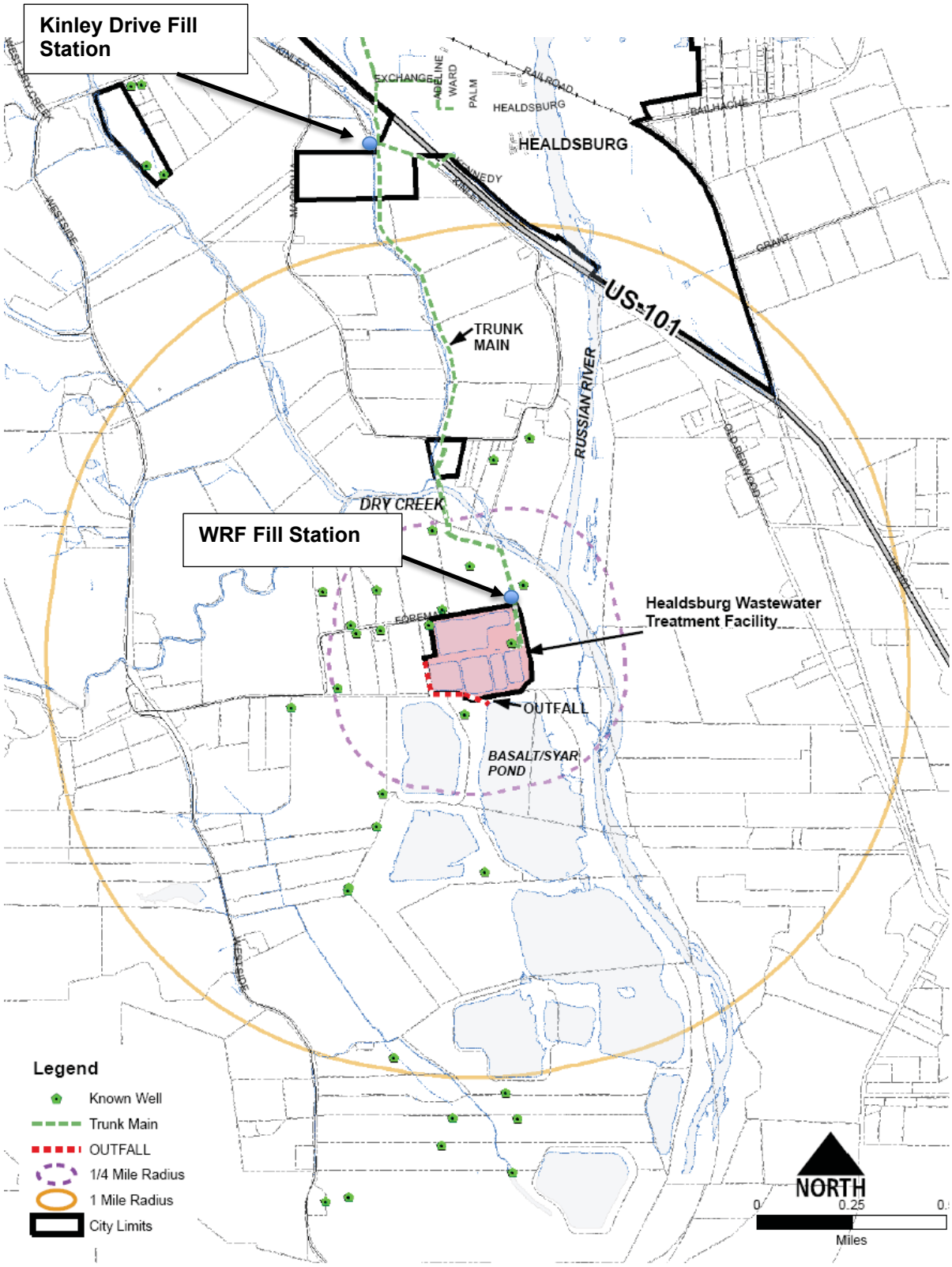

Figure 1. Healdsburg WRF Location

Figure 2. City of Healdsburg WRF Site Plan

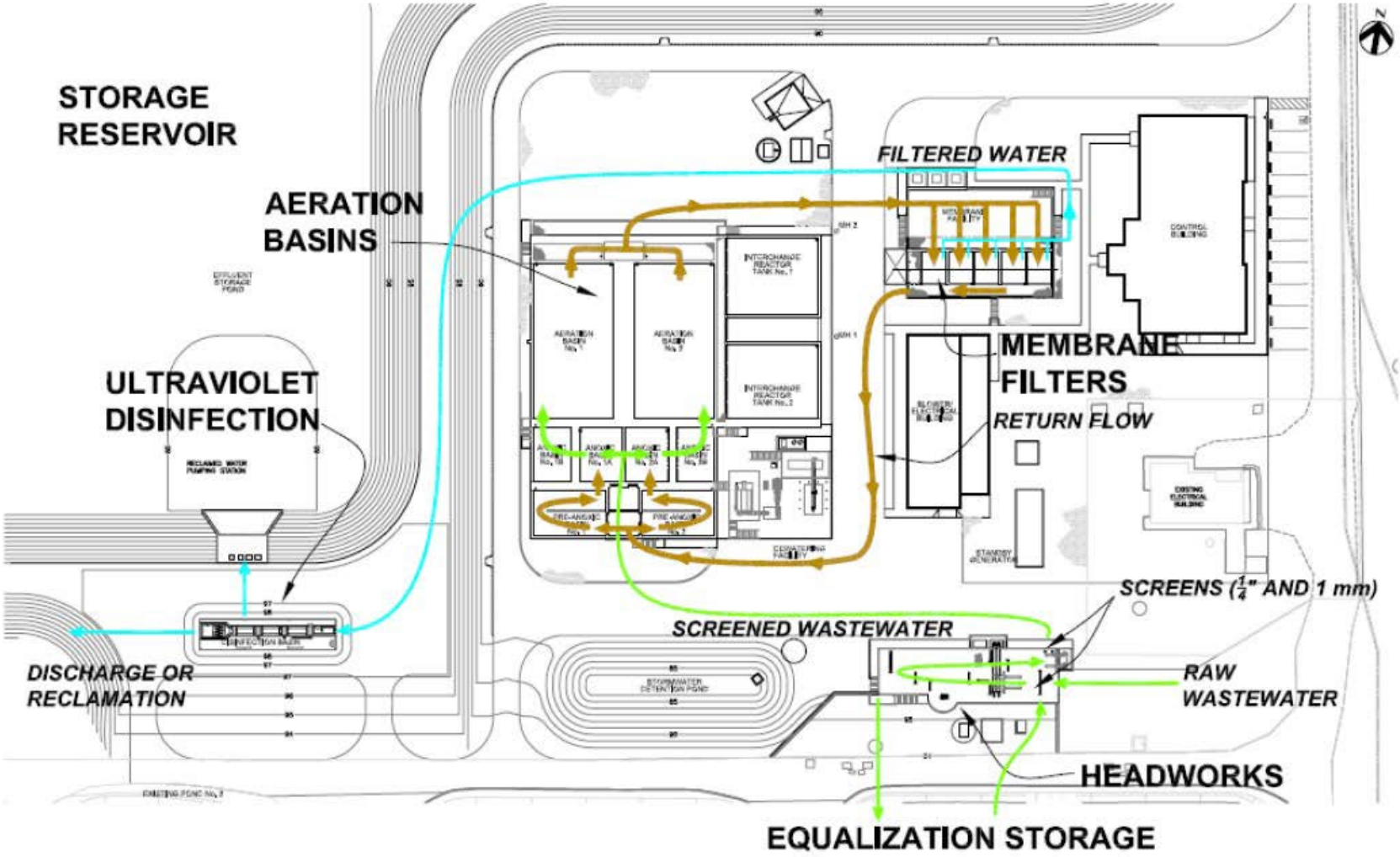

Figure 3. City of Healdsburg WRF Flow Schematic

2.5.1 Biological and Aeration Facilities

The aeration basins provide biological removal of BOD and nitrogen to meet the design effluent goal of ammonia (NH4-N) less than 1.0 mg/L and total nitrogen (TN) less than 10 mg/L based on a maximum monthly flow of 3.2 mgd and maximum monthly loading conditions. Design criteria for the aeration basins are summarized in **Table 3**.

Table 3. Aeration Basin Design Criteria.

Process Unit Design	Design Condition	Parameter	Typical Design Criteria	Recommended Operating Conditions
Pre-Anoxic Tank (Remove DO[1] in RAS)	Maximum Monthly	Hydraulic Retention Time (HRT)	1-2 hrs	1.32 hr
		Percent Anoxic Volume	20%-30%	16%
Anoxic Tank (Denitrification)	Maximum Monthly	Hydraulic Retention Time (HRT)	1-2 hrs	2 hrs
		Percent Anoxic Volume	20%-30%	23%
Aerobic Tank	Maximum Monthly	Solids Retention Time (SRT) (aerobic)	12-15 days at 15 ˚C	12 days at 15 ˚C
		Mixed Liquor Suspended Solids (MLSS)	8,000-10,000 mg/L	9,000 mg/L
	Peak Flow	Oxygen Uptake Rate (OUR)	<80-100 mg/L-hr	77 mg/L-hr

[1] Dissolved oxygen

Two parallel biological treatment trains are provided, as illustrated in **Figure 4** and **Figure 5**. Each train consists of a pre-anoxic basin, two anoxic basins in series, and an aeration basin. Common to both trains at the influent end of the treatment process are the recycle split box and the influent split box.

Return activated sludge (RAS) from the membrane facility and screened mixed liquor from the drum screens are returned to the recycle split box. From the recycle split box, flow is equally divided between the two pre-anoxic trains by overflow weirs. The pre-anoxic basin provides adequate time and space for the RAS dissolved oxygen to be consumed by the biomass before entering the first anoxic basin in the treatment train.

A portion of the RAS and mixed liquor in the recycle split box can be bypassed around both the pre-anoxic basins and anoxic basins and sent directly to the aeration basin. This allows finetuning of the flow and detention time in the pre-anoxic basin. A lower flow to the pre-anoxic basin and anoxic basins will result in less denitrification. Screened and degritted effluent from the headworks is conveyed to the influent split box where it is equally divided between the two treatment trains. Flow splitting is accomplished by overflow weirs. After splitting, influent enters the first anoxic basin into the second anoxic basin and then into the aeration basin. Denitrification occurs under anoxic conditions in the anoxic basins.

The aeration basins are completely mixed and aerated using fine bubble rubber membrane diffusers. The basins provide flow equalization during daily diurnal peak flows to control membrane operating flux. A minimum of 0.20 to 0.25 million gallons are needed to fully equalize diurnal peak flow at the maximum and average day flow rates during the dry season,

respectively. The aeration basins were designed to have a side water depth of 16 feet and a total depth of 20 feet with a 4-foot freeboard.

2.5.2 Membrane Bioreactor (MBR)

The Evoqua (formerly Siemens) Memcor MBR B40N system shown in **Figure 6** and **Figure 7**, provides an absolute barrier to all micro-organisms and suspended solids greater than 0.04 micron in size. The membrane system consists of five tanks of Evoqua B40N membrane modules. Each membrane cell has two spare slots, allowing one complete cell of eight modules to be taken out of service with modules stored in four remaining cells. The MBR system has a capacity of 1.60 mgd average daily flow with peaks up to 4.0 mgd in four tanks having the fifth membrane tank available as standby capacity.

Mixed liquor is continuously pumped into the membrane tanks from the aeration basins, via a common feed manifold supplying the membrane cells. Mixed liquor is fed through a ported manifold that distributes mixed liquor across the width of the tank, and an air-scour system provides the agitation and scouring. Membrane fouling is prevented by creating an airlift at the base of each module. As the two-phase pulse of air and mixed liquor rise through the module, a turbulent cross flow scours the membrane surface.

After the solid and liquid phases are separated by the membrane process, the concentrated mixed liquor is recirculated back to the biological process. The MBR system includes microfiltration units comprised of field-installed membrane modules with integral PVC racks and 316L stainless steel headers. Each cell contains butterfly valves and pneumatic actuators with stainless steel discs, filtrate flow meter with controller, pressure transducers and level switches for level control. The filtrate header is equipped with an air educator valve to prime the filtrate pumps.

Each cell contains 16 membrane modules grouped together in 8 manifolded assemblies termed "racks" with integrated 316 stainless steel and PVC pipe work to produce the desired flow. The rack assemblies are manifolded together via a cell filtrate header and an air header. The racks are connected to the filtrate header by flexible hoses and couplings and fixed in place by a series of stainless steel guides. Flow and turbidity are monitored at each individual tank. An additional turbidity meter in the filtrate gallery monitors the combined filtrate.

A total of eight membrane racks are installed in each of five cells (fitted with Evoqua B40N membrane modules). Each rack is furnished with membrane pulse diffusers, inter-connecting liquid piping, filtrate collection pipe, and lifting lugs. The MBR design criteria are summarized in **Table 4**.

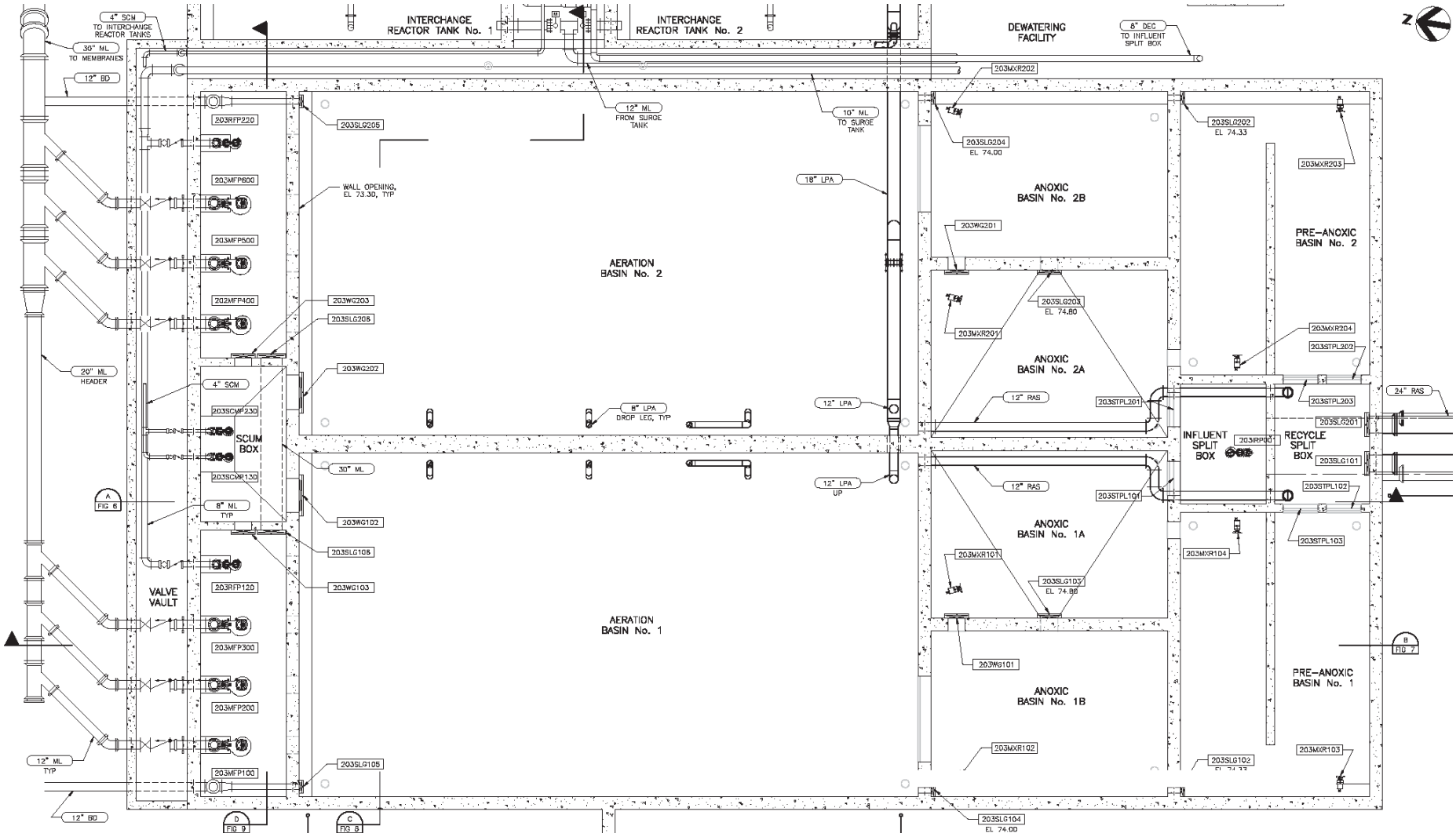

Figure 4. City of Healdsburg WRF Biological Facility Lower Plan.

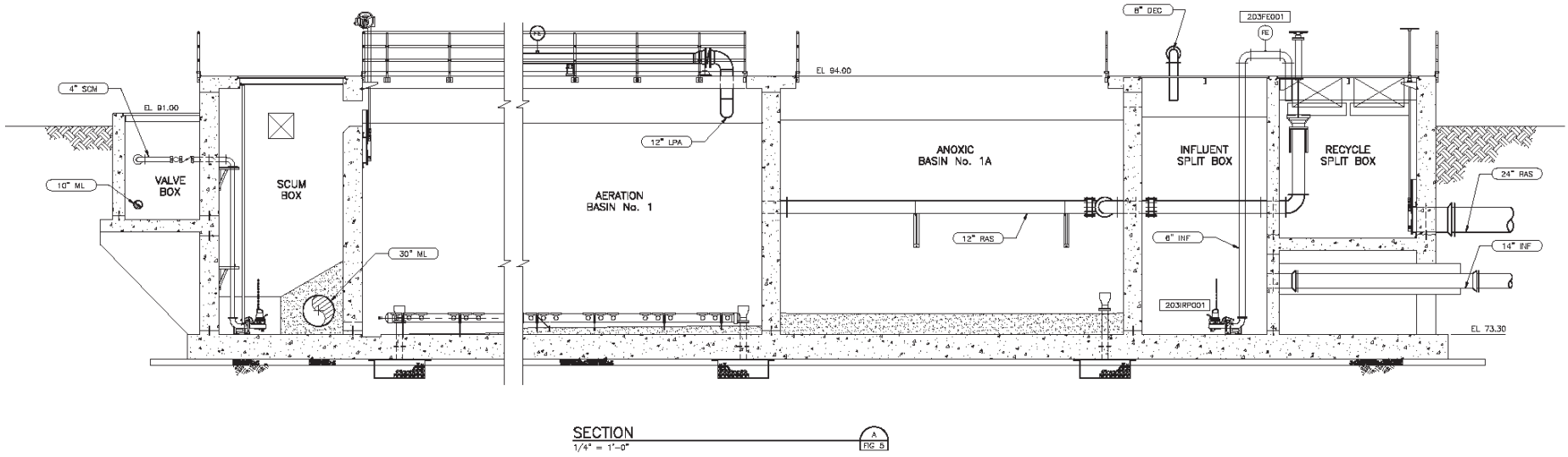

Figure 5. City of Healdsburg WRF Biological Facility Section 1.

Regulatory Certification

The Alternative Treatment Technology Report for Recycled Water[8] includes the Siemens (Memcor Products) B40N 0.04-micron PVDF hollow fiber membrane process as a filtration technology for use in compliance with the California Water Recycling Criteria (Title 22). The California Department of Public Health (CDPH) accepted the equipment as an alternate treatment technology on October 29, 2008.[9]

Siemens provided a certificate verifying that the membrane installed in the City of Healdsburg WRF MBR system is identical to the membrane that was recognized by the CDPH (now DDW) as being acceptable for compliance with treatment requirements of the California Recycled Water Criteria (**Appendix ER-D**).[10]

Table 4. MBR Design Criteria.

Description	Design Criteria
Peak daily capacity	4.0 mgd (in four tanks, fifth tank used as standby)
Membrane area per module	404 ft^2
Number of membrane trains	5
Number of modules per train	128
Instantaneous flux rate at:	
1.6 mgd (average daily flow)	9.6 GFD (B40N)
4.0 mgd (peak daily flow)	24.7 GFD (B40N)
4.0 mgd (peak hour flow)	24.7 GFD (B40N)
Net flux rate at:	
1.6 mgd (average daily flow)	8.9 GFD (B40N)
4.0 mgd (peak daily flow)	22.1 GFD (B40N)
4.0 mgd (peak hour flow)	22.1 GFD (B40N)
Maximum TMP*	50 kPa
TMP* range	5-50 kPa
MBR influent turbidity	Not monitored
MBR effluent turbidity	Less than 0.2 NTU 95% of the time Not to exceed 0.5 NTU at any time

*TMP = Transmembrane Pressure (kPa)

[8] "Alternative Treatment Technology Report for Recycled Water," State Water Resources Control Board, Division of Drinking Water, September 2014.

[9] Letter from the CDPH dated October 29, 2008, signed by Jeffrey L. Stone.

[10] Letter from Siemens dated October 30, 2009, signed by Robert G. Spuhler

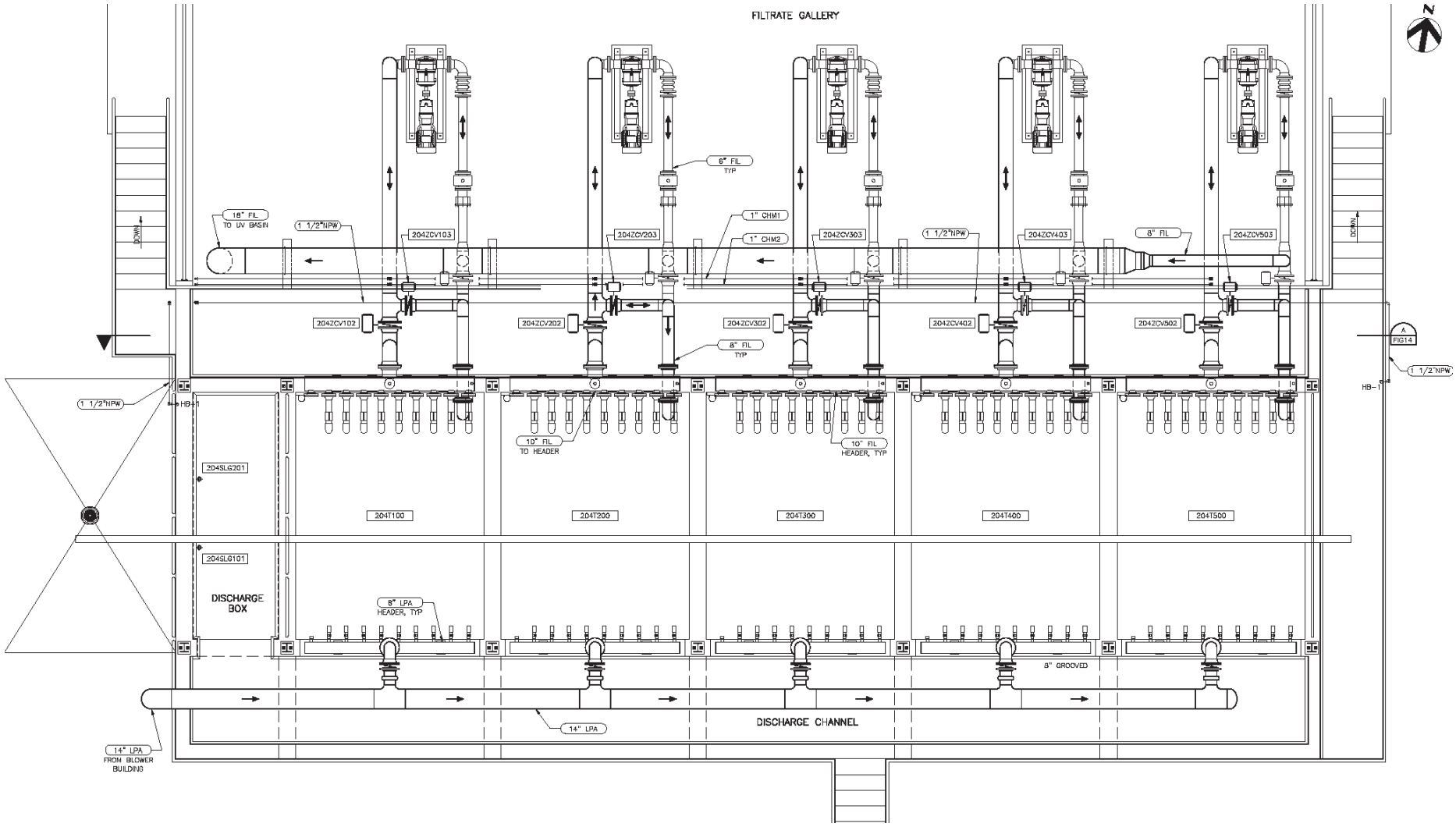

Figure 6. City of Healdsburg WRF Membrane Facility Deck Plan.

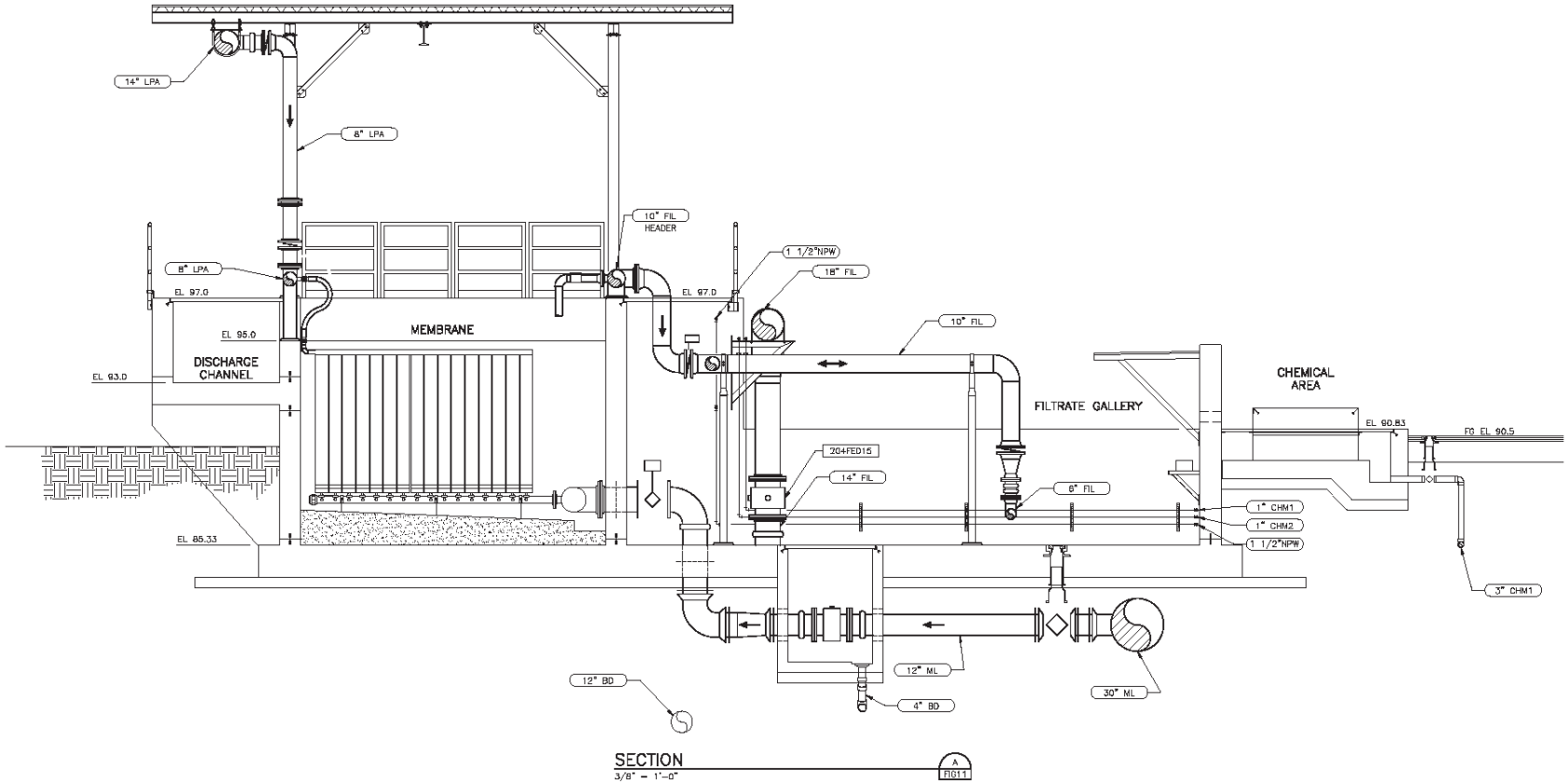

Figure 7. City of Healdsburg WRF Membrane Facility Section 1.

Monitoring and Control

A summary of the MBR monitoring and control equipment is provided in **Table 5**.

Table 5. MBR Monitoring and Control Equipment

Description	Qty	Location	Function
Mixed Liquor Feed Flow Meters	5	Mixed liquor feed line into each tank	Monitors the flow of mixed liquor into each tank.
Membrane Tank Level Transmitter and Level Switches	5	Membrane tank	Monitors membrane cell level. Assures membranes are always submerged in water and mixed liquor will not overflow the RAS channel.
Membrane Pressure Transmitter	5	Suction side of each cell filtrate pump	Measures operating pressure in the membrane modules. Pressure reading used for TMP calculation.
Filtrate Flow Meters	5	Discharge side of each filtrate pump	Measure flow through the membranes.
Filtrate Turbidimeter (individual cell)	5	Filtrate lines after each filtrate pump	Monitor filtrate quality from an individual cell.
Filtrate Turbidimeter (combined effluent flow)		Combined filtrate line, 18-inch filtrate manifold	Monitor combined filtrate quality prior to disinfection.
Filtrate Manifold Flow Meter	1	18-inch filtrate manifold	Each of the 5 filtrate pumps discharges to an 18-inch filtrate manifold. The flow meter in this line measures the total filtrate flow to UV disinfection.
Filtrate Manifold Temperature Transmitter	1	18-inch filtrate manifold	Measures temperature of the combined filtrate prior to UV disinfection. Used to calculate the temperature-corrected flux and permeability, which is used to measure performance of the membrane modules and determine when cleaning is required.
Process Air Instruments	1	Blower Building	Process air discharge header is monitored by a pressure indicator, pressure transmitter, and temperature transmitter.
Process Control System	1	Electrical/Blower Building	Consists of a Master Control Panel (MCP), Local Cell Panels, CIP Control Panel, supervisory control and data acquisition (SCADA). The MCP monitors control system operations such as water levels in the MBR system, membrane performance, relaxation, MC and CIP processes, scour air supply, compressed air supply, and chemical addition.

Relaxation

Evoqua no longer recommends nor uses a backwash as part of its standard operating procedure for membrane bioreactor systems. A relaxation step in lieu of a backwash provides more than adequate time for the membrane to cleanse via the turbulence caused by the tank aeration.

Relaxation occurs at the completion of 12 minutes filtration, or about 4 times every hour. During relaxation, the filtrate pump is ramped down by the variable frequency drive (VFD) and the filtrate valves are closed to prevent any potential siphon effects. A summary of the relaxation steps is provided in **Table 6**. In periods of high flow or high loading, an extended relaxation of 30 minutes can be initiated to maintain the cleaning interval.

Table 6. Relaxation Description

Relaxation Mode	Step	Duration (min)	Flow Through Membranes	Description of Step
Periodic	1. Relaxation	1	0	Filtrate pump VFD frequency is dropped to 0 Hz. Aeration and membrane recirculation pump are still running.
	2. Filtration	12	Filtration flow in forward direction	Filtrate pump is controlled by a VFD to pull filtrate through the membranes, from outside to inside.
Extended	1. Extended Relaxation	30	0	Filtrate pump is stopped. Aeration and membrane recirculation pump are still running.

Integrity Monitoring

A Membrane Integrity Failure Occurrence is defined as a loss of integrity (i.e., partial or complete fiber breaks) that results in any of the following:

- Turbidity exceeding 0.2 NTU for an individual membrane unit more than 5 percent of the time for the last 20 readings (excluding readings taken within 1 hour after membrane unit maintenance clean or clean-in-place (CIP).
- Turbidity exceeds 0.5 NTU for an individual membrane unit on any single reading at any time (excluding readings taken within 1 hour after membrane unit maintenance clean or CIP).

Filtrate turbidity monitoring is the primary measurement of membrane integrity in an Evoqua MBR system. Individual cell turbidimeters are provided in addition to a combined filtrate turbidimeter. The cell filtrate turbidity data is recorded in the plant control system and trend graphs may be viewed as an aid to system integrity maintenance. Based on the requirement to maintain combined effluent below 0.2 NTU, an individual cell turbidity reading consistently (more than 70% of the time for more than 24 hours) above 0.18 NTU will trigger a troubleshooting response. The controller for each tank will automatically stop filtrate flow on a turbidity reading greater than 0.5 NTU, notify the operator immediately and put the tank into recirculation until turbidity falls below this level for 5 seconds or more. If this 0.5 NTU condition persists (in recirculation) for one hour, the tank will shut down and send another notice to the operator. The controller will also notify the operator whenever the turbidity exceeds 0.2 NTU and put tanks into recirculation if turbidity exceeds 0.2 NTU for four hours or more. The controller will return the tank to recirculation filtration only if turbidity falls below 0.2 NTU. If this 0.2 NTU recirculation condition persists for 12 hours, the tank will shut down and send another notice to the operator.

The leak test is used to localize an integrity loss within a cell. The operator will manually initiate the leak test on the cell and look for a stream of air bubbles to identify the source of the leak. The isolation does not require the cell to be drained or shutdown or the rack to be lifted out of the cell.

The principal steps of the integrity test or pressure decay test (PDT) includes stopping filtration, pressurizing the inside of the module fibers and headers with air at 5 psi, isolating the cell from the air supply and monitoring the pressure decay over a period of time (typically 2-3 minutes). Each cell is tested at intervals determined by the operator.

2.5.3 Effluent Disinfection

Membrane permeate is pumped from the membrane facility to the disinfection basin. UV disinfection is provided by the Trojan UV3000Plus system to disinfect a peak flow of 4.0 mgd. The UV disinfection system, shown in **Figure 8** and **Figure 9**, consists of one channel with three UV lamp banks (2 duty and 1 redundant) in series. Filtered and UV disinfected wastewater normally flows by gravity to the Recycled Water Storage Ponds or to the Basalt Pond.

In case of UV system failure, a motorized and remotely operable slide gate will be shut, and the UV channel effluent will overflow and the effluent will be diverted to the Equalization Basins. Any one of the following critical alarms for the UV system will cause the diversion gate to shut:

- Low UV dose
- Maximum flow exceeded
- UV Transmittance signal fault
- Flow signal fault
- Insufficient number of UV banks in service for current flow
- Low water level shutdown
- High combined filtrate effluent turbidity

These gates may also shut remotely by any operator with access to the SCADA system. All flow retained in the Equalization Basins is returned to the headworks for full tertiary treatment prior to discharge. The basin has adequate volume for more than 24 hours of emergency storage at ADWF.

The UV system uses horizontal lamps in modular arrangement with parallel modules grouped to form a bank across the open channel. Low pressure, high intensity amalgam lamps are mounted to modules, which hold 8 vertically spaced lamps enclosed in quartz sleeves. The closed end of the quartz sleeve slides into the formed module leg and the open end of the sleeve fastens to a molded lamp holder assembly that is attached to the other module leg. The module legs feature a streamlined design to minimize head loss along the length of the module.

All wiring between the ballast and lamps is contained within the module leg. No wiring is exposed to water. The modules are supported by a module rack, which is anchored to the channel walls. The rack suspends the modules in the channel so that the lowest lamp is located just above the bottom of the channel and the module enclosure sits above the water. The modules are suspended from the rack by the module enclosure. Below the module enclosure is a “light lock” which is used to prevent UV light from escaping above the lamps.

The module enclosure uses an anodized aluminum extrusion. The top of the enclosure is designed with a lip for lifting a single module by hand from the channel. Variable output electronic ballasts and a module control board are housed in the module enclosure. One ballast is provided for every two lamps. The ballasts are mounted on a ballast tray that slides in and out of the enclosure.

The Module Control Board (MCB) is used to monitor the status of the lamps and ballasts. Information is sent between the MCB and the Communications Control Board (CCB) via the Relay Control Board (RCB). One RCB is provided for each module. Both the RCBs and CCB are located in the Power Distribution Center (PDC). The modules are connected to the PDC using a power cable, which extended from one end of the module enclosure. The power cable for each module is plugged into a labeled receptacle on the PDC.

CCR Title 22 standards and NWRI guidelines (Section 2.2) were used to develop the UV disinfection system design criteria, as summarized in **Table 7**.

Regulatory Certification

The Alternative Treatment Technology Report for Recycled Water[11] includes the Trojan UV3000Plus as a disinfection technology for use in compliance with the Title 22 Criteria.[12] Trojan provided a certificate verifying that the UV equipment installed is identical to the technology used in the validation testing with respect to lamp spacing, type of lamp, quartz sleeve characteristics, and ballasts. The certificate also verifies that the UV equipment was the same as recognized by Department of Health Services (now DDW) as being accepted for compliance with treatment requirements of the California Recycled Water Criteria (**Appendix ER-D**).[13]

[11] Ibid, page 21.

[12] Letter from the Department of Health Services dated June 11, 2003, signed by Richard H. Sakaji.

[13] Letter from Trojan Technologies dated October 30, 2009, signed by Mark Eyre.

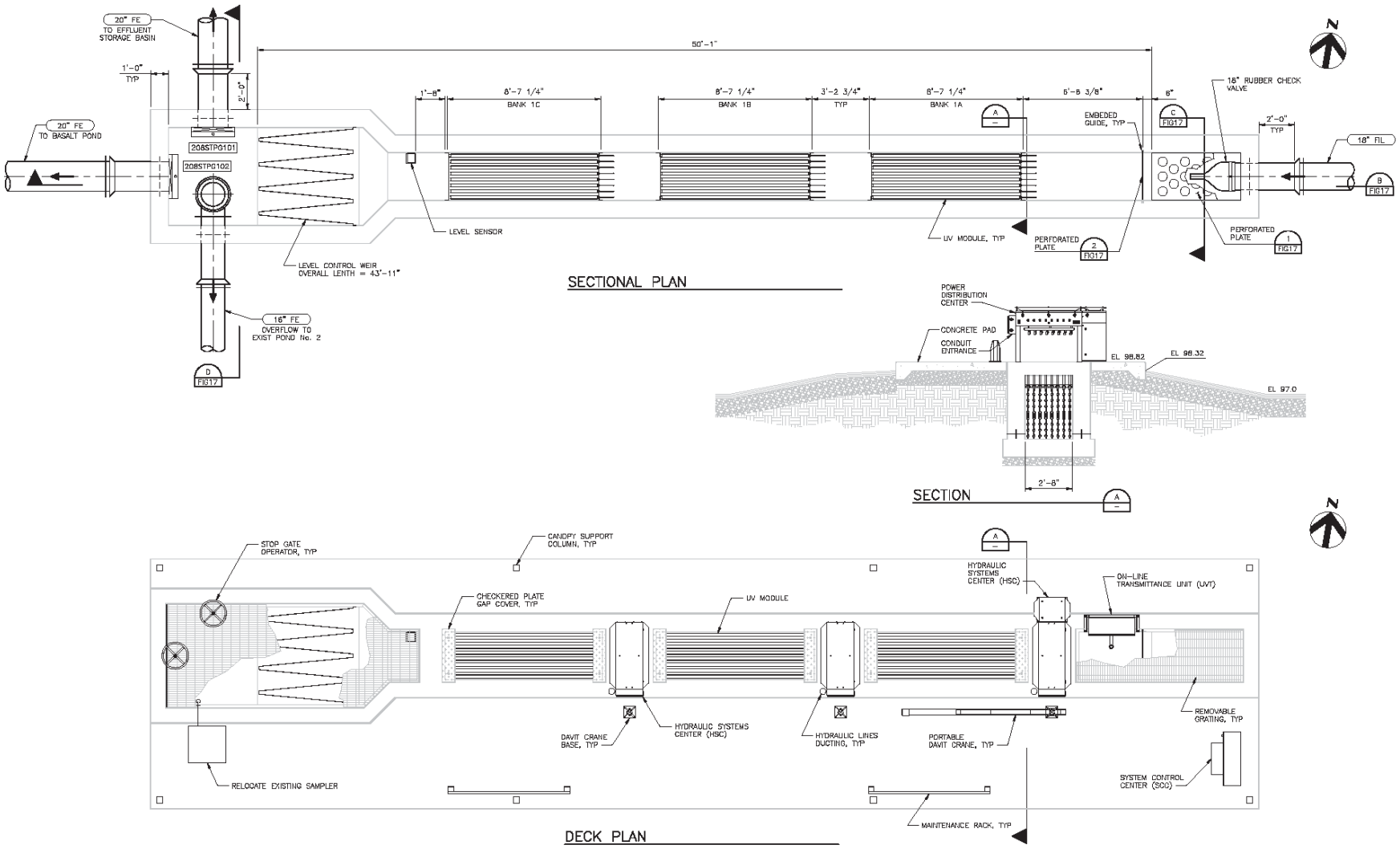

Figure 8. City of Healdsburg WRF Disinfection Basin Plans and Section.

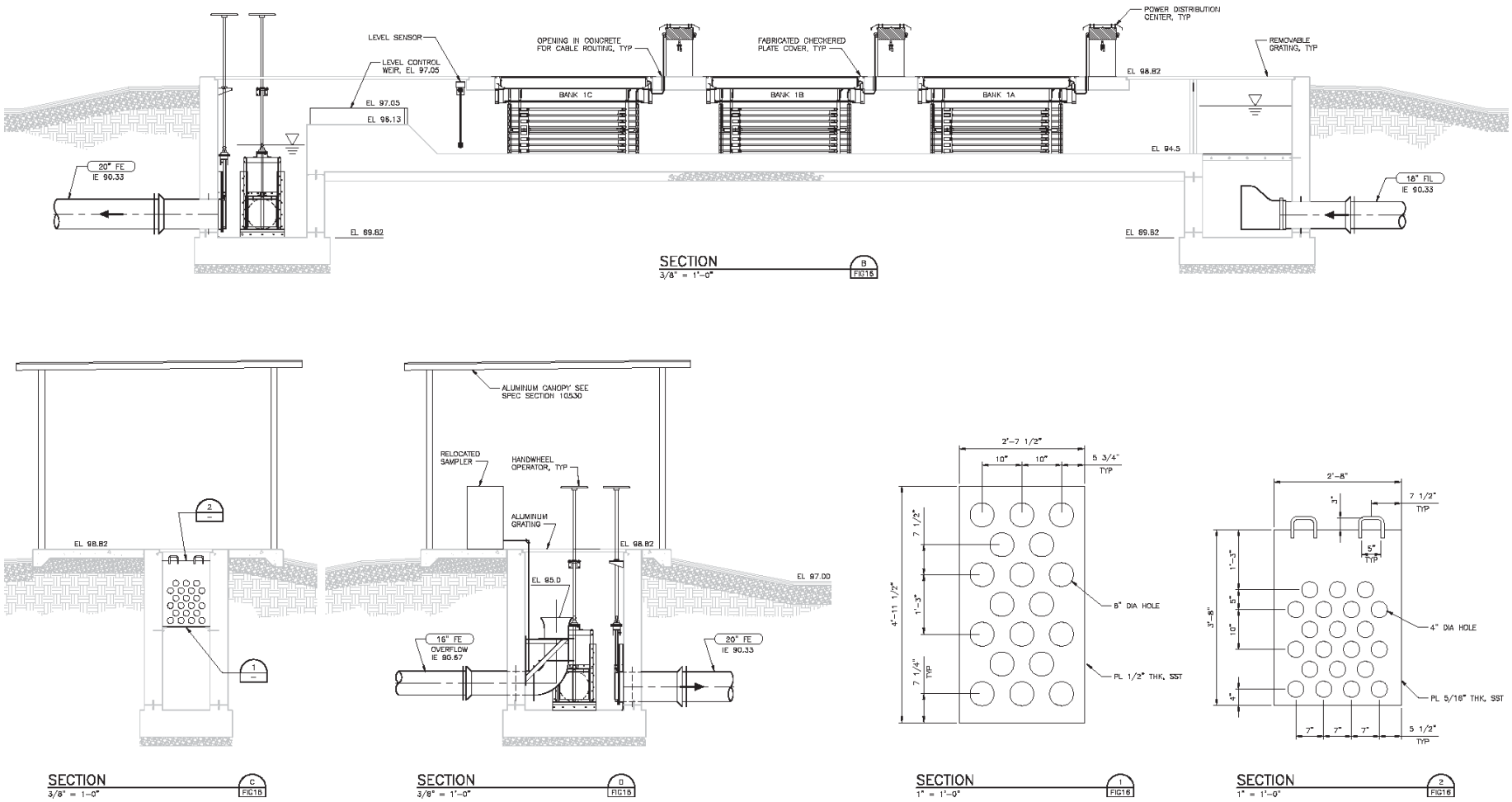

Figure 9. City of Healdsburg WRF Disinfection Basin Sections and Details.

Table 7. UV System Design Criteria

Description	Design Criteria
Peak design flow	4.0 mgd
Average design flow	1.6 mgd
Number of channels	1
Dimensions of the channel	50-ft L x 32-in W x 52-in D
Total number of banks	3 (2 duty, 1 redundant)
Banks in use at peak flow	2
Banks in use at average flow	2
Number of modules per bank	8
Number lamps per module	8
Total number of UV lamps	192
Module material	316 SST Quartz, Teflon
Lamp spacing	4 in
Lamp arc length	58 in
Sleeve material	Quartz
Sleeve dimensions	1,950 mm x 25 mm x 28 mm
Sleeve nominal wall thickness	1.5 mm
Water level relative to UV lamps	0.45 – 2.45 in
Velocity range	0 – 3 ft/sec
MBR effluent suspended solids	Less than 5 mg/L
MBR effluent average particle size	Maximum 10 Microns
Effluent coliform, 7-day median	Less than 2.2 MPN/100 mL
Effluent coliform	Maximum 23 MPN/100 mL
UV dose (at the end of lamp life time and peak flow)	Minimum 80,000 μW-s/cm^2
Design UV transmittance	65% at 254 nm
UV transmittance reduction factor	80%
Redundancy	Minimum 50%
Minimum and maximum effluent temperature	35/95 F
Seismic design code	UBC Zone 4

Monitoring and Control

A summary of the UV disinfection system monitoring and control equipment is provided in **Table 8**. A copy of the UV System O&M Manual is provided in **Appendix ER-A**.

Table 8. UV Disinfection Monitoring and Control Equipment.

Description	Qty	Location	Function
UV Intensity Sensor	3	Positioned between the fifth and sixth lamp from the top	Continuously measures the UV intensity produced in each bank of modules.
On-line UV Transmittance Controller and Sensor	1	UV channel upstream of the first bank of lamps	Sample and measure the percent of UV transmittance (%T) in the effluent. The results are communicated to the SCC from the SC100 Controller and are used to adjust the UV dose in conjunction with flow signals and lamp age.
Photometer	1	Hand held	Measure percent of UV transmittance of unfiltered effluent.
Level Control Weir	1	End of UV channel	Fixed serpentine weir to maintain the appropriate water level over the lamps at all flows to ensure uniform UV exposure and protect the system.
Water Level Sensor	1	Downstream of the UV system	Provides a digital signal and triggers an alarm when the water level is too low. When the water level is too low, the bank will automatically shut down.
System Control Center (SCC)	1	UV deck	Monitors and controls all UV system functions including dosage adjustment based on effluent UV transmittance and flow. The PLC controller continuously monitors and controls the system's functions. The controller communicates with the operator interface, PDC, and HSC. Equipped with alarm reporting system for fast and accurate diagnosing of system process and maintenance alarms.
Power Distribution Center (PDC)	1	UV deck next to each bank	Powers each bank of modules. Distributes power from the main electrical service out to the modules in the bank. Contains the communication and control equipment for the bank of lamps. On Bank 1A, the PDC also contains the Hydraulic System Center (HSC).
Communications Control Board (CCB)	3	Within the PDC	Controls and monitors the lamp, ballast, and bank status. The SCC polls each CCB in sequence to continually update the status of modules and ballasts. The messages are decoded by the controller and then checked for error prior to displaying the data on the status screen.
Hydraulic System Center (HSC)	1	UV deck next to each bank	Operates the automatic cleaning system which provides in- channel cleaning of the lamp sleeves while the lamps remain submersed in the channel.

Equipment Validation

Trojan Technologies developed the UV3000Plus Validation Report (February 2006) and subsequent revisions (Rev. 1.0 May 2007) submitted to CDPH (now DDW) which describes the results from the performance validation testing of a pilot scale Trojan UV3000Plus system with a lamp spacing of 4 inches. Subsequently, CDPH issued a conditional acceptance letter and a series of extended acceptance letters that provide design conditions and operational settings for the UV3000Plus application for California water recycling. The CDPH-approved conditions include the validated flow range being from 6 to 126 gallon per minute (gpm) per lamp; UVT from 53% and up; and end-of-lamp-life factor of 0.98, etc. The validation is applicable to UV3000Plus systems with banks consisting of 24 to 240 lamps. The banks in the City's UV3000Plus system have 64 lamps; in addition, all design and operation parameters are within the CDPH-approved conditional ranges. Therefore, this validation is applicable to the City's UV system and no full bioassay validation was performed for this installation. A Checkpoint Bioassay was conducted on the UV system prior to the distribution of the recycled water.

Bioassay Experiments and UV Operational Dose

During the UV system design, sizing of the UV equipment was strictly based on bioassay testing conducted as part of the pilot testing in the UV3000Plus Validation Report. Bioassay testing was conducted during that study by adding concentrated MS-2 coliphage (MS-2), a nonpathogenic indicator virus, to the tertiary filter effluent stream. Samples were collected from the influent and effluent of the UV reactor to determine the inactivation of MS-2 through the disinfection system under different operating conditions.

The UV dose delivered (D_{dose}) by a UV disinfection system is dependent on flow, water quality (measured in terms of ultraviolet transmittance, UVT), and the intensity of the UV output from the lamps (a function of power input). Therefore, bioassay tests were conducted at a range of flows, UVTs, and power settings. A multiple linear regression was performed on the data generated during the bioassay testing to determine the delivered dose per bank as a function of these three variables. The dependent variable for the regression analysis is the log of the delivered dose (mJ/cm^2). The independent variables are the log of flow (gpm/lamp), log of UVT (%), and log of power (%). The resulting equation presented below does not include lamp aging and sleeve fouling factors.

$$\log D_{Dose} = -4.63 - (0.70 \times \log Flow) + (2.91 \times \log UVT) + (1.09 \times \log Power)$$ [14]

After the incorporation of appropriate sleeve fouling and lamp aging factors, this equation was used to design and operate the UV3000Plus disinfection system.

Field Commissioning Test

A representative from Trojan was at the plant site to witness the installation and startup of the UV disinfection equipment in June 2008. A Field Service Report (to the installer/contractor) stating the UV disinfection system and ancillary equipment were installed correctly and were in satisfactory operating conditions summarized the following:

- Proper installation of the equipment

[14] From UV3000plus Validation Report, Rev. 1.0 May 2007

- Proper inspection, checking, and adjustment of the equipment
- Start-up and field-testing for electrical components
- Proper operation of controls and alarms
- Proper instrument calibration
- Proper operation under full load conditions
- Proper operation under all control modes

Performance Test

A performance test for the installed UV disinfection system was conducted after system installation. The performance test was conducted during the month of October through December 2008 for a minimum 30 days. Trojan developed a performance test protocol for the UV3000Plus to demonstrate the installed equipment achieved the design disinfection limits. As indicated in Trojan's Performance Guarantee, the design disinfection limits can be achieved provided the peak flow is less than 4.0 mgd, suspended solids do not exceed 5 mg/L, and UV transmission is a minimum of 65 percent. A testing matrix was prepared on a weekly basis during the performance testing period. The performance test results are provided in **Appendix ER-B.**

The performance test was conducted over 30 days in which two sets of samples were collected per day. A set of samples consisted of one microbiological, TSS, and UVT sample collected upstream of the UV system, and one microbiological sample collected downstream of the UV systemThe following data were recorded during the test:

- The date and time that the samples were taken.
- The flow through the UV disinfection channel at the time of sampling, as measured from the plant effluent flow meter and displayed on the UV system control screen.
- The hours of operation of each bank, as displayed on the UV system control screen.
- The time of last lamp cleaning.
- The calculated UV intensity measured in mW/cm^2, as displayed on the UV system control screen.
- The total coliform count per 100 mL in the UV disinfection channel influent (membrane permeate) and effluent.
- The percent transmittance at a wavelength of 254 nanometers of the UV disinfection channel influent.
- TSS concentration in the UV disinfection channel influent.

2.5.4 Effluent Storage and Pumping

Final recycled water flows from the UV disinfection system to either the Basalt Pond or the Recycled Water Storage Ponds. The Recycled Storage Ponds provide a total of 39.6 MG of recycled water storage capacity (Recycled Water Storage Pond #1 = 25 mgal; Recycled Water Storage Pond #2 = 14.6 mgal). The Recycled Water Storage Ponds are lined (HDPE, 60 mil

liner) to prevent recycled water leakage and infiltration to groundwater. A pumping station located on the south side of the Recycled Water Storage Ponds includes a set of vertical turbine pumps dedicated to the recycled water system.

2.5.5 Operations and Maintenance Manual

An operations and maintenance manual (O&M Manual) for the WRF is incorporated into the plant process information and control system (SCADA). Access to the document can be obtained by contacting the City of Healdsburg Municipal Utility Department.
The O&M Manual addresses the details of operation and maintenance of every key WRF components and includes the following major chapters:

- Process Overview
- Coarse Screening
- Grit Removal
- Flow Equalization
- Fine Screening
- Biological Treatment
- Membrane Facility
- Effluent Disinfection
- Reclaimed Water Storage
- Cannibal System (no longer in use)
- Biosolids Dewatering
- Plant Utilities
- Plant Reliability Features

2.6 PLANT RELIABILITY FEATURES

CCR Title 22, Sections 60333 through 60355 (Articles 8 and 10) define reliability requirements for recycled water production. The WRF meets these requirements as follows:

- *Flexibility of Design (Article 8, §60333)*: The WRF has been designed to provide for efficient operation and maintenance and to achieve the highest possible degree of treatment under varying circumstances. The capacity and redundancy of critical processes in the WRF to achieve adequate treatment under varying flow and loading conditions are highlighted in **Figure 3**. The WRF includes a number of process diversion features that prevent potential overflows resulting from a malfunction within the treatment process:
    - Automatic wet-weather flow diversion: The headworks incorporates an automatic downward-acting weir to divert flows to the equalization basin. When the Parshall flume flow-measurement device in the headworks detects flows greater than 4.0 mgd (wet-weather capacity, or an operator selected flow), the weir gate, located

just downstream of the coarse screening and grit removal in the headworks structure, automatically skims and diverts excess flows to the equalization basins.

- An equalization pumping station located adjacent to the headworks structure pumps equalized inflows back to the head end of the headworks structure. Two 25-HP submersible pumps controlled by variable frequency drives convey flow back from the Equalization Basins to the headworks for treatment.
- Fail-safe overflow: In addition to the automatic flow diversion to the equalization basins as described below, the headworks structure also includes a separate "failsafe" overflow at its head end that diverts all inflows through a 20-inch line to the equalization basins if any malfunction or blockage causes flows to back up in the headworks structure. This overflow is located at the east end of the structure, just upstream of the coarse screens.
- Motorized slide gate diversion: Following construction and start-up of the WRF, the City added remotely operable motorized gate operators for automatic diversion to the Equalization Basins. The operators were installed on two slide gates just downstream of the "fail-safe" overflow in the headworks. In the event of any malfunction within the WRF, this allows the operators to quickly close these gates remotely from the SCADA system screen and divert all influent to the Equalization Basins via the overflow. In addition, the gates automatically shut under any of the following conditions:
  - If either of the two aeration basins reach a high level while all filtration tanks are offline, subject to alarms and slight delays to allow an operator to respond.
  - If either of the two aeration basins reaches a high level while all filtration tanks are offline, but aeration basin level levels continue to rise.
  - If the two aeration basins reach a high level.
  - If the discharge channel downstream of the membrane filtration tanks reaches a high level.
- Fine Screen overflow protection: The 1-mm fine screens in the headworks are essential to protect the membrane filters. Because of the small opening size, grease or oil can blind the screens and cause the upstream water level to back up. The City operations staff installed a baffle plate above each of the two screens. If any blockage causes the fine screens to blind, water will back up behind the baffle plate (instead of overflowing the screen) and overflow the upstream equalization weir. This prevents the screens from being bypassed and protects the integrity of the membrane filters.
- Effluent diversion: See **Section 2.5.3**.

- *Alarms (Article 8, §60355):* Alarms are integrated into the local process controls as well as the SCADA system for the WRF. The process monitoring alarms are summarized in **Appendix ER-C** and include signals for:
  - Interruption of power supply, activation of standby power generator, and return to utility service as indicated by digital outputs from electrical gear.

- Failure of membrane filtration process as indicated by continuous measurement of trans-membrane pressure and effluent turbidity.
- Failure of UV disinfection process as indicated by lamp ballast monitoring and continuous measurement of water level, UV dose, and effluent turbidity.

- *Power Supply (Article 8, §60337)*: The WRF includes a diesel-engine driven generator with an automatic transfer switch, a sound-attenuating weatherproof enclosure, and a diesel storage tank sized to provide 12 hours of operation at normal load. The automatic transfer switch will sense a power failure and start the standby generator, transferring load to the generator and returning the load to utility service when available. Additionally, there is also a gate that will be shot in case of a failure to ensure non-compliant water will never enter the distribution system.
- *Emergency Storage or Disposal (Article 10, §60341)*: The total Recycled Water Storage Pond capacity of 39.6 mgal can provide emergency storage capacity for approximately 10 days of peak wet weather flow, and approximately 28 days of storage during dry weather flows.
- *Biological Treatment (Article 10, §60345)*: The WRF includes two aeration basins, four denitrification basins, and redundant support equipment (**Figure 3** and **Figure 4**) as well as the process monitoring alarms in **Appendix ER-C**.
- *Filtration (Article 10, §60351)*: The WRF includes five membrane filtration basins (**Figure 3** and **Figure 6**), each equipped with an on-line effluent turbidimeter, as well as the process monitoring alarms in **Appendix ER-C**. The plant is designed to treat the peak daily capacity in four tanks, in case one membrane tank or its supporting components are out of service.
- *Disinfection (Article 10, §60353)*: The WRF includes three banks of eight UV disinfection modules with eight UV lamps per module (**Figure 3**), continuous measurement of UV intensity, and the following low and high-priority alarms and set points:
  - High-Priority Alarms
    - Low-Low UV Transmittance: This alarm indicates that the influent UV transmittance has fallen below a predetermined set point of 65 percent.
    - Low-Low UV Dose: This alarm indicates that the UV dose has fallen below the alarm limit of 80 mWsec/cm^2. The alarm limit is determined by the dose alarm offset percentage value, which is the percentage of the design dose at which the alarm is triggered.
  - Low-Priority Alarms
    - Low UV Transmittance: This alarm indicates that the influent water reuse UV transmittance has fallen below a predetermined set point of 67 percent.
    - Low Operational UV Dose: This alarm indicates that the operational UV dose has fallen below the predetermined set point of 85 mWsec/cm^2.

The WRF is staffed during daytime hours and the SCADA system provides unattended operations at night. An on-call operator receives any night-time alarms via an auto-dialer connected to the SCADA system.

2.7 SUPPLEMENTAL WATER SUPPLY

The City does not provide a supplemental water supply for recycled water users.

2.8 MONITORING AND REPORTING

The City monitors the quality and quantity of recycled water according to requirements specified in the NPDES permit and the site specific MRP.

The City conducts the following monitoring at the WRF when producing recycled water:

- UV transmittance and operational UV dose are monitored continuously at Monitoring Location INT-002 (within the UV disinfection system).
- Filter loading rate is calculated daily at Monitoring Location INT-001A (prior to filtration).
- Filter effluent turbidity is monitored continuously at Monitoring Location INT-001B (after filtration).
- WRF effluent is monitored at least once a day for total coliform bacteria at Monitoring Location REC-001 (after disinfection, prior to discharge to Recycled Storage Ponds).
- WRF effluent is monitored at least once per week for BOD_5, TSS, and pH at Monitoring Location REC-001 (after disinfection, prior to discharge to Effluent Storage Pond).
- WRF effluent flowrate is monitored continuously at Monitoring Location REC-001 (after disinfection, prior to discharge to Recycled Water Storage Ponds).

In addition, the City conducts the following monitoring when distributing recycled water:

- Recycled water flowrate is monitored continuously at Monitoring Location REC-002 (after storage, prior to distribution).
- Recycled water nitrogen concentrations (ammonia, nitrate, nitrite, organic nitrogen) are monitored monthly at Monitoring Location REC-002 (after storage, prior to distribution).
- Recycled water mineral concentrations (sodium, chloride, boron, and Total Dissolved Solids) are monitored monthly at Monitoring Location REC-002 (after storage, prior to distribution).
- Priority Pollutant[15] concentrations are monitored 3 times in 5 years at Monitoring Location EFF-001 (after disinfection, prior to discharge to Recycled Storage Pond or Basalt Pond).

Operational records are maintained at the WRF that include water quality analyses, records of operational problems and equipment breakdowns, diversion to emergency storage or disposal, and corrective or preventative actions. The City documents and maintains a separate file of any

[15] As listed in Appendix A of 40 Code of Federal Regulations (CFR) part 423.

process or equipment failures triggering an alarm, the date/time of the alarm, the cause of failure, and corrective action, and submits a summary of operating records to the Regional Water Board quarterly.

The following recycled water use area monitoring is conducted on a monthly basis and reported to the Regional Water Board in the annual report:

- Total volume of recycled water supplied to each recycled water User.
- Total acreage where recycled water was applied.
- Hydraulic application rate at each use site.
- Total nitrogen application rate at each use site.
- Maximum allowable hydraulic agronomic rate.
- Summary of recycled water use site inspection results (i.e., runoff, nuisance odors/vectors, notification sign placement, cross-connection control, etc.)

The following recycled water program operational information is reported to the Regional Water Board in the annual report:

- Summary of recycled water Users, date/term of recycled water user agreements, and use areas.
- Summary of all monitoring results.
- Summary of operational problems, plant equipment malfunctions, diversions of off-spec recycled water.
- Record of equipment or process failures that initiated alarms, as well as corrective/ preventative actions.
- Compliance summary and discussion of the compliance record.
- Inspection and enforcement activities.
- Summary of cross-connection and backflow prevention activities undertaken.
- Evaluation of WRF performance and forecast of flows for upcoming year.

Delivery of inadequately-treated recycled water to the use areas will never occur as an automatic transfer switch will start the standby generator in case of a power failure and a gate will be shot in case of a failure to ensure non-compliant water will never enter the system. However, in the rare occasion of a failure, the City will call all the affected Users to inform them. The City will also notify the Regional Water Board within one business day of determining that delivery of off-specification recycled water has taken place. In circumstances where the emergency requires termination of delivery to Users, the Regional Water Board will be copied on any correspondence concerning non-compliance between the City and Users.

2.9 CONTINGENCY PLAN

Redundancy of critical processes and other system reliability features are built into the WRF. The following contingency plan (required by Title 22, Section 60323) has been developed to prevent delivery of inadequately treated wastewater to the use areas.

The following conditions would indicate the possibility of producing inadequately treated recycled water. If any of the following conditions occur, the effluent gate valves at the UV structure will close and flow will be diverted to the Equalization Basins.

- Failure of upstream treatment processes or the UV disinfection system
- High turbidity in the filtered effluent (see **Section 2.6**)
- Initiation of any of the following critical alarms:
  - Low UV dose
  - Hydraulic max exceeded
  - UVT signal fault
  - Flow signal fault
  - Not enough healthy banks (for current flow)
  - Low water level shutdown
  - High effluent turbidity (over time)
  - Low UVT

The Equalization Basins (total 9.6 mgal capacity) provide adequate equalization storage for extended wet weather flows (more than 24 hours during peak flows). The City has the ability to divert inadequately treated wastewater from the UV disinfection system to the Equalization Basins and from there to the WRF headworks for retreatment. As described above in **Section 2.6**, this diversion can be initiated remotely by an operator.

In all cases when a shutdown is required, an investigation will be conducted to determine the cause of the incident, and the recycled water will not be redirected for tertiary treatment until the problem has been corrected and the effluent conditions have returned to acceptable levels. In the event of a water quality condition requiring the interruption of recycled water delivery to the use areas, the City will notify DDW, Regional Water Board, and the Sonoma County Environmental Health Division by telephone within one business day.

3.0 Transmission and Distribution System

The City provides recycled water through pipelines and fill station kiosks. Currently, the City has approximately 12,200 linear feet of 12-inch and 17,640 linear feet of 16- inch pipelines and can deliver recycled water to approximately 900 acres. The Recycled Water Program expansion will add 6,000 linear feet to irrigate a minimum additional 270 acres. The current and proposed pipeline system is shown in **Figure 10**.

Recycled water is provided to City vehicles, self-haulers, commercial haulers, and tanker truck operators at the WRF Fill Station (340 Foreman Lane) and the Kinley Drive Fill Station. Self-haulers can only obtain recycled water at the WRF Fill Station. The maximum amount of recycled water that can be picked up by a self-hauler is 300 gallons per visit or 3,000 gallons per day. The area that can be served by hauled recycled water is depicted in **Figure 11** and the fill station locations are shown in **Figure 1**.

Permitted commercial haulers and truck operators are issued a key or an access code to utilize the WRF and the Kinley Drive Fill Stations. There are no restrictions on access to the fill stations by permitted truck owner/operators. The permitted entities may utilize the WRF and Kinley Drive Fill Stations 24 hrs/day. Recycled water deliveries by commercial haulers are limited to 3,000 gallons per day per site. Both fill stations use similar automatic kiosks to deliver recycled water and prevent spillage. The kiosks have locked doors and a keypad system is used to record the user's identity, time, date, and volume of recycled water obtained during fill-up. When the WRF Fill Station is open for self-haulers, a City employee is always present to assist with fill-up operations.

The WRF Fill Station and the Kinley Drive Fill Station consist of hydrants located in paved areas surrounded by an asphalt berm. Drainage is directed to the sanitary sewer system. Users connect via hose to coupling on the fill station. A camlock fitting with a shutoff valve is provided on the hose. High alcohol hand sanitizer is provided on site, so customers may clean their hands after handling recycled water.

The City delivers recycled water to Syar Industries, Inc., for aggregate processing and dust control. Recycled water is delivered from the City's meter (located north of the WRF) through a pipeline owned and operated by Syar Industries to a fill point located at the aggregate processing facility (13666 Healdsburg Avenue, Healdsburg, CA 95448). The locations of the City's meter, the Syar Industries pipeline, and the fill point are shown in **Figure 12**. To deliver recycled water from the WRF to the aggregate processing facility, Syar Industries refurbished an existing 8-inch pipeline that connects with the City's recycled water line. The pipeline is comprised of various segments of steel, PVC, and HDPE pipe and handles a maximum flowrate of 2.16 million gallons per day. The pipeline crosses Dry Creek and the Russian River through buried conduit. At the end of the refurbished recycled water pipeline, the Syar Industries fill point is used to fill water trucks that control dust on facility roads. A pipeline was constructed to connect the recycled water fill point to a storage pond at the aggregate processing area (commonly called the 150 hp pond, based on the pumping system). The pipeline is a buried 8-inch HDPE pipe with a manually operated, lockable valve installed above ground at the pond edge.

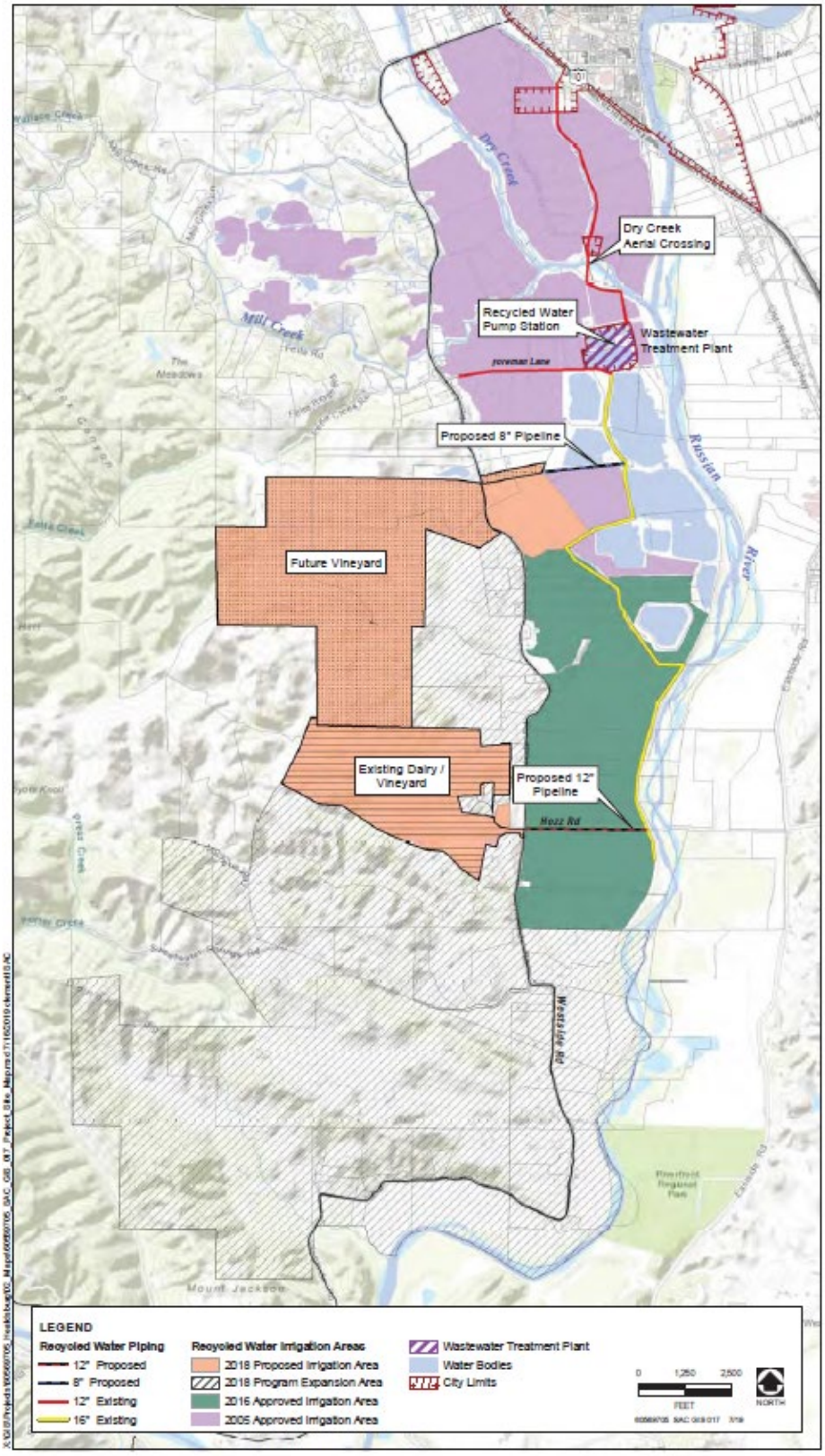

Figure 10. City of Healdsburg Recycled Water Pipelines

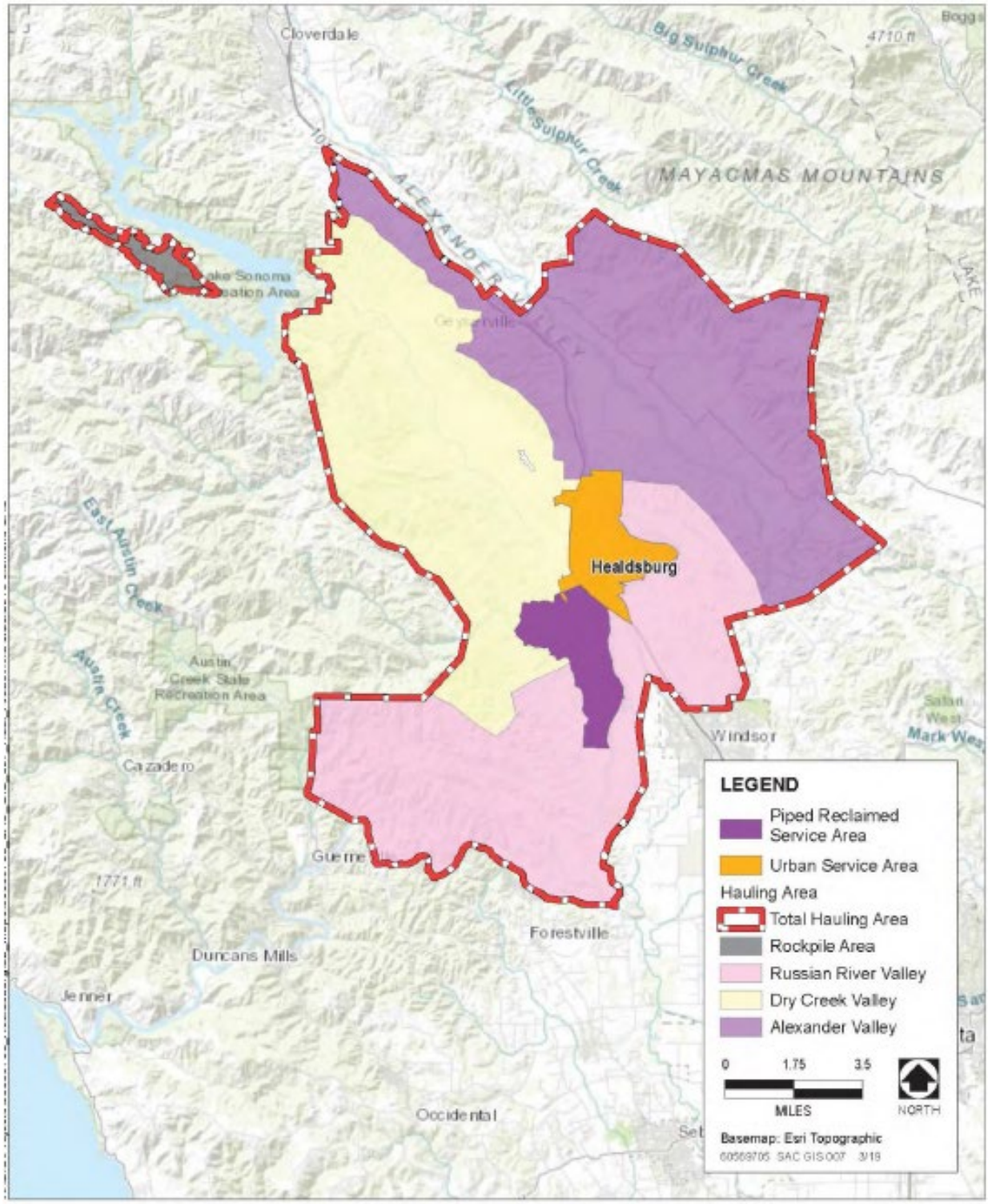

Figure 11. City of Healdsburg Recycled Water Hauling Area

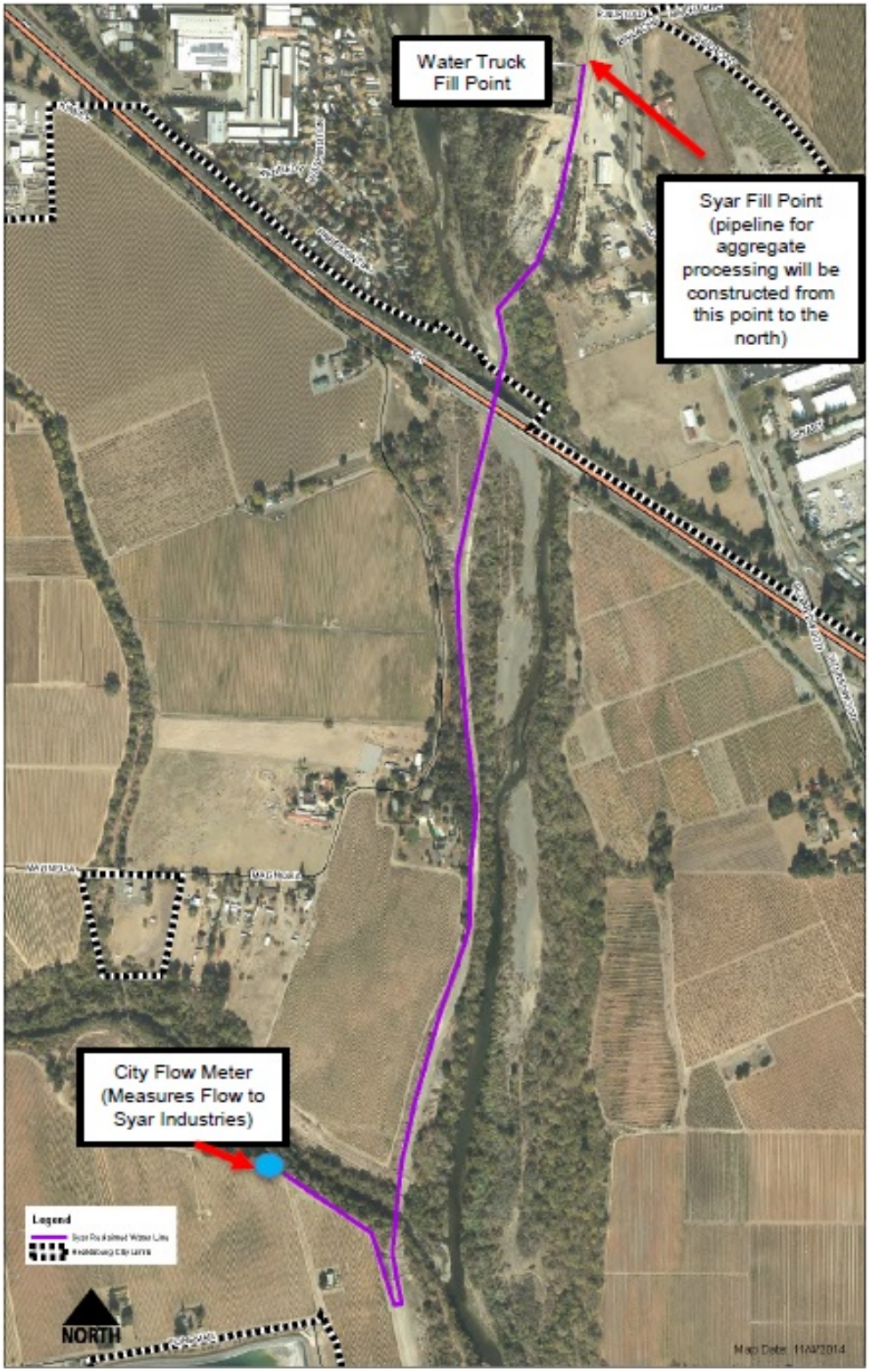

Figure 12. Location of Syar Industries' Recycled Water Pipeline and Fill Point

4.0 Use Areas

The City's current and planned recycled water uses include agricultural irrigation (pasture, cut hay, orchards, vineyard, cannabis), landscape irrigation, vineyard frost protection, fire suppression, sanitary sewer cleaning, street sweeping, and construction uses. The City uses recycled water to maintain and protect City property and equipment (Administrator Controlled Uses). To manage the use of recycled water on private property, the City maintains recycled water use agreements or issues permits (Contracted Uses). The recycled water uses, distribution methods, and estimated recycled water volume utilized are summarized in **Table 9**.

To ensure compliance with applicable regulations, the City's Recycled Water Use Agreements and permits include the following requirements. Specific best management practices are prescribed based on the type of recycled water use undertaken (detailed in subsequent sections).

- Designation of a Recycled Water Site Supervisor. The Site Supervisor will provide a phone number to the City and be reachable 24 hours a day.
- Diligent implementation and maintenance of Best Management Practices (BMPs) to prevent impacts to groundwater or surface waters.
- Recycled water must not be allowed to escape the recycled use area(s) in the form of surface runoff.
- Adequate measures shall be taken to prevent overspray, ponding, or runoff of recycled water from authorized recycled water use areas.
- Recycled water must not be applied to water-saturated or frozen ground or during periods of precipitation such that runoff is produced.
- There shall be no irrigation within a minimum of 50 feet of any domestic (drinking water well) or impoundment of recycled water within a minimum of 100 feet of any domestic (drinking water) well.
- Recycled water must not be allowed to escape as surface flow that would either pond and/or enter waters of the State.
- Recycled water must not be applied into State waters, within 25 feet of State waters containing standing or flowing water, nor in a manner that could result in uncontrolled runoff into State waters.
- Adequate protection of all recycled water ponds (if applicable) against overflow, structural damage, or a reduction in efficiency resulting from a 25-year, 24-hour storm or flood event or greater, and notification of the Regional Water Board Executive Officer, if a discharge occurs.
- Direct or windblown spray, mist, or runoff from application areas must not enter dwellings, designated outdoor eating areas, food handling facilities, roadways, or any other area where the public would be accidentally exposed to recycled water.
- Drinking water fountains (and other potable water sources) must be protected against contact with recycled water spray, mist, or runoff.
- Minimum freeboard, consistent with pond design, must be maintained under normal operating conditions in any reservoir or pond containing recycled water.
- Areas where recycled water is used must be restricted and/or clearly marked with appropriate signage. Recycled Water warning signs must meet the following criteria or provide an equivalent degree of protection:
    - Be no less than 4 inches high by 8 inches wide.

    - Include the wording “Recycled Water- Do Not Drink” in Spanish and English.
    - Display the international symbol for “Do Not Drink”
- Piping, controllers, valves, etc. must be clearly marked and secured to ensure operation only by the user.
- Recycled water must not be introduced into any permanent or potable water piping system.

Table 9. City of Healdsburg Controlled and Contracted Recycled Water Uses

Type of Use	Use Sites	Distribution Method	Volume Utilized (Estimates)
Administrator (City) Controlled Uses			
Fire Suppression	WRF, City Structures, City Parks	Truck Hauling	Emergencies Only
Sanitary Sewer Cleaning	City Sanitary Sewer System	Truck Hauling	2,000 gal/day (periodic, daily maximum)
Street Sweeping	City Streets	Truck Hauling	1,000 gal/day (periodic, daily maximum)
Landscape Irrigation	City Parks	Truck Hauling, Pipeline	12,200 gal/day (periodic, daily maximum)
Contracted Uses			
Aggregate Processing, Dust Control	Syar Industries	Pipeline	8,000 gal/day (dust control) 50,000 gal/day (aggregate processing, 80 to 120 days/year)
Construction Uses	Construction Sites	Truck Hauling	15,000 gal/day
Sanitary Sewer Cleaning	Private Sanitary Sewer Lines	Truck Hauling	2,000 gal/day (periodic, daily maximum)
Landscape/Garden Irrigation	Residential, Commercial Business Landscaping	Self-Haulers, Commercial Haulers (Trucks, Tanks), Pipelines	110,000 to 250,000 gal/day (Based on irrigation of 25 to 56 acres,180 days/year)
Vineyard Irrigation	Vineyards	Truck Hauling, Pipelines	540,000 gal/day (Based on 600 acres, 150 days/yr)
Orchard Irrigation (Apple, Plum, Prune, and Peach Trees)	Orchards	Truck Hauling, Pipelines	7,000 gal/day per acre (periodic, daily maximum)
Cannabis Irrigation	Cannabis Cultivation Fields and Facilities	Truck Hauling, Pipelines	11,500 gal/day per acre (periodic, daily maximum)
Pasture/Cut Hay (Ryegrass, Alfalfa) Irrigation	Ranches and Farms	Truck Hauling, Pipelines	3,800 gal/day per acre (based on 150 acres, 138 days per year)
Fire Suppression	Structures, Open Space	Truck Hauling, Pipelines	Emergencies Only
Frost Protection	Vineyards	Pipelines	2.6 mgal/day (8 hrs/day, 55 gpm/acre, 100 acres)

4.1 IRRIGATION

The existing and planned irrigation areas are shown in **Figure 10.** The types of irrigation that will utilize recycled water are described below.

4.1.1 Landscape Irrigation

Recycled water is used by the City, residents, and business owner/operators for landscape garden irrigation at homes, parks, golf courses, schools, and commercial buildings. Irrigation is accomplished primarily by sprinklers and drip irrigation. The irrigated areas are supplied through commercial hauler and self-hauler pickups at the WRF Fill Stations, and pipelines if adjacent to the use area. User Agreements or permits must first be secured by all Users. With proper signage, recycled water may be stored on the User's property in above ground, leak proof containers, and then applied to lawns, yards, gardens, or other landscaped areas.

In most cases, use areas will be irrigated during evenings and early mornings to minimize public contact with recycled water. Landscape irrigation is typically conducted on a daily basis from April to October and varies based on weather conditions.

4.1.2 Pasture/Cut Hay (Ryegrass, Alfalfa) Irrigation

The City will provide recycled water to contracted Users to irrigate pasture and cut hay (ryegrass, alfalfa). Irrigation will be accomplished primarily by sprinklers. Irrigation is conducted typically on a daily basis from April to October and varies based on weather conditions.

4.1.3 Orchard Irrigation

The City will provide recycled water to contracted Users to irrigate apple, prune, plum, and peach orchards**.** Irrigation is accomplished primarily by sprinklers. Orchard irrigation is conducted typically from mid-April through mid-October.

4.1.4 Vineyard Irrigation

The City provides recycled water for micro-irrigation of vineyards through pipelines and fill station pickups. Vineyards generally use drip irrigation systems. Depending on the type of drip irrigation system, each vine could have between one and four drip emitters with each emitter flowrate between 0.5 and 2.0 gallons per hour. Vineyard blocks are irrigated once or twice per week. Depending on the grower's management practices, each vine probably receives between 6 and 16 gallons of water per week. It is anticipated the use areas outside of the City limits will be irrigated for eight hours during the daylight hours.

4.1.5 Cannabis Cultivation

The City intends to provide recycled water to cannabis growers. Supplemental recycled water can offset the use of groundwater during the forbearance period (dry season) and decrease the need for storing surface water during wet season to irrigate during the forbearance period. Cannabis growers should already be enrolled under General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for Discharges of Waste Associated with Cannabis

Cultivation Activities (Cannabis Order) or other valid and appropriate waste discharge requirement orders (WDRs) and their applicable waivers (Order R1-2015-0023 or Order R5-2015-0113) before applying for a recycled water use permit. Outdoor irrigation can be accomplished by sprinklers, flood, or furrows. Cannabis irrigation is conducted typically from mid-April to the end of July.

4.1.6 Best Management Practices for Irrigation with Recycled Water

The use of recycled water for irrigation will be protective of public health and surface water/groundwater quality by the agronomic rate assessment and implementation of the following BMPs and regulatory requirements.

Irrigation Practices

- Apply recycled water within hydraulic agronomic rates.
- Do not irrigate during or immediately before or after rainfall events.
- Do not irrigate on water-saturated or frozen ground.
- Do not irrigate prior to a predicted rainfall event of 0.5 inches or greater.
- Consider implementing shorter, more frequent irrigation periods to prevent soil saturation and increase soil water available to roots.
- Do not irrigate for more than 12 continuous hours.
- Allow at least 24 hours of drying time between irrigations.
- To ensure compliance with agronomic rate thresholds, use well water or local surface water if additional irrigation or post-harvest irrigation is needed.
- Do not allow recycled water to pond on-site. All irrigation water must infiltrate within a 24-hour period.
- Maintain 100 ft setbacks to surface waters (including ponds with river connections), unless it can be demonstrated that a lesser setback is sufficient.
- Recycled water must be prevented from entering street gutters, storm drains, or nearby creeks.
- Any personnel working with recycled water should apply hand sanitizer or wash their hands with soap and potable water after working with recycled water.
- Recycled water must not be applied when the public could be inadvertently exposed.
- Recycled water must not be sprayed onto external drinking water fountains or faucets used for potable water.
- Irrigation must not occur within a minimum of 50 feet of any domestic water supply well. City staff will inspect the site of each domestic well with user staff to ensure that the necessary 50-foot buffer has been created.
- Recycled water must not be applied within 25 feet of standing or flowing State waters, nor in a manner that could result in uncontrolled runoff into State waters.
- Access to irrigated areas will be restricted when recycled water is being used.
- Recycled water storage must be managed to control odor or nuisance conditions.

Fertilization Practices

- Apply recycled water within nitrogen agronomic rates.

- When calculating the amount of commercial fertilizer needed, consider nitrogen load applied through irrigation with recycled water.
- Cleanup fertilizer spills immediately and remove waste from the site.
- Do not leave fertilizers on paved surfaces or in locations where it could migrate offsite or into nearby surface waters.
- Consider using petiole measurements to determine amount of nitrogen fertilizer required.

Equipment Operation and Maintenance

- Inspect and maintain irrigation distribution system once per week during growing season to prevent pipe breaks or leaks.
- Repair leaks or pipe breaks within 72 hours or prior to the release of 1,000 gallons, whichever comes first.
- Do not install hose bibs in areas that can be accessed by public.
- Inspect and maintain drip emitters once per month during growing season. Verify or re-establish proper operation, aim, and flowrate.
- Periodically adjust valves or pressure regulators to ensure operation of the irrigation system at the appropriate pressure.
- Consider using automatic rain shut-off devices.
- If timers are used, test accuracy of irrigation timers and recalibrate or repair as necessary.
- Post recycled water use signs at site entrances and corners. Mark recycled water equipment with signs or purple tape.
- All trucks used to haul recycled water must have proper signage. The containers used to store or transport recycled water must display Recycled Water Notice Stickers to indicate recycled water is present and should not be consumed.
- Inspect site once a month to verify the proper placement and legibility of recycled water identification signs, tags, stickers, and above ground pipe markers. Replace signs and markers as needed.
- Discourage or prevent public access to irrigation site. Limit public access at times of irrigation through perimeter fencing and appropriate signage.
- Utilize double-check valves to prevent backflows from the recycled water distribution system to agricultural wells.
- Conduct recycled water operations training prior to each growing season and whenever new employees are hired.

4.2 FROST PROTECTION

The City will provide recycled water to vineyard Users for frost control to help reduce excessive stress on surface water and groundwater resources due to the large demands. The added benefits associated with use of recycled water for frost protection include reduced pumping of groundwater and reduced effluent discharge/nutrient loading to the surface water streams.

Water is expected to be used for frost protection as follows:

- Months of use: March to May
- Average number of frost events per year: 5 (ranged from 0 to 20 over past 30 years)
- Frost event duration: 1-3 days

- Frost event demand instantaneous rate: 55 gpm/acre
- Water delivery regime:
    - 8 hours (for frost protection)
    - 18-22 hours (for recharge of storage ponds)
    - Water distribution method: solid-set sprinklers

Vineyard farmers apply 55 gpm/acre for frost protection and begin application when field conditions dictate frost is imminent (based on dew point measured in the field with a wet bulb thermometer). Farmers rely on frost reports and years of experience to address frost events. Frost protection systems are initiated and terminated manually, and farmers remain onsite during the event to monitor conditions. The total volume of water applied is dependent on the type of sprinkler and the duration of frost conditions. The use of cover crops prevents runoff and utilizes the extra nitrogen that may be applied during the frost event.

To minimize the use of recycled water, Users will evaluate whether other frost protection methods can be implemented to reduce the volume of water needed for frost control. Examples of passive methods include increasing soil water content to increase heat storage and removing ground cover that prevents heat from being stored. Other methods to protect crops include use of wind machines and chemical applications. Wind machines are used by pear farmers, but wind machines can worsen frost conditions in vineyards.

To ensure the proper use of recycled water for frost protection, Users will adhere to the following BMPs and regulatory requirements:

- Conduct pre-season inspections and infrastructure testing to ensure proper operation and verify runoff capture systems are in place.
- Do not use domestic water as a backup supply for frost protection.
- Plant cover crop to prevent runoff, protect against erosion, and provide additional nitrogen removal.
- Check irrigation systems during spray events to minimize ponding and runoff.
- The application of recycled water for frost protection must not exceed the applicable nutrient agronomic rates of the vineyard and the cover crop.
- Protect potable water wells or connections from spray and runoff by covering, eliminating cross-connections, and diverting flows from these areas.
- Any personnel who contact recycled water should wash their hands and shower as soon as possible.
- If not already in place, post signs indicating that recycled water is being used for irrigation and label any storage areas.
- Recycled water valves, outlets, quick couplers, and sprinklers shall be of a type, or secured in a manner, that permits operation only by the User's authorized personnel.
- Restrict access to irrigated areas when recycled water is being used.
- Do not use recycled water for frost control within a minimum of 50 feet of any domestic (drinking water) well.
- Do not use recycled water within 25 feet of State waters containing standing or flowing water, or in a manner that could result in uncontrolled runoff into State waters.

- Do not store recycled water without City approval. Any storage facility containing recycled water for reuse applications must be managed to control odor or nuisance conditions.
- All recycled water storage ponds shall be adequately protected from erosion, washout, and flooding from a 24-hour rain event having a predicted frequency of once in 25 years.
- Prevent recycled water from entering street gutters, storm drains, or nearby creeks.
- Irrigation equipment should be inspected and tested prior the irrigation season and inspected frequently throughout the year during use to ensure that the equipment is functioning properly. Any maintenance needs should be promptly addressed to avoid ponding, runoff, etc.
- The Site Supervisor must attend the initial and periodic refresher training required of all recycled water Users.

4.3 CONSTRUCTION USE

Recycled water is primarily used at construction sites for controlling dust on roads and from uncovered trucks that are transporting materials around construction sites. Recycled water may also be used for soil compaction, concrete mixing, herbicide/pesticide dilution, consolidating backfill in trenches, and pressure testing new sewer, gas, or recycled water lines. Recycled water is available to permitted water haulers at the WRF and Kinley Drive Fill Stations. Recycled water may be transported to sites within the City's recycled water hauling area (shown in **Figure 11**).

Owner/operators that transport and use recycled water for construction purposes must obtain a permit (**NOI Attachment B**) and obey the City's Recycled Water Use Guidelines (**NOI Attachment C and D**). Truck haulers must record the volume of recycled water picked up at the fill station and the address and volume of each recycled water delivery (the commercial hauler recycled water fill-up and delivery log is provided in the **NOI Attachment E**). A completed log is submitted to the City at the end of each calendar month (due by the 5th day of the following month).

The following BMPs and regulatory requirements are specified for truck haulers and construction uses of recycled water.

- Recycled water users should apply hand sanitizer or wash their hands with soap and potable water after working with recycled water. Hand washing or hand sanitation stations shall be located at all recycled water fill stations.
- Recycled water shall not be applied in areas where the public would be inadvertently exposed to recycled water.
- Do not drink recycled water or use it for food preparation. Additionally, the truck driver must notify workers and/or the public when recycled water is used at a site and tell them that they are not to drink recycled water or use it for food preparation.
- Precautions should be taken to avoid food coming into contact with recycled water while the use site is still wet.
- Truck drivers should be equipped with an adequate first aid kit. Cuts or abrasions should be promptly washed, disinfected, and bandaged.
- Recycled water shall not be allowed to spray onto external drinking water fountains or faucets used for potable water.

- Recycled water shall not be applied where it could contact or enter passing vehicles, buildings, areas where food is handled or eaten, or storm drains.
- Recycled water users shall take adequate measures to prevent overspray, ponding, or run off of recycled water from the authorized recycled water use area and at the filling station.
- Recycled water shall not be applied on water-saturated or frozen ground or during periods of precipitation such that runoff is induced.
- Recycled water shall not be applied on slopes if runoff cannot be controlled.
- There shall be no irrigation within 50 feet of any domestic (drinking water) well. There shall be no impoundment of recycled water within 100 feet of any domestic (drinking water) well.
- Any irrigation runoff shall be confined to the recycled water use area and shall not be allowed to escape as surface flow. No recycled water shall be applied to irrigation areas during periods when soils are saturated.
- Recycled water shall not be allowed to escape from the designated use area(s) as surface flow that would either pond and/or enter waters of the State.
- Recycled water shall not be applied into State waters, within 25 feet of State waters containing standing or flowing water, nor in a manner that could result in uncontrolled runoff into State water.
- All unused recycled water must be returned to WRF for proper disposal. The unused recycled water must not be released into open streams or waterways
- Vehicles used for transportation and distribution of recycled water must have watertight valves and fittings and must not leak.
- Vehicle recycled water storage tanks must be cleaned of contaminants prior to use. A truck or tank that has contained material from a septic tank, cesspool, or hazardous waste shall not be used to convey recycled water.
- Truck storage tanks for the storage and transport of recycled water must comply with all federal, state of California and local requirements for the storage and transport of water that is to be reused.
- Storage tanks cannot have prior use of carrying substances that are hazardous, within the meaning of federal or state of California definitions of hazardous or toxic materials, wastes or substances or poison.
- Storage tanks must be clean of all substances to prevent contamination with residue.
- Recycled water must not be introduced into any permanent piping system and no connection shall be made between the tank truck and any part of a potable water system.
- User must comply with all requirements and restrictions specified by the Regional Water Quality Control Board and the Division of Drinking Water.
- Tanker trucks used to transport recycled water should not be used to carry potable water unless approved by the Division of Drinking Water.
- The treatment, storage, distribution, or reuse of recycled water shall not create a nuisance as defined in Section 13050(m) of the California Water Code.
- No recycled water shall be applied to irrigation areas during periods when soils are saturated.
- Recycled water shall not be allowed to escape from the designated use area(s) as

surface flow that would either pond and/or enter waters of the state.
- All cross-connections shall be addressed by installing an air-gap.
- Annual refresher training for construction workers using recycled water shall be conducted.
- All containers utilized for recycled water storage shall be properly labeled.

If an herbicide requires dilution prior to application, recycled water may be used for dilution. The application of herbicide within the construction area will be in accordance with the City's Integrated Pest Management (IPM) Policy. The following BMPs are additional strategies to prevent spills and contaminated runoff.

- Do not mix or prepare more solution for application than needed.
- Do not prepare solution near storm drains or nearby creeks.
- Apply herbicide only when wind speeds are low (less than 5 miles per hour).
- Avoid excessive application.
- Herbicide application is not allowed before, during, or immediately following rain events.
- Herbicide application is not allowed when soil is already very wet (saturated).
- Prevent recycled water ponding (make sure recycled water "soaks in" to soil).
- Make sure herbicide solution does not leave the area as runoff or overspray.

4.4 AGGREGATE PROCESSING

Syar Industries operates an 84.5-acre aggregate processing facility in Healdsburg, CA, on the South and East banks of the Russian River. The site is divided into two parcels by Healdsburg Avenue. The larger parcel, north of Healdsburg Avenue, is the aggregate screening and wash process area.

Site topographic features are characterized by meandering riverbanks and stockpiles of aggregate. The elevation varies from about 75 feet mean sea level at the southern portion of the site to about 125 feet atop stockpiles of aggregate. The average elevation is between 96 to 100 feet above mean sea level. Portions of the site adjacent to the river are located in flood prone areas for the 100-year flood (Zone A13) and portions of the southern parcel are mapped in the 100 to 500-year flood (Zone B), according to the National Flood Insurance Rate Map for the City of Healdsburg. The majority of the site is pervious to rainfall, with only 1% of the site containing impervious surfaces, including buildings and paved parking. The nearest surface water is the Russian River. A nearly continuous stream bank vegetation buffer surrounds the facility along its Russian River Boundary. The site plan and features are shown in **Figure 13**.

Recycled water is delivered to Syar Industries, Inc. for aggregate processing at its main plant for dust control on the facility roads and for washing and processing aggregate materials. Recycled water will replace the use of onsite groundwater wells. The City Council adopted an EIR Addendum in October 2014 that addressed impacts of recycled water used for aggregate processing.

The City expects to deliver recycled water to Syar Industries for aggregate processing 80 to 120 days per year. The aggregate processing can occur any time during the year. Recycled water will only be used during business hours when the Syar Industries staff is onsite to observe and maintain the equipment. Approximately 50,000 gallons of recycled water per day will be needed

to top off a storage pond at the aggregate processing area (commonly called the 150 hp pond, based on the pumping system). Recycled water will compensate for water lost during aggregate processing and through evaporation.

To produce asphalt and concrete aggregate, sand and gravel are removed from the river through terrace mining operations. The aggregate materials are stored at the facility and then conveyed to screens/crushers for sorting and washing. The wash water is pumped from the 150 hp pond to the aggregate processing facility. Two washing methods are utilized onsite. One method employs spray bars to apply wash water to material traveling on conveyors over a screen deck. The used and excess wash water is captured in a collector pan under the screen deck and diverted to the drain system. The other method employs wash tubs. The materials are submerged in the wash tubs and then removed with either a sand screw or wet paddle washers. The wash water remains in the tubs which have drain holes to divert excess and used wash water to the drain system as needed.

After processing, the wash water drains into three steel-lined sumps that are located below facility grade-line and protected by levees. Two of the sumps receive water through a piped system, while the third sump receives water from an open drainage ditch that is lined with concrete. Water collected in the sumps is pumped to a clarifier for treatment. The inside diameter of the clarifier is 54 feet and the total volume is approximately 25,200 gallons. Clarified water is collected by an effluent launder and conveyed by weir overflow into a drain box that diverts the water into a 12-inch buried PVC pipe to the 150 hp pond. The weir elevation at the clarifier is 19.75 ft. Silt and clay sediments are the primary by-products of aggregate processing, and they are removed from the process wash water in the clarifier. The aggregate processing facilities are highly water-efficient. When processing materials, Syar Industries pumps approximately 250,000 gallons of water from the 150 hp pond each day. Since the wash water is treated, stored, and reused, only 50,000 gallons per day of "new water" or "make up" water is needed to accommodate evaporative and process losses. Process losses include water lost by evaporation during the washing process and water retained within solids that are removed by the clarifier.

The clarified wash water is directed to the 150 hp pond for storage and re-use in processing. While most of the property is pervious to rain, some runoff can occur in the aggregate processing area that gets captured by the wash drains and directed to the 150 hp pond. If groundwater is no longer used for aggregate processing, the 150 hp pond will eventually contain only recycled water and collected stormwater runoff from the aggregate processing area. At least 2 ft of freeboard is maintained in the 150 hp pond. During large precipitation events ($\leq$ 25 year, 24-hr storm event), overflow can be prevented by continuous operation of the 150 hp pumps, sending water through the aggregate processing area, to the clarifier, and back to the 150 hp pond. Under worst case conditions, the pond will overflow to a lower area with pumps available to send water to a holding basin near the clarifier.

Solids from the clarifier are pumped to a belt press for dewatering. Approximately 95% of the water is removed during the dewatering process. The dewatered solids are stockpiled onsite for additional drying and are later sold as soil amendments and fill material for construction and vineyard leveling. Water removed from the dewatering process is returned to the 150 hp pond and is reused for aggregate processing.

The 150 hp pond has a capacity of over 200,000 gallons and is protected by levee banks. The pond was constructed in the 1940's and a heavy duty visqueen liner was installed in the early

1990's. During years of operation, silt (from the clarified water) has built up on top of the plastic. There is currently 3 to 4 ft of silt on the walls and bottom of the pond. During times when no inflows to the pond have occurred, there is no observed drop in water level. The pond is maintained every 5 years. During maintenance, the pond is drained to expose the outlet piping and suction screen. Silt that has accumulated near the suction screen is cleaned to ensure effective pumping/water transfer. The walls and bottom of the pond are never disturbed.

There are no potable water supply lines or potable groundwater wells onsite or within 100 ft of the facility. Potable water is provided to employees through bottled water service at 13 different locations. Two non-potable wells are utilized onsite. Both are considered industrial supply wells and contain enough iron to cause discoloration in the water. Groundwater Well #1 is located near the Syar Industries office and was drilled in the early 1990's. Historically, water from this well has been used for dust control. Groundwater Well #2 is located approximately 1,000 feet west of the 150 hp pond and was drilled in the 1940's. Historically, water from this well has been used for aggregate processing. Groundwater Well #2 will not be used when recycled water is available. The employee fixed restroom is plumbed to Groundwater Well #1 for its water supply. This well is at the truck scales. In the work area, where the recycled water is used, there are port-a-potties with self-contained handwashing stations inside them. The restroom is connected to an onsite septic system and the leach field is located just south of the Healdsburg Avenue overcrossing.

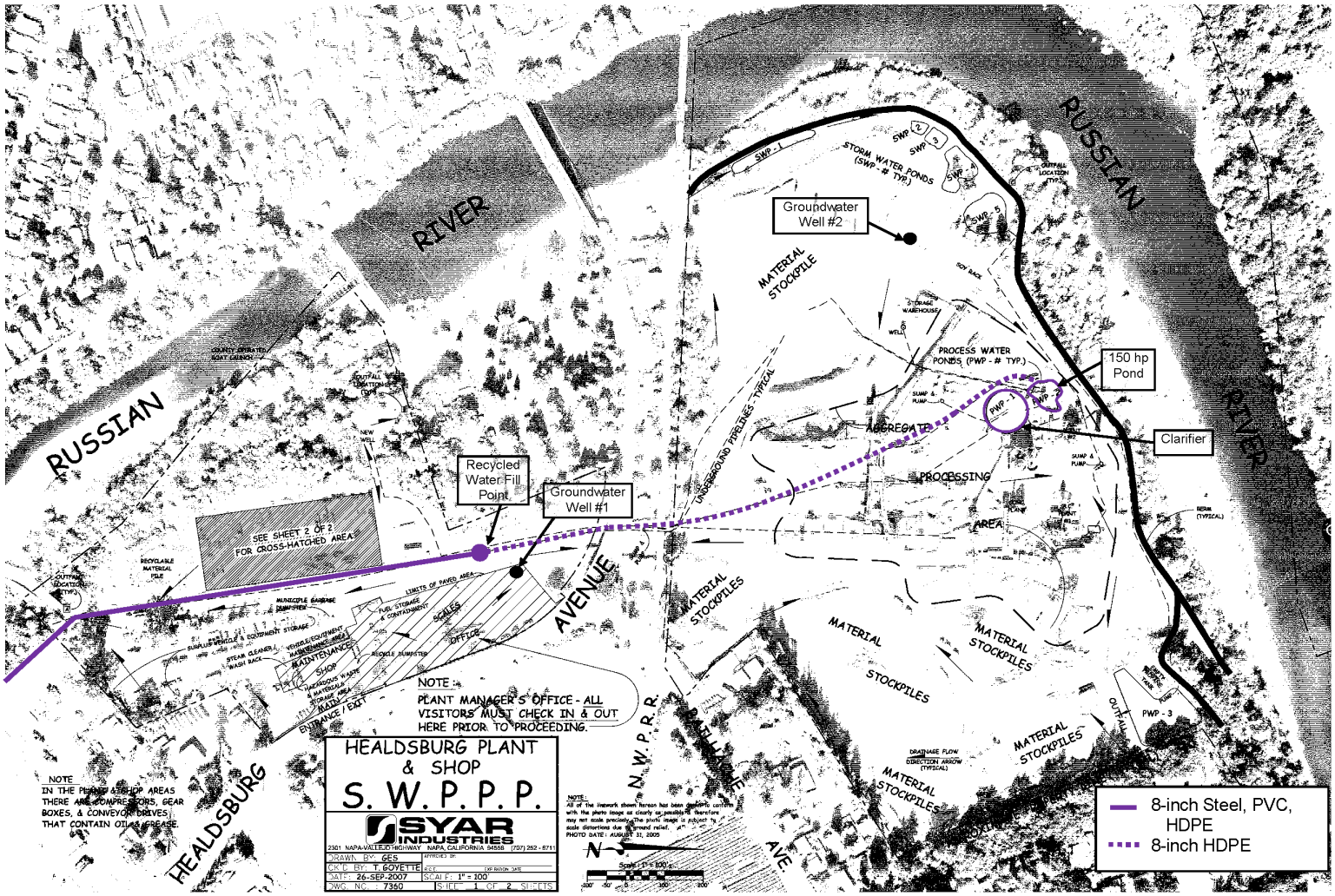

Figure 13. Syar Industries Aggregate Processing Facility Site Plan

When the wells are used, water is pulled from the depth of the highest groundwater producing aquifer. Typically, Groundwater Well #1 pulls from an aquifer located 70-120 feet below ground surface and Groundwater Well #2 pulls from 80 to 110 ft. below ground surface. When the wells are not in use, the well casings fill with water to the shallow groundwater depth (70 to 80 ft below ground surface). Both wells are bermed to protect the aquifer from onsite runoff.

The aggregate facility does not have a potable water system on site, so backflow to the potable system is not a concern. However, if potable water is ever extended to the facility, a reduced pressure backflow preventer will be installed. An air gap will be used to prevent backflow from the aggregate processing area to the recycled water pipeline. Depending on the level in the 150 hp pond, the air gap will be one to six feet.

Diligent implementation and maintenance of the following BMPs and regulatory requirements are prescribed to prevent impacts to groundwater or surface waters:

- Recycled water must not be allowed to escape the recycled use area(s) in the form of surface runoff.
- Implement an Operations and Maintenance Plan that provides to detect/correct leaks from all equipment and facilities that utilize recycled water. (
- Maintain recycled water infrastructure (pipelines, pumps, etc.) to prevent and minimize breakage and leaks.
- Adequate protection of all recycled water ponds against overflow, structural damage, or a reduction in efficiency resulting from a 25-year, 24-hour storm or flood event or greater, and notification of the Regional Water Board Executive Officer, if a discharge occurs.
- Use areas that are sprayed to control dust must be sprayed during dry weather and for short durations.
- Direct or windblown spray, mist, or runoff from application areas must not enter dwellings, designated outdoor eating areas, or food handling facilities, roadways, or any other area where the public would be accidentally exposed to recycled water.
- Drinking water fountains (and other potable water sources) must be protected against contact with recycled water spray, mist, or runoff.
- Minimum freeboard, consistent with clarifier and pond design, must be maintained under normal operating conditions in any reservoir or pond containing recycled water.
- Areas where recycled water is used must be restricted and/or clearly marked with appropriate signage.
- Piping, controllers, valves, etc. must be clearly marked and secured to ensure operation only by the user.
- Maintenance must be provided for access roads, including grading and debris removal. Additionally, Syar will be responsible for repair of all fencing and gates, repair and maintenance of all drainage ditches and culverts to ensure movement of return flows and to minimize standing water.
- Recycled water use signs must be placed at all access roads, at each corner of the facility, and in areas where recycled water is used. Exposed pipes, pumps, and valves must be marked with purple tape and tags to indicate recycled water use.

Additional BMPs are employed to prevent stormwater pollution and recycled water runoff. The facility is graded to ensure runoff will be collected in the sumps and directed to the 150 hp pond. Drainage channels are inspected regularly to ensure they are free of debris and erosion. The

storage area is graded in order to prevent direct storm water runoff. BMPs such as silt fences, berms, rip-rap, and straw are used where necessary in order to remove sediment loads and reduce the velocity of water through drainage channels. All incidental runoff drains to the 150 hp pond.

Public access to the aggregate processing facility is restricted. The facility is fenced on all sides except the portion of the facility that borders the Russian River. A steep bank and berm are present along the Russian River that discourages public access. Security personnel guard the facility at night. There are multiple gates on the property, but most are locked 24 hours per day. An entrance gate and driveway and exit gate and driveway are used during regular business hour operations.

4.5 FIRE SUPPRESSION

In emergency situations, recycled water may be used for fire suppression at the Healdsburg WRF, City property, private property, or public lands. Recycled water will be available at the City's fill stations, through the recycled water pipeline, or directly from storage ponds at the WRF.

Training exercises will be undertaken (at least annually) to educate fire fighters about the uses and health risks presented by recycled water since exposure to infectious agents may occur through open wounds and inhalation. An air gap separation will be maintained whenever tanks on emergency vehicles are filled with any type of water. Organizations that transport and use recycled water for fire suppression purposes must obtain a permit (**NOI Attachment B**) and obey the City's Fire Suppression Guidelines.

The following BMPs are recommended to ensure fire fighter safety when using recycled water:

- Bottled potable water should be provided for drinking and treating wounds.
- Wounds should be cleaned with potable water.
- Firefighters should shower with potable water upon return to the station following firefighting with recycled water.
- Decontamination showers must be connected to a potable water system.
- Since fire engines could possibly use their on-board tanks to distribute drinking water during civil emergencies, this tank should be disinfected following the use of recycled water for firefighting.
- Fire departments that use recycled water for firefighting training should develop a plan and describe how they will comply with other CCR Title 22 requirements (e.g., preventing spray mist from leaving the site or reaching eating areas, residential areas, or the storm drain, avoiding standing in recycled water mist, 50-foot setback to wells, signage, etc.).
- All unused recycled water must be returned to WRF for proper disposal. The unused recycled water must not be released into open streams or waterways.
- Responding fire personnel must be adequately trained in the safe use of recycled water. New/existing fire personnel must receive annual refresher courses regarding the issues concerning recycled water and its safe use when operating hydrants charged with recycled water.
- During fill-up, utilize the hand sanitation station located at the WRF and Kinley Drive Filling Stations.

4.6 SANITARY SEWER CLEANING

The City and private companies use recycled water to periodically clean sewer lines. Sewer systems need regular inspections and maintenance to prevent accumulation of solid waste that can cause odor and/or clogging. Sewer cleaning is done throughout the year but is more frequently done in the summer and fall. Jetting, augering, and flushing is conducted by the City to clean and maintain public sewer lines. Jetting, augering, and flushing may also be conducted by private companies to clean and maintain privately owned sewer lines. Jetting is the process where high-pressure water is directed against pipe walls to remove debris and grease build-ups. Augering uses mechanical rotating blades to break up grease deposits, cut roots, and loosen debris thereby effectively removing silt, sand, gravels and solids waste from pipeline. Flushing introduces a heavy flow of water into the sewer line at a manhole to remove floatables, sand, and silt. Typically, flushing is used in a combination with other cleaning methods, especially mechanical augering. Currently, the City has a Vac-Con Vactor/Jetting Truck, a separate truck-mounted Harben High Pressure Water Jetting unit, four industrial sewer lateral maintenance tools (augers), and a closed-circuit TV (CCTV) camera which can be used to inspect smaller diameter sewer mains and laterals.

The Vac-Con Vactor/Jetting Truck operates by using a combined jetting and vacuuming system. The jetting process introduces and pushes a high-pressure hose with a jetting nozzle into a pipeline. The high-pressure water exiting the nozzle propels the hose further into the sewer lines and clears obstructions. Water pressures range between 1,100 to 1,200 psi and a water flow between 75 to 80 gallons of water per minute. Subsequently, the vacuuming system absorbs all the solids and water into a sludge tank. Once cleaning is done water from the sludge tank is emptied into a sanitary sewer line and the solids are taken to the landfill. Two people are required to operate a sewer cleaning truck. One person operates the combined jetting and vacuuming system, and the other attends the manhole upstream from the process. The person upstream is responsible for notifying the person downstream if the hose is moving forward and indicating when the hose has reach its destination.

As described in the City of Healdsburg Sewer System Management Plan (SSMP) the City maintains five sewer cleaning lists. Sewer lines can be placed on a 60-Day, 90-Day, 180-Day, One-Year, or Three-Year list based on the conditions of the line. High priority areas require cleaning more frequently, as more trash and sediment is likely to occur, while low priority areas rarely accumulate debris and require less maintenance. The City cleans and maintains approximately 13 miles of sewer main each year. Approximately 90% of the City's sewer lines are placed in the Three-Year List (low hazard, problem free locations).

Sanitary sewer cleaning is an appropriate and important use of recycled water. Use of recycled water ensures valuable potable water will not be utilized when a lower quality of water is available and sufficient. Water and waste generated during cleaning operations is returned to the WRF for treatment. The City will only use recycled water in the sewer cleaning trucks. As a result, separate filling systems (one for potable water and one for recycled water) are not necessary. An air-gap feature is provided on the fill inlet to the on-board tank. Sewer cleaning trucks will obtain recycled water from the City's fill stations. For sanitary sewer cleaning, the primary operational concern is preventing spills during truck fill ups and during the cleaning operation. Private companies that transport and use recycled water for sewer cleaning operations must obtain a permit (**NOI Attachment B**) and obey the City's Sanitary Sewer Cleaning Guidelines.

The following BMPs are specified for sanitary sewer cleaning with recycled water.

- Hand washing stations and/or hand sanitation kits will be located on all cleaning trucks.
- Any person working with recycled water must wash their hands with soap and potable water or use hand sanitizer after contact with recycled water.
- Trucks will be equipped with signage stating that recycled water is used.
- Recycled water shall not be applied where spray, mist, or runoff comes into contact with external drinking fountains, passing vehicles, or designed eating areas.
- Storm drains and creeks will be protected from spilled recycled water by covering and blocking drain inlets.
- Equipment will be cleaned over absorbent pads, drip pans, plastic sheeting or other material to capture all spillage. Generated waste material will be properly disposed.
- The Spill Response Plan will be followed for suspected spills into the storm drains.
- Annual refresher training for crews using recycled water will be conducted.

4.7 STREET SWEEPING

The City is planning to use recycled water for street sweeping operations in the future. Currently, an outside contractor conducts street sweeping for the City and declines to use recycled water. However, the City anticipates this situation will change in the near future. Either a different contractor will be utilized, or the City will conduct street sweeping with City equipment and City staff. If a different contractor is utilized and the contractor agrees to use recycled water, a use agreement and street sweeping guidelines will be developed.

Street sweeping of streets and rights-of-way is a management strategy to reduce the amount of trash, debris, and particulates that wash off and contaminate creeks during rain events. Most street sweeping vehicles are equipped with a dust suppression and vacuum system. Spraying small volumes of water before the street is swept prevents dust formation. Water is then absorbed by the vacuum system, and any remaining water evaporates from the ground. Therefore, under ideal conditions no runoff should be produced during street sweeping. An average street sweeping vehicle tank holds 220 gallons of water. The volume of water utilized per day depends on the area that is swept. Vehicles will be filled at the City's recycled water fill stations.

To prevent adverse health effects and protect water quality from street sweeping operations, the following BMPs will be implemented.

- A Recycled Water Site Supervisor will be assigned by the City. The site supervisor will train employees on proper recycled water use and signage.
- Annual refresher training of vehicle operators will be conducted. Training records will be maintained at the WRF.
- Hand washing stations and/or hand sanitation kits will be located on all vehicles.
- Any person working with recycled water must wash their hands with soap and potable water or use hand sanitizer after contact with recycled water.
- Street sweeping vehicles will never be used to transport potable water.
- Street sweeping vehicles must be water tight to prevent leaks.
- Street sweeping vehicles will be equipped with an air gap for backflow protection.
- Recycled water will not be used for street sweeping during, or immediately before or after a rain storm.

- Recycled water must not be applied where spray, mist, or runoff comes into contact with external drinking fountains, passing vehicles, pedestrians or designed eating areas.
- Recycled water must not enter storm drains.
- Recycled water signage will be placed on vehicles whenever they are operated to notify workers and the public of recycled water use in progress.
- The City will educate the public about the use of recycled water in street sweepers by placing notifications in water/sewer bills.

4.8 COOLING

Cooling water is not an element of the City's Recycled Water program.

4.9 GROUNDWATER RECHARGE

Groundwater recharge is not an element of the City's Recycled Water Program.

4.10 DUAL PLUMBED USE AREAS

There are no dual plumbed recycled water use areas at this time.

4.11 OTHER INDUSTRIAL USES

There are no other industrial uses for recycled water at this time.

4.12 USE AREA DESIGN

The City of Healdsburg Cross-Connection Control Program is implemented by City Ordinance Nos. 976 and 1075 and Building code chapter 13.16. The City's Cross-Connection Control Program must be followed at all recycled water use sites. Dual-plumbed systems are not allowed currently, but the City may develop a dual-plumbed program in the future. Piped connections between recycled water storage containers and onsite irrigation systems are not allowed. At least once per year, City staff will conduct inspections at all sites that are connected to the City's recycled water pipelines. City staff will conduct inspections of sites supplied by commercial haulers and self-haulers on a representative basis (at least one third visited each year). Possible cross-connections will be identified during the site visits. If a commercial hauler reports a potential cross-connection, City staff will visit the site within 24 to 48 hours (depending on the cited problems) and conduct a cross-connection control investigation.

The City employs certified Cross-Connection Control Specialists to conduct site visits. The observations and findings of the Cross-Connection Control Specialist will be recorded on the Cross-Connection Control Investigation and Test Report (**NOI Attachment F**) and deficiencies (if any) will be noted along with the prescribed corrective action.[16] If activities were conducted that could compromise the integrity of a potable water supply system, a recycled water system shutdown test may be performed and/or corrective actions prescribed. If any deficiencies were noted, the City will establish a deadline for compliance and assist with re-inspections to identify

[16] The City of Healdsburg Recycled Water Cross-Connection Control Program was approved by the State Water Resources Control Board, Division of Drinking Water on April 22, 2014, email from Janice Thomas (DDW) to Cathleen Goodwin (Regional Water Board).

when the corrections have been completed. The User must implement the prescribed corrective actions and submit verification to the City. The deficiencies must be corrected in order to initiate or continue delivery of recycled water. Some recycled water use sites may warrant their own special cross-connection control plan. When needed, the City will ensure the site-specific plan is developed and implemented properly.

If a backflow prevention device is present onsite it will be tested at least annually. Backflow devices owned by the City will be tested by the City. Backflow devices owned by others must be tested by a certified backflow device tester with test results submitted annually to the City as a condition of recycled water use.

The results of site investigations and testing will be incorporated into the User's file and included in the City's annual recycled water report to the Regional Water Board. The City will send an inspection notice to all recycled water Users by February 1 of each year. The notice will include a requirement to complete the tests and/or inspections and implement corrective actions (as needed) by April 30th.

4.13 USE AREA INSPECTIONS AND MONITORING

4.13.1 City Inspection Program

At least once per year, the City performs unannounced, randomly timed inspection of sites connected to the recycled water pipeline. The observations are used to verify information reported in the User Self-Monitoring Reports including recycled water volume applied, operation of storage and irrigation systems, placement of warning signs, and evidence of runoff or ponding. The City maintains a database that includes the location and running total of recycled water volume delivered to landscape and vineyard irrigation sites that received hauled recycled water. At least one third of these recycled water users will be inspected each year. Construction sites that utilize recycled water will be randomly inspected at least once per year.

In accordance with the General Order, site inspections include the observations listed in **Table 10** and the following additional requirements for irrigation sites. The City's observations and findings are recorded on the Site Inspection Report (**NOI Attachment G**).

- Presence and condition of Recycled Water Notice Stickers on storage tanks.
- Irrigation with recycled water within 50 ft. of a domestic water supply well.
- Piped connections between recycled water storage containers and irrigation systems.
- Connections between recycled water storage and domestic water supply systems.

A significant violation is defined as a "violation of the DDW recycled water use criteria that impacts or threatens to impact public health or water quality" and may include reservoir overflows, leaks/breaks in distribution system, or runoff from a User site. A significant violation must be reported to the Regional Water Board within 24 hours. In addition, the California Office of Emergency Services (Cal OES) must be notified by telephone as soon as possible of any release of hazardous materials to surface waters. Users are responsible for reporting any possible violations of their permit conditions immediately by telephone to the City. The City then records the information supplied by the User, completes a Significant Violation Report (if necessary), and calls the Regional Water Board within 24 hours. The Regional Water Board notification is followed by a written report from the City within 15 days to describe the corrective actions taken.

Table 10. City of Healdsburg Recycled Water Use Area Monitoring Requirements.

Parameter	Sample Type	Sampling Frequency	Reporting Frequency
Recycled Water User	---	---	Annually
Recycled Water Flow	Meter (gpd)	Monthly	Annually
Acreage Applied	Calculated (acres)	---	Annually
Application Rate	Calculated (inches/acre-year)	---	Annually
Soil Saturation/ Ponding	Observation	Quarterly	Annually
Nuisance Odors/ Vectors	Observation	Quarterly	Annually
Discharge Offsite	Observation	Quarterly	Annually
Notification Signs	Observation	Quarterly	Annually

4.13.2 User Self-Monitoring Program

As part of the terms and conditions of the Recycled Water Use Agreement, metered users are required to perform monthly observations of site conditions and verify proper operation of the recycled water facilities/equipment. Vineyard users must perform the observations once per month during the irrigation season and record the results in the User Self-Monitoring Report **(NOI Attachment G).** In addition to conducting site observations, vineyard Users must compile and report the following information to the City. This information will be used to assess compliance with agronomic rate requirements.

- Block identifier and area irrigated.
- Source and volume of irrigation water applied to each block (recycled water and well water).
- Percent shaded ground at solar noon (for 2 randomly selected blocks per month).
- Amount and nitrogen content of fertilizer applied to each block.

The User Self-Monitoring report and the recycled water use data must be submitted to the City by the fifth day of the month after the month when observations were performed. Although User self-monitoring is required on a monthly basis, User awareness must be continuous to note any violations of recycled water use requirements.

If a violation of recycled water requirements is observed (e.g., runoff from site, leaks/breaks in irrigation system, drainage to surface waters, reservoir leaks/overflows), metered users must contact the City immediately by telephone. The metered users also have a responsibility to discuss any planned operational changes with the City prior to implementation. Depending on the nature of the violation and/or operational changes, the City will inform the Regional Water Board and may change the terms and conditions of the Recycled Water Use Agreement.

4.13.3 Commercial Hauler Inspection Program

When delivering more than 300 gallons/visit to a particular site or User, the commercial hauler will act as a "Distributor" and perform a site inspection. The City is delegating some inspection authority to the commercial hauler, but the City is ultimately responsible for compliance at each use site. The commercial hauler will ask the User how long it took to use water previously delivered, ensure no connections exist between the recycled water and domestic water supply systems, and look for evidence of over-application and runoff. The commercial hauler must submit a completed inspection form (**NOI Attachment E**) for each site to the City at the end of the month.

4.14 USE AREA EMPLOYEE TRAINING

All WRF staff and City employees that interface with the recycled water program will receive an orientation on recycled water program operation and regulatory requirements. The General Order, CCR Titles 17 and 22, and sections of the WRF O&M Manual on water recycling facilities will be reviewed by the participants. Employees will tour the WRF during their first month of work to learn how recycled water is produced, monitored and distributed to Users.

The City will train metered Users prior to startup of recycled water delivery. In June 2014, the City prepared a "Training Program Technical Report for Micro-Irrigation of Vineyards."[17] The report will be utilized for source material, but the program will be updated to address current permit provisions and recycled water program conditions. Training events will be conducted with the Recycled Water Site Supervisors and key personnel to provide an overview of recycled water regulations, introduce program forms, and detail when/how to submit required information. A copy of the General Order, CCR Titles 17 and 22, and the recommended or required BMPs will be provided. Additional training will occur when regulations change, operations are modified, or new employees start work.

The City will conduct recycled water training for landscape irrigation self-haulers and commercial haulers when their permit applications or use agreements are submitted and annually thereafter. The training program will include appropriate uses of recycled water, health and safety guidelines, watering guidelines, cross-connection prevention, and program rules. The training presentations for self-haulers and commercial haulers are provided in **NOI Attachment H**.

[17] "Training Program Technical Report Micro-Irrigation of Vineyards (June 2014)," prepared by City of Healdsburg, June 2014.

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Appendix ER-A. UV Disinfection System O&M Manual

TROJAN UV3000 PLUS™

OPERATIONS AND MAINTENANCE MANUAL

HEALDSBURG, CA.

SPEC SECTIONS 01340, 11300 & 01650

Document #	OM511201	Checked By:	SDI	Date:	07OC05
Revision:	A	Approved By:	CMC	Date:	07OC05

The TrojanUV3000Plus™ in this manual may be covered by one or more of the following United States (US) or Canadian (CDN) Patents:

US 5,006,244	US 4,872,980
US 6,663,318	US 5,418,370
US 6,342,188	US 6,635,613
US 6,646,269	US RE 36,869
CDN 2,117,040	CDN 2,239,925

FOREIGN PATENTS AND FOREIGN PATENTS PENDING.

OVERALL

TABLE OF CONTENTS

Preface iii

PREFACE

General Information

Congratulations on your purchase of the TrojanUV3000Plus™.

This Operations and Maintenance (O&M) Manual provides instructions on how to operate the system and carry out routine maintenance.

The objective of this manual is to provide simple, clear, and complete instructions. It is backed by Trojan Technologies commitment to offer superior customer support. Every effort has been taken to ensure the accuracy and completeness of information in this manual.

If you do not understand any of the information or procedure explanations in this manual, call Trojan Technologies for assistance.

Do not undertake operation, repairs or servicing of equipment unless you are familiar with the operation and servicing of technical equipment and are trained in electrical and mechanical safety.

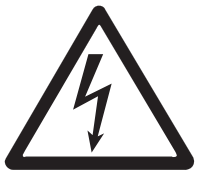
Your common sense and good judgment are crucial to the safe and successful operation and maintenance of the TrojanUV3000Plus™.

WARNING

Consult your technical manual before servicing!

1. Read the Warnings and Precautions and General Lock out Procedure in this section before operating or performing any maintenance on this equipment.
2. Read procedures thoroughly before starting.
3. Review all warnings and cautions that accompany any procedure and review warnings and precautions section each time you prepare to perform maintenance on the TrojanUV3000Plus™.

Four types of notices are used in this manual.



DANGER

Contains information that if not heeded; will cause death or serious injury to personnel.

WARNING

Contains information that if not heeded, could cause death or serious injury to personnel.

CAUTION

Contains information that if not heeded, may cause moderate injury or equipment damage

Note: *Provides comments which clarify information (e.g. On some models the valve is at the rear of the unit.)*

This section of the O&M Manual contains important contacts, warnings and precautions, general lock out procedures, a list of acronyms, glossary of terms, and description of the operator's kit.

Chapter 1 - provides an introduction into the theory of ultraviolet light disinfection.

Chapter 2 - is an overview of the TrojanUV3000Plus™ components and operation.

Chapter 3 - provides instructions for the start up and shut down procedures for short or long-term periods (e.g. winterization).

Chapters 4 and on - provide details for the operation, maintenance, and specifications for the major components of TrojanUV3000Plus™ including the System Control Center, Power Distribution Center, UV Module, UV Sensor, Water Level Control and optional ActiClean™ Cleaning System.

Appendices include Warranties, Project and System Descriptions, Controls Philosophy, Layout and Electrical Drawings, MSDS's, Wastewater Sampling Techniques, Replacement Parts List, System Maintenance and Manufacturer's Manuals (if applicable).

Important Contacts

TROJAN TECHNOLOGIES

Head Office (Canada) 3020 Gore Road London, Ontario Canada N5V 4T7 Toll Free Number: 1-800-291-0218 Fax: 1-800-291-0083 Internet: http://www.trojanuv.com	**Europe** Laan van Vredestein, 160 2552 DZ, The Hague, Netherlands Telephone: 31-70-391-3020 Fax: 31-70-391-3330 For projects in Continental Europe
Your Local Representative DC Frost Associates, Inc. 2855 Mitchell Drive, Suite 215 Walnut Creek, CA 94598-1609 Telephone: 925-947-6733 Fax: 925-947-6784 E-mail: www.dcf@dcfrostassoc.com	**For information on or assistance with the Hach SC100 Controller and UVAS sc Sensor (if provided) contact the Hach Company directly. Refer to the Manufacturer's Manual Appendix for contact information.**

Warnings And Precautions

Please read warnings and precautions before proceeding with operation, maintenance or repair of the equipment. Always follow local safety codes and ensure tools and personal protective equipment are in good condition and properly fitted and tested.

	DANGER
	*Electrical Hazard!* *LOCK OUT and TAG all sources of power before performing any maintenance, cleaning or repairs on any piece of equipment. The power sources may include electrical, hydraulic, or stored energy. Refer to the general lock out and tag procedures in this manual.*

	WARNING
	*Lockout Electrical Power*
	*Wear UV Resistant Face Shield!* *Unprotected exposure to ultraviolet light can cause severe burns to the eyes and skin. Face shield should be worn as the primary protection against such exposure. Never look directly at the energized lamps unless you are wearing ultraviolet resistant face shield or glasses (for short-term exposure)*
	*Eye Protection Must be Worn!* *As added protection, or as a minimum protection for short-term exposures, tight fitting glasses- with side shields protection where the such shields are contiguous - must be worn at all times when there is a potential exposure to Ultraviolet light. Glasses such as wrap-around style are most effective.* *Wear Eye Protection!* *Wear goggles when servicing equipment.*

	WARNING
	*Wear Protective Gloves!* *Always wear protective gloves when working on equipment.*
	*Wear Safety Boots!* *Always wear protective footwear when working on equipment.*
	*Wear Ear Protection!* *The TrojanUV3000Plus™ does not produce a harmful level of noise, but users are cautioned that they should wear hearing protection as appropriate to protect against other noise that may be present at a wastewater or water treatment plant.*
	*Wear Hard Hat!* *Wear an approved hard hat and other personal protective equipment that is required according to construction site, wastewater or water treatment plant safety regulations.*
	*Slip Hazard!* *Module surfaces, grating, walkways and channel walls may be slippery when wet or ice covered.*
	*Fall Hazard!* *Use care when working around open channels. Replace safety grating after lifting modules.*

	**WARNING**
	*Trip Hazard!* *Stay alert and be aware of potential trip hazards before working on equipment.*
	*Corrosive! The Cleaning Agent contains phosphoric acid. Avoid inhalation, ingestion, or exposure to eyes and skin. Wear appropriate clothing and personal protective equipment.*
	*Hot Surface!* *Allow electronic ballast and lamps to cool before handling.* *Ultraviolet lamps become hot during operation. Hot lamps can cause serious burns. Prior to removing the lamps, allow lamps to cool for a minimum of 5 minutes. This prevents burns and damage to the lamp. Top of PDC will become hot with prolonged exposure to sunlight.*
3 ~	*Three Phase Alternating Current!*
~	*Single Phase Alternating Current!*
|	*On (Supply)*

	WARNING
	*Off (Supply)*
	*Protective Earth Terminal!*
	*Consult your technical manual before servicing!*

	CAUTION
	*Do not adjust the ALC once Trojan Personnel have set up the equipment.* *The ALC is not intended to function in no flow conditions. A recirculation pump or other level control device is required if periods no flow are expected.* *There should never be anything welded to or placed on the ALC unit. Doing so will affect the operation as well as the water level it was set to maintain.* *Trojan relies on quality samples to prove disinfection efficiency, UV dose demand, and effluent quality variation. Proper sampling techniques are essential.* *Trojan does not recommend the use of reducing agents (e.g. sodium thiosulphate or EDTA). Reducing agents in a sample will lead to false results and produce a low %UV Transmittance.* *Do not change any setting without being aware of the consequences to the system operation first. Contact Trojan Technologies before making changes.*

	Use caution when using gate alarm reset pushbuttons. Gates may begin to move immediately when the button is pushed and can cause physical damage to equipment if the cause of the fault is not corrected first. Be sure that all personnel are clear of gates and gate control motors and gearing before pushing these buttons. *Use only warm water to rinse the inside of the wiper canister. Other cleaning agents may affect UV transmittance through the sleeve.* *Do not spray water in or around the Power Distribution Center when lids are open.* *Make sure the power cord and hydraulic lines do not fall into the channel.* *Ballast trays must be carried in an upright position only.* *Handle ballast tray in upright position.* *When replacing the sleeve nut, ONLY hand tighten to prevent damage to the module.* *Seal sockets must be clean and dry. Clean with isopropyl alcohol if required.* *Lamp connectors must be clean and dry. Clean with isopropyl alcohol if required.* *O-rings must be free of nicks, dirt or water. Replace as required.* *Do not use abrasive pads such as steel wool, copper wire or SOS pads since they will scratch the sleeves and cause damage to the system.* *Do not over tighten pressure cone.* *Wet sleeve before sliding through wiper canister.* *Ensure all inner parts of wiper canister are reinserted in the proper orientation. Failure to do so will result in an incomplete seal.* *If performing a manual cleaning of the quartz sleeve, ensure the sleeve is dry on the inside before assembling lamp assembly. Traces of wet alcohol could result in the formation of a coating after the lamps are turned on.* *Use only Trojan approved cleaning agents. Other cleaning agents are not recommended and their use could jeopardize disinfection or damage the system.* *Use only Trojan approved hydraulic fluid in the Hydraulic System Center (HSC). Other non-approved oils could damage the system. Refer to the Material Safety Data Sheets (MSDS) Appendix for further information.* *Use appropriate wiring practices, which conform to your local codes! Ensure adequate grounding!*

	Do not submerge the module enclosures under water or the electrical components within may be damaged. Module enclosures are water resistant not waterproof. *Flooding the module enclosure constitutes improper operation of the equipment and may cause extensive damage.* *If you do not completely understand any of the information or procedures in this manual, call Trojan Technologies for assistance.*
	**CAUTION** **OBSERVE PRECAUTIUONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES**

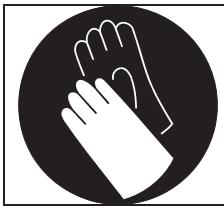
General Lockout Procedures

The following procedure is the minimum requirement. Additional precautions should be taken depending on site-specific protocols. Always check with the plant manager and senior electrician for additional precautions.

WARNING

Wear UV Resistant Face Shield!

Unprotected exposure to ultraviolet light can cause severe burns to the eyes and skin. Face shield should be worn as the primary protection against such exposure. Never look directly at the energized lamps unless you are wearing ultraviolet resistant face shield or glasses (for short-term exposure).



WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

WARNING

Wear Safety Boots!

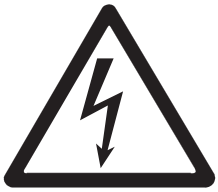
Always wear protective footwear when working on equipment.

WARNING

Lockout Electrical Power

Lockout and Tag Procedure

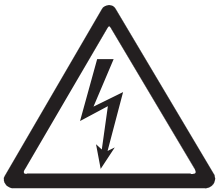
1. Locate and identify electrical supply to equipment. Identify specific breakers that service Trojan Technologies' equipment. If you are unsure, contact plant electrician or maintenance personnel to locate correct electrical supply.



WARNING

Be aware that the panel may be fed from multiple sources!

2. While standing to the side, and facing away from the electrical panel, use your closest arm to move the disconnect switch to "Off".
3. Attach your lock and safety tag to disconnect switch. Include your name, date and time, and work to be performed on tag.
4. Return to System Control Center. Go to Bank Control Screen, and verify correct power source has been locked out.



WARNING

The equipment may have stored energy! Ensure that all parts have stopped moving and any stored capacitance has been effectively drained.

5. Test system by pressing start buttons or other controls to ensure power has been locked out.

6. Proceed to work area and visually check to ensure equipment is off.
7. Double check with a multimeter at equipment service entrance that the system has been de-energized.
8. It is now safe to work on the system.

After Service Work Is Complete

1. Ensure all equipment is in “Off” position.
2. Clear any tools or debris from work area.
3. Remove all lock out devices and tags.
4. While standing to the side, and facing away from the electrical panel, use your closest arm to move the disconnect switch to the “On” position.
5. Notify plant manager or site electrician that work is complete and system has been restarted.

List of Acronyms/Glossary

°C – Degrees Celsius
°F – Degrees Fahrenheit
~ - Single Phase Alternating Current
%T - percent Transmittance
#L - # Lamp (ie. 3L – 3 Lamp)
△ - Delta
℮ - Edison
100%T - 100 percent Transmittance
3~ - Three Phase Alternating Current
3R - Type 3R
4 - Type 4
4X - Type 4X

A - Amps
AC - Alternating Current
ACK - Acknowledge
ACS - ActiClean™ Cleaning System
ALC - Automatic Level Controller
ANSI - American National Standards Institute
A/R - As Required
ASTM - American Society for Testing & Materials
Bar - Barometric Pressure
BSP - British Standard Pipe
CE - Conformitée Européenne (European Conformity)
CCB - Communications Control Board
cm - Centimeters
COMM - Communications
CPU - Central Processing Unit
CSA - Canadian Standards Association
c/w - Complete With
D - Disabled
DC – Direct Current
DNA - Deoxyribonucleic Acid
DP - Distribution Panel
DWG. - Drawing
E - Enabled
EC - E-Coli
EL. - Elevation
ELPD - Earth Leakage Protection Device
EMI - Electro Magnetic Interference
EOL - End of Life
EPA - US Environmental Protection Agency
EPDM - Ethylene-propylene-diene rubber
EPROM -Erasable Programmable Read Only Memory
Est. - Estimated
EXT - Extend

FC - Fecal Coliform
Ft. - Foot/Feet
FWP - Fixed Weir Plate
G# - Generation # (ie. G1 - Generation 1)
GND - Ground
GPD – Gallons / Day
gpm - US Gallons Per Minute
GUI - Graphical User Interface
HCB - Hydraulic Control Board
Hp - Horsepower
Hrs - Hours
HSC - Hydraulic System Center
Hz - Hertz
in. - Inch(es)
in·lb- Inch pound
I/O - Input/Output
JIS – Japanese Industrial Standards
kPA - Killopascals
kVA - Kilovolt amps
kW – Kilowatts
kWh - kilowatt hours
Lb·ft - Pound Foot
LED - Light Emitting Diode
LHL - Low Headloss Automatic Level Controller
LOC - Local
LPM - Liters / minute
L/s - Liters / second
M - meters
mA - Milli Amp
MAX - Maximum
M^3/Day - Cubic Meters per Day
MCB - Module Control Board
MGD - Million Gallons / Day
mg/l - Milligrams per liter
MIN - Minimum
mJ/cm^2 - Millijoules per squared centimeter
mL - Milliliters
MLD - Million Liters per Day
mm - Millimeters
MSDS - Material Safety Data Sheets
mW/cm^2 - Milliwatts per squared centimeter
mWs/cm2 - Milliwatt seconds per squared centimeter
NO. - Number
nm - nanometer
N·m - Newton meter
NPT - National Pipe Thread
O&M - Operation and Maintenance
OEM - Original Equipment Manufacture
OI - Operator Interface
PDC - Power Distribution Center
ph - Phase
PLC - Programmable Logic Controller
PPM - Parts per Million
PREV – Previous
PSi - Pounds per Square Inch
PSS - Point Source Summation
Qty. - Quantity
REM - Remote
RET - Retract
REV. - Revision
RCB - Relay Control Board
RNA - Ribonucleic Acid
SBR - Sequencing Batch Reactor
SCADA - System Control and Data Acquisition
SCC - System Control Center
sec - Second
SPEC - Specification
SPSS - Single Point Source Summation Method
SST - Stainless Steel
Temp - Temperature
TC - Total Coliform
TSS - Total Suspended Solids
TVSS - Transient Voltage Surge Suppressor
TYP. - Typical
UI - User Interface
UPS - Uninterrupted Power Supply
UV2 - UV2000™
UV3 - UV3000™
UV3+ - TrojanUV3000Plus™
UV3B - UV3000™Basic
UV4LF - UV4000™LF
UV4 – TrojanUV4000Plus™
UL – Underwriters Laboratory
UV - Ultraviolet
UVM - UV Module
UVT - UV Transmittance
V - Volts
VA - Volt amps
VAC - Volts Alternating Current
VDC - Volts Direct Current
w - Wire
w/ - With
W/o - Without
WL - Water Level
W/m^2 - Watts per meter squared
Y - Wye

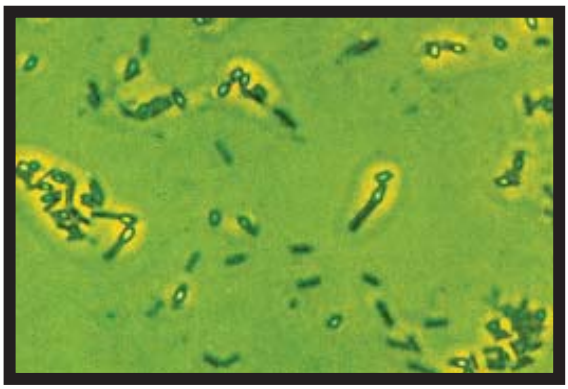
Operator's Kit

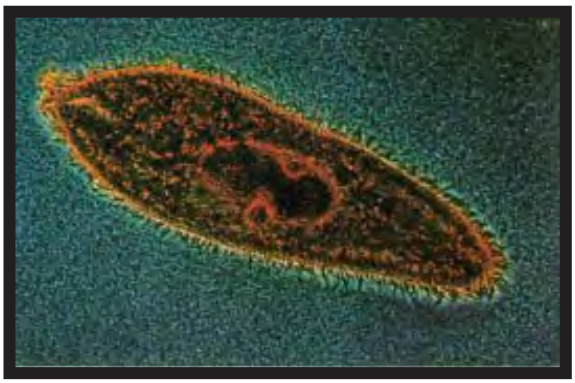
An operator's kit is provided with each TrojanUV3000Plus™. The following items are included in the kit:

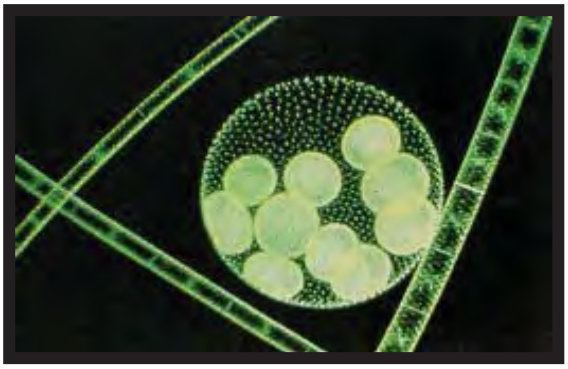
1. One clear UV face shield.
2. Four pairs of disposable vinyl gloves.
3. One 6 inch galvanized steel funnel for adding hydraulic oil to the Hydraulic System Center (HSC).
4. One Wiper Collar Cap Tool for the ActiClean™ Cleaning System.
5. One replacement filter for the Hydraulic System Center.
6. One hydraulic bleeder hose.
7. One bottle of rust inhibitor for hydraulic components (Safegard M1).

Chapter 1

INTRODUCTION TO UV THEORY







1 INTRODUCTION TO UV THEORY

1.1 What Is Ultraviolet Light?

Ultraviolet (UV) light is the portion of the electromagnetic spectrum with wavelengths between 100 and 400 nanometers (nm). Germicidal wavelengths are located in the spectral region of 200nm to 300nm. The low-pressure mercury lamp radiation is essentially monochromatic with its output at 253.7nm. The medium-pressure mercury lamp is polychromatic with germicidal output spread over different wavelengths.

1.2 Disinfection vs. Sterilization

Disinfection is the reduction of pathogens (disease causing microorganisms) to non-infectious levels, whereas sterilization is the total inactivation of all living cells and viruses.

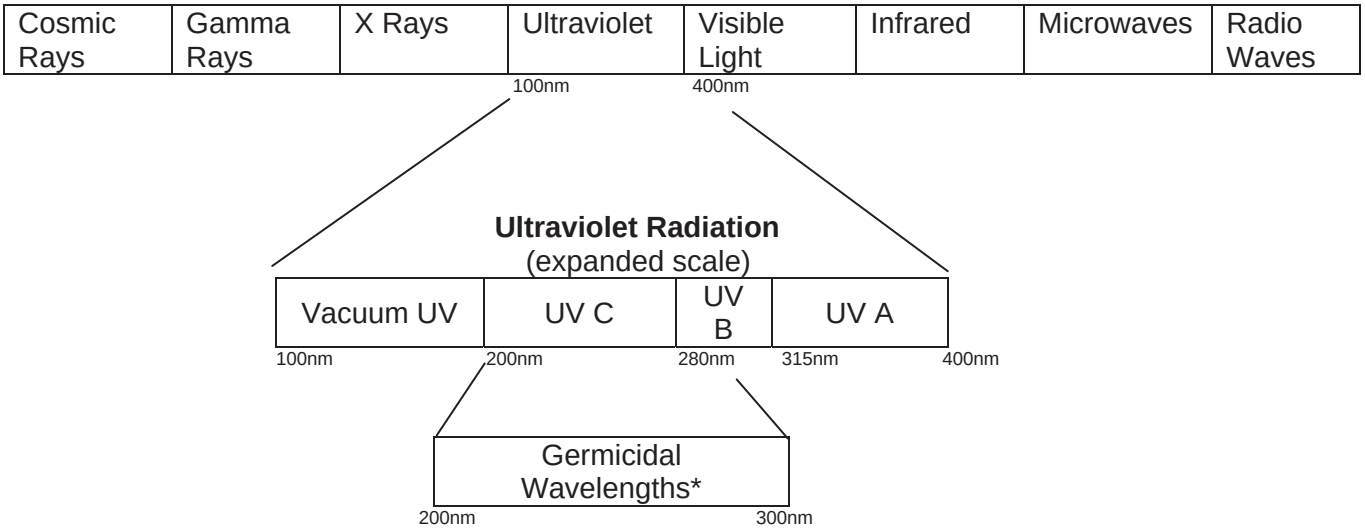
1.3 How Does UV Light Disinfect?

Microorganisms are inactivated by UV light as a result of photochemical damage to nucleic acids.

Cellular RNA and DNA absorb the high energy associated with short wavelength UV radiation. The absorption of UV energy, most strongly in the wavelength range of 240 to 280nm, results in the formation of new bonds between adjacent nucleotides, creating doubled structures or dimers in the nucleic acid. Dimerization of adjacent pyrimidines, particularly thymine in the case of DNA, is the most common photochemical damage. Formation of numerous thymine dimers in the DNA of bacteria and viruses prevents replication and results in cell death.

The amount of cell damage depends on the dose of UV energy absorbed by the microorganisms and their resistance to UV. Most bacteria and viruses require relatively low UV doses for inactivation. In general, bacteria are more sensitive than viruses, and the protozoan parasites *Cryptosporidium* and *Giardia* are more sensitive to UV than most

Electromagnetic Spectrum



*Peak effectiveness approximately 260-265nm

bacteria. Gram-negative bacilli are more sensitive than gram-positive cocci and bacterial spores.

1.4 Factors Affecting UV Disinfection

The UV dose delivered by a disinfection system is a product of UV intensity (milliwatts per square centimeter) and retention (exposure) time in seconds:

UV Dose = Intensity X Time

The units of dose are milliwatt seconds per square centimeter ($mW.s/cm^2$) or millijoules per square centimeter (mJ/cm^2).

"UV intensity" is affected by:

- wastewater quality,
- microbial inactivation kinetics,
- equipment/lamp configuration, and
- lamp age and sleeve fouling.

Temperature and pH do not affect UV disinfection.

Wastewater Quality

Common wastewater parameters that impact UV intensity are:

- UV Transmittance (%T), resulting from the presence of UV-absorbing organic and inorganic compounds (e.g., nitrate, iron).
- Total suspended solids (TSS) or more correctly, the characteristics of the particles that make up the TSS such as:
  - particle size distribution,
  - the number of particles in each size range,
  - particle optical properties.

UV Transmittance

UV Transmittance (%T) is a measure of the ability of the wastewater to transmit UV light. It is both a measure of water quality and an important design factor for sizing UV equipment.

Wastewater, with a higher %T, requires less UV energy input to disinfect. Reduced transmittance in wastewater effluent results in a lower UV intensity delivered through the effluent. The absorption of UV by the water is sometimes referred to as UV demand. Since UV dose = Intensity X Exposure Time, a reduced intensity due to water absorption of UV can be compensated for by increasing the retention time, increasing the number of lamps in the reactor, or increasing the lamp intensity (by increasing power to the lamps or changing to more powerful lamps).

UV Transmittance is measured with a UV spectrophotometer set at a wavelength of 254nm. The transmittance of a sample in a one-centimeter path length quartz cuvette is read as a percentage compared to pure water (set at 100%). A 60 %T means that the intensity entering the cuvette has fallen to 60% of that value in passing through one centimeter of sample water.

Transmittance decreases in the presence of UV absorbing substances and particles that either absorb or scatter UV light. This results in a reduction of available UV energy for disinfection.

Wastewater transmittance also depends on the concentration of industrial process waste relative to the total plant flow. Industries that influence UV transmittance include textile, printing, pulp and paper, food processing, meat and poultry processing, photo developing, and chemical manufacturing. The presence of UV-absorbing particles, dissolved organics and inorganics in the wastes of these industries will reduce transmittance.

Treatment process chemicals can also influence %T. Wastewater treatment processes may use metal salts for enhanced solids removal, phosphate reduction and odor control. Dissolved aluminum salts have no effect on UV transmittance, and flocculated solids containing aluminum do not show an increased resistance to UV disinfection relative to similar particles without aluminum.

Iron in water absorbs UV directly, fouls sleeves, and provides a protective shield by adsorption onto suspended solids and bacterial clumps.

Increased resistance to UV is experienced when there is increased amounts of iron associated with solids.

Wastewater transmittance depends on upstream treatment processes. In general, suspended growth processes produce effluents with transmittances that range from 60% to 65%. Fixed film processes range from 50% to 55%T and lagoons from 35% to 45%T.

Total Suspended Solids (TSS)

The Total Suspended Solids are composed of bacteria-laden particles of varying number and size. The solids enclose the interior bacteria, making it more difficult for UV or chemicals to disinfect wastewaters with higher levels of TSS. High TSS wastewaters generally also have larger particles that are more difficult to disinfect. In addition, increased iron content in the solids can result in shielding or protection of bacteria from UV. The protection by particles is directly related to the number, distribution of sizes, bacterial density, and chemical composition of the particles. Particles also reduce UV intensity in an effluent by absorbing and scattering UV light. These factors contribute to an increased UV demand in wastewater.

The measurements of particle size distribution in wastewater effluents are used to indicate filter and clarifier performance. Typically, particle sizes are related to the type of upstream wastewater process. Sedimentation and filtration result in a decrease in both the number and mean size of particles. Smaller particles are generally easier to disinfect unless they are laden with iron or otherwise optically dense.

Microbial Inactivation Kinetics - The UV Dose Response Curve

As shown in the below figure, low UV doses typically produce a rapid decrease in bacteria numbers. The linear relationship of log (surviving microbial counts) versus UV dose is typical first-order kinetics.

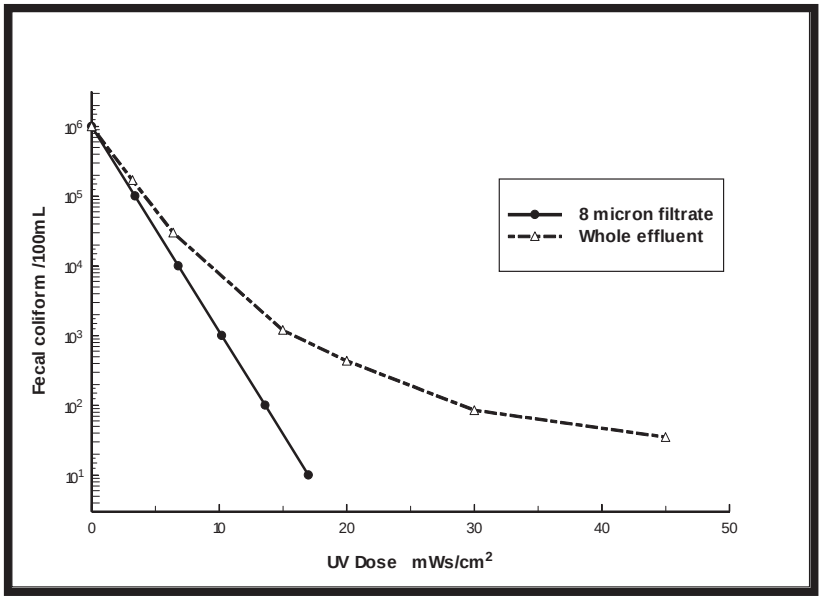
At higher doses a deviation or tailing occurs due to shielding of microbes within particles. The particles provide protection to microbes so that higher UV doses are required to penetrate and kill all the bacteria within the particles.

There is a bacterial density beyond which additional inactivation cannot be economically achieved. This is because some of the particles are large, or so opaque to UV that sufficient UV dose cannot be delivered to the most internal bacteria in these particles to cause inactivation. Surviving bacteria in a particle result in one microbial count for that particle when microbiological counts are performed. There is a diminishing return to applying additional dose due to the very slow accumulation of dose by these core microbes.

In such cases, alterations in up-stream processes that significantly improve effluent quality will have the added benefit of decreasing the UV dose required to achieve a desired disinfection limit.

Sedimentation and filtration result in a decrease in TSS levels, (decreased particle sizes and numbers). The figure shows that the result of filtration is a decrease in the UV dose required to achieve a given disinfection target.

Typical UV Dose-Response Curve for Filtered and Unfiltered Wastewater



UV Equipment Configuration

The UV reactor is configured to optimize the number of UV lamps required to provide a specific dose in the water quality being treated, and for the required hydraulic capacity. Optimal equipment configuration will produce adequate turbulent flow (mixing) and minimal headloss.

Lamp spacing is selected to control the water layer around the quartz sleeve and to provide the optimum average intensity for the water quality being treated and the headloss limitations.

Lamp Age and Sleeve Fouling

UV intensity gradually decreases with time and use due to lamp aging and sleeve fouling. This is factored into the design, so that equipment will maintain the required UV dose throughout the life of the UV lamps.

For proper performance, UV lamps should be replaced after the specified lamp life in the warranty.

Lamp life depends on the number of ON/OFF cycles used for flow pacing during disinfection.

Uniform intensity in a system can be managed with a staged lamp replacement schedule.

An accumulation of inorganic and organic solids on the quartz sleeve decreases the intensity of UV light that enters the surrounding water. The fouling rate varies with process and effluent types and may be more rapid in the presence of high concentrations of iron, calcium and magnesium ions.

Some Trojan systems have an ActiClean™ Cleaning System option that combines chemical and mechanical cleaning and significantly reduces operator maintenance time.

Chapter 2

SYSTEM OVERVIEW

2 SYSTEM OVERVIEW 2-1

2 SYSTEM OVERVIEW

2.1 System Components

The TrojanUV3000Plus™ is made up of several components:

- System Control Center (SCC)
- Power Distribution Center (PDC)
- UV Modules
- UV Sensor
- Water Level Control
- ActiClean™ Cleaning System and Hydraulic System Center (HSC)
- On-line UV Transmittance Controller and Sensor
- Water Level Sensor

System Control Center (SCC)

The SCC is an enclosure that contains all of the hardware required for central control of the system. It includes a PLC controller, the Operator Interface, input/output connections and communication hardware. The SCC is also equipped with an extensive alarm reporting system to ensure fast and accurate diagnosing of system process and maintenance alarms.

Power Distribution Center (PDC)

The PDC powers each bank of modules and spans the width of the channel. On Bank 1A the PDC also contains the Hydraulic System Center (HSC) equating to a combined PDC/HSC.

The PDC distributes power from the main electrical service out to the modules in the bank. It contains the communication and control equipment for the bank(s) of lamps.

UV Modules

The UV lamps are mounted in modules installed in open channels. The lamps are enclosed in quartz sleeves, which are positioned horizontally and parallel to the direction of flow. A bank or reactor is made up of 8 lamp modules that are placed in parallel positions and spaced 4 inches, depending on the system design. The number of lamps and lamp spacing in a UV module depends on effluent quality and flow rate. The module/bank configuration has been determined by Trojan Technologies and is based on relevant information collected from the site.

UV Sensor

Trojan Technologies' UV Sensor patent pending, measures the UV intensity produced in each bank of modules.

On 8-lamp modules, the sensor is positioned between the fifth and sixth lamp from the top.

The UV Sensor incorporates a photodiode that gathers UV light from the lamp underneath the sensor. The light is then converted into an analog signal displayed in mW/cm^2 at the Operator Interface in the SCC.

Water Level Control

A weir is used to maintain the appropriate water level over the lamps at all flows. Maintaining control of the water level ensures uniform UV exposure and protects the system by keeping the lamps submerged.

ActiClean™ Cleaning System (ACS) and Hydraulic System Center (HSC)

When the ACS is used, a magnetically coupled submersible wiper drive is supplied on each UV module. This patented design drives a wiper carriage assembly with attached wiper canisters along the UV modules. The wiper canisters surround each quartz lamp sleeve and are filled with a Trojan approved cleaning agent. Cleaning takes place when the cleaning fluid in the wiper

canisters contacts the lamp sleeves between two wiper seals.

Cleaning is achieved mechanically with the scraping action of the wiper seals and chemically by the chemical reaction between the cleaning agent and the build-up on the sleeves. The cleaning takes place while the lamps are submersed and while the lamps are operating.

All the lamp sleeves within the bank are cleaned simultaneously. The frequency of cleaning is adjustable at the Operator Interface in the SCC.

The ACS is hydraulically actuated using the HSC, which is a stainless steel enclosure located in close proximity to the UV channel as shown or attached directly to the PDC (not shown). The HSC contains the pump, valves, and reservoir for the ACS. The HSC pumps hydraulic fluid to manifolds resting below the PDC(s). Extend and retract hoses from each module are plugged into the manifold to complete the hydraulic loop. The fluid is used to extend and retract the magnetically coupled wiper drive on each module.

Water Level Sensor

Another feature is the low water level sensor. This sensor is positioned down stream of the system and provides a digital signal when the water level is too low. Under these conditions an alarm is triggered and displayed at the SCC.

When the water level is too low the bank will shutdown. The low water level sensor is a standard system feature.

On-line UV Transmittance Controller and Sensor

The Hach SC100 Controller and UVAS sc Sensor sample and measure the percent of UV transmittance (%T) in the effluent. The results are communicated to the SCC from the SC100 Controller and are used to adjust the UV dose in conjunction with flow signals and lamp ageOperations Overview

Control System Overview

The TrojanUV3000Plus™ is designed to operate automatically. Each system is custom sized and programmed to meet site-specific objectives.

The operation of the TrojanUV3000Plus™ is managed at the SCC by its PLC controller, which continuously monitors and controls the system's functions. The controller is the brain of the TrojanUV3000Plus™ control system and communicates with the Operator Interface, PDC and HSC. Custom electronics, pressure switches and water level sensor provide the controller with the necessary system parameters.

The Operator Interface allows complete control and monitoring of the entire TrojanUV3000Plus™ . The TrojanUV3000Plus™ operates using an automatic dose paced control system, to maintain an adequate UV dosage for the effluent flow conditions while conserving power.

The power to the UV lamps is automatically adjusted in response to analog inputs from the flow meter and On-Line UV Transmittance Controller and Sensor. These inputs are continually monitored in the SCC and the corresponding power setting is adjusted (i.e., turned up/down or on/off) in response to changes in flow or effluent quality. The SCC acts as the brain of the system as it receives input from all of the system monitoring devices and enables the lamps to respond accordingly.

A level control device is positioned just downstream of the reactor to maintain water over the lamps at all flows.

Each module bank uses a Communications Control Board (CCB), which controls and monitors the lamp, ballast and bank status. The CCB is located within the PDC. All communications to and from the PDC travel to the CPU module in the SCC through a RS485 serial link. The SCC polls each CCB in sequence to continually update the status of modules and ballasts. The messages are decoded by the controller and then checked for

errors prior to displaying the data on the Status screen.

The input/output card in the SCC receives two analog 4-20 mA signals that indicate:

- flow from the plant effluent flow meter, and
- percent Transmittance (%T) from the UV Transmittance Controller and Sensor.

These analog signals are communicated to the SCC via wires connected to the two analog inputs on the input/output (I/O) card in the SCC.

Alarm History and Alarm Summary screens provide the operator with an indication of system faults as they occur.

An auto answer modem located in the SCC permits off-site Trojan personnel to monitor system performance and assist in diagnosing faults.

ActiClean™ Cleaning System

The frequency of automatic cleaning is set by the operator and then implemented by the SCC.

Cleaning frequency is adjusted depending on the fouling rate and may be programmed to operate as frequently as once per hour. The recommended cleaning schedule in typical conditions is once every 24 hours.

The cleaning system can also be manually controlled using the Wiper Selector switches located on the HSC.

All modules in a bank are cleaned simultaneously. Each module is fitted with a patented magnetically coupled wiper drive and one wiping canister per lamp. Hydraulic fluid within the rod pushes the internal piston of the wiper drive to extend or retract depending on the direction of flow.

During a cleaning sequence, the solenoid opens and distributes hydraulic fluid from the HSC to the manifold underneath the PDC which then distributes fluid to each module via the hydraulic extend line. To retract the wiper drive, the solenoid switches and the direction of hydraulic fluid flow is reversed.

Maintenance Summary

Do not undertake operation, repairs or maintenance of equipment unless you are familiar with the operation and servicing of technical equipment and are trained in electrical and mechanical safety.

CAUTION

If you do not completely understand any of the information or procedures in this manual, call Trojan Technologies for assistance.

Common sense and good judgment are crucial to safe and successful operation and maintenance of the equipment. If your level of training, skill or comprehension of the material in this manual may in some way result in or contribute to injury, damage to the equipment or your ability to perform safe operation or maintenance work, have the work done by a qualified operator or Trojan Representative.

- Read the Warnings and Precautions section and General Lock out Procedure before operating or performing any maintenance on this equipment.
- Read procedures thoroughly before starting them.
- Review the warnings and cautions that accompany the procedures each time you prepare to perform maintenance on the TrojanUV3000Plus™.

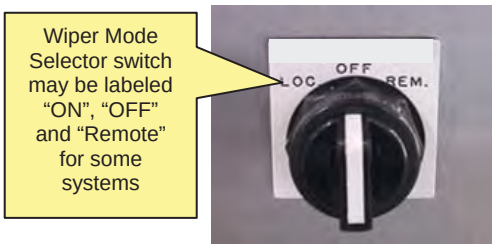
Chapter 3

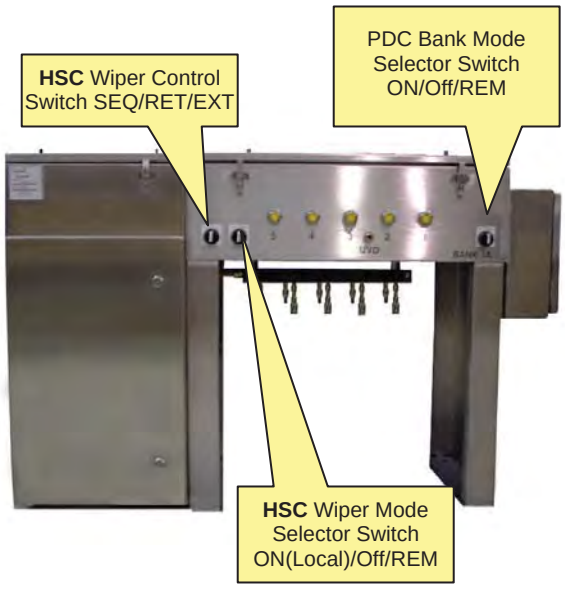
START UP AND SHUT DOWN PROCEDURES

3 START UP AND SHUT DOWN PROCEDURES

3.1 Start Up Of UV System

1. Ensure that all modules in a bank are inserted in the correct orientation. Refer to the Maintaining Staggered Module Configuration found in the UV Module chapter.
2. Ensure Bank Mode Selector switch on PDC is set to OFF.
3. Ensure that ALL Wiper Mode Selector switch(es) on HSC are in OFF position.



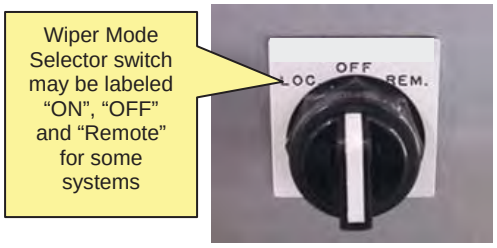


Combined PDC/HSC

4. Turn on main power breaker in SCC enclosure.
5. Turn on main power switch (i.e., disconnect switch or breaker) for PDC.

Note:	*The main power switch for the PDC is in a separate enclosure or panel and is not typically supplied by Trojan Technologies*

6. Turn on main power breaker on HSC enclosure.
7. Turn on other breakers in HSC and check to see if any of the breakers trip. If breakers trip, investigate and rectify fault.
8. Switch Bank Mode Selector switch on PDC to REM (remote).
9. Go to Bank Control Screen at SCC to verify bank is on REMOTE AUTO.
10. At the HSC, switch the Wiper Control switch to SEQ, then switch the Wiper Mode Selector for Bank 1A to LOC(local) or ON to initiate a wiper sequence and confirm that the wiper functions properly. If successful, switch the Wiper Mode Selector switch for Bank1A to REM (remote).
11. Switch HSC Wiper Control Switch to RET.



12. Repeat steps 1 – 10 for any additional banks.
13. Go to Wiper Control Screen at SCC and verify that wipers are in REMOTE AUTO.

3.2 Shut Down Of UV System

1. Go into Bank Control screen at SCC and put all banks in REMOTE OFF.
2. Go into Wiper Control Screen at SCC and put wipers in REMOTE OFF.
3. Turn Bank Mode Selector switches on PDC to OFF position.
4. Turn Wiper Mode Selector switches at HSC to OFF position.

3.3 Shut Down For Prolonged Periods

In some instances, wastewater treatment plants are only required to have seasonable disinfection.

If that is the case, the following procedures should be completed to winterize the UV equipment. The procedures apply to plants that continue effluent flow through UV equipment but do not disinfect during the winter season.

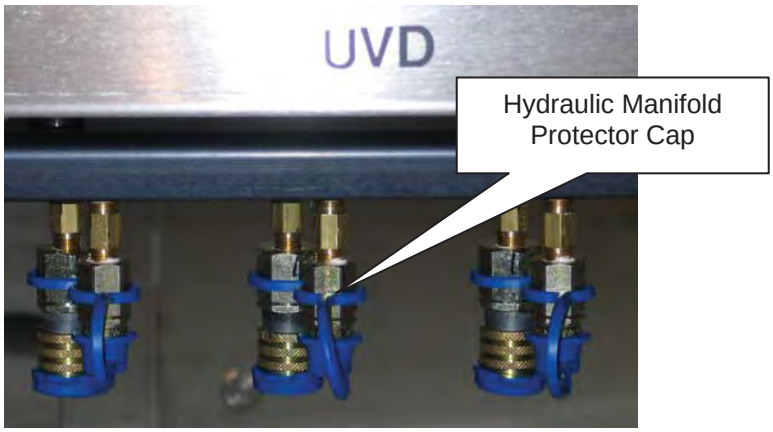
UV Modules

The primary concern for UV modules during the winter season is the potential for damage to the quartz sleeves and lamps if the effluent is allowed to freeze. To avoid damage remove the modules from the channel.

To remove modules, disable the modules at SCC and then unplug each of the connections to the individual modules at the front of the PDC. (See Disconnect Module Power and Hydraulic Lines in the UV Module chapter.)

Prolonged Shut Down of ActiClean™ Cleaning System

1. Follow the Drain Wiper System found in the ActiClean™ Cleaning System chapter to remove the module from the channel and drain the wiper system.
2. Close the top Wiper Filler plug.
3. Put protective caps (provided by Trojan) on the PDC receptacles and UV Module power cords.
4. Cap the hydraulic manifold couplers and hydraulic hose ends with the attached protective caps.



5. Fill hydraulic cylinder with food grade grease provided in the kit. Follow the Grease the Hydraulic Cylinder procedure found in the ACS chapter.
6. Store the dry module (without cleaning agent or water) in a dry location for the winter season.

Prolonged Shut Down Procedure of On-Line UV Transmittance Controller and Sensor

If the On-line UV Transmittance Controller and Sensor are to be shut down for an extended period of time (such as for winter months), follow these procedures.

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

WARNING

Wear UV Resistant Face Shield!

Always wear goggles or face shield when working with lamps or sleeves to protect against cuts in the event of breakage

1. Shut down all power to On-line UV Transmittance Controller.
2. Disconnect the On-Line UV Transmittance Sensor from the controller.
3. Clean the On-Line Transmittance Sensor especially the optical path. Use either dilluted acid or bleach.

CAUTION

Use either diluted acid or bleach cleanser, not both.

4. Dry off the On-Line UV Transmittance Sensor.
5. Disconnect the On-Line UV Controller.
6. Store both the controller and sensor in a dry, clean location, where the temperature is above freezing.

Start Up Procedure for the On-Line UV Transmittance Controller and Sensor

1. Install and calibrate the On-Line UV Transmittance Controller and Sensor as required in the UVAS sc Sensor User Manual found in the Miscellaneous Equipment Appendix of this manual. Contact the Hach Company directly for assistance.

Chapter 4

SYSTEM CONTROL CENTER

4 SYSTEM CONTROL CENTER 4-1

4 SYSTEM CONTROL CENTER

4.1 SCC Overview

Description

The operation of the TrojanUV3000Plus™ is managed at the System Control Center (SCC), which houses a PLC based controller and the Operator Interface. The PLC controller evaluates inputs and outputs from the system's components, monitors system status, makes adjustments, provides notification of system faults and triggers the alarm system. Information processed by the PLC controller is displayed at the Operator Interface and allows the operator to further monitor and control system functions.

Standard Allen Bradley CompactLogix L32E components shown below.

Note:	*Components may very depending on the processor provided,*

The PLC is programmed to provide safe and efficient control of the UV system's banks of lamps as it interfaces with the Power Distribution Center (PDC), Communication Control Boards (CCB), effluent flow signal, On-line UV Transmittance Controller and Sensor and Hydraulic System Center (HSC). Information from these sources is used to control the automatic dose-pace strategy for the UV lamp banks.

The Operator Interface consists of a touchscreen display located on the SCC door. It allows the operator to monitor and control all UV system functions.

The TrojanUV3000Plus™ is designed to run in either automatic mode (the PLC monitors and controls the UV dosage produced by the banks) or manual mode (the operator selects the power level). When the ActiClean™ Cleaning System (ACS) is used the PLC also controls the wiper system when in the automatic mode.

An extensive alarm reporting system provides the operator with the tools for fast and accurate diagnosis of system process problems and maintenance alarms.

The SCC also houses an optional auto-answer modem, which allows remote monitoring and troubleshooting by Trojan service personnel.

Specifications

Item	Value
Enclosure	• 304 stainless steel, wall mounted • UL Listed to U.S. and Canadian standards • built to Type 4X requirements for watertight enclosures when required
Power requirements	120 VAC 60 Hz, 2 kVA, typical

? HOW TO INFO

Maintenance

Like all steel products exposed to the outdoor environment, the enclosure's exterior should be washed monthly with a mild soap and water solution.

A damp sponge or soft cloth should be used for regular cleaning. Do not use any corrosive cleansers on the SCC cabinet or Operator Interface.

Operation

The operator may run each bank in automatic mode, which allows the PLC controller to monitor and control the UV dosage or in manual mode through the Operator Interface. Additionally local bank control override switches are available for each on the PDC enclosure. To allow local control of the UV banks, bypass the PLC controller by placing the Bank Mode Selector switch(s) on the PDC(s) in the Local On or Off position.

A detailed description of the operation of each of the Operator Interface screens is provided in this chapter.

Power Up/Power Down Procedure

Follow the steps in the Start Up and Shut Down Procedures chapter to power up the SCC.

When the SCC is started up, the PLC controller and Panelview Plus Operator Interface perform self-diagnostics and read the status of each UV bank from the CCBs. The Operator Interface display shows diagnostic messages until the power up sequence is complete. The interface will then display the System Overview screen.

After the system is powered up, the operator should verify that the system is communicating with the UV banks and displaying the correct bank mode and lamp status on the Bank Overview Screen. All banks that were currently running prior to the SCC being restarted will go through a warm-up sequence and continue to run.

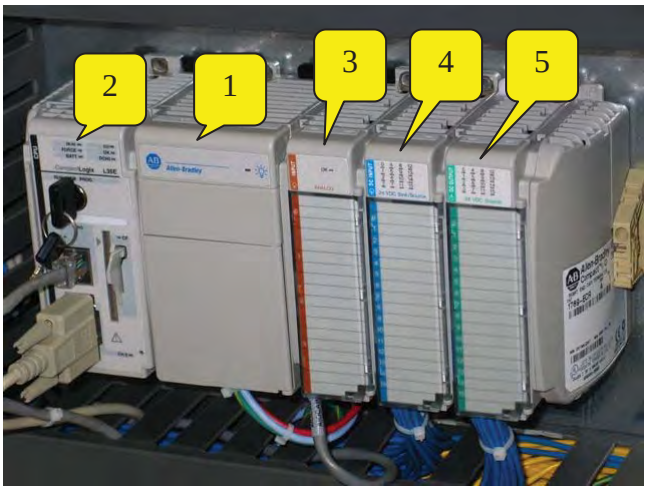
4.2 PLC Controller

Description

The PLC controller contains the control program for the UV system and interfaces with the UV lamp banks, Operator Interface, and other required discrete and analog signals.

Standard Allen Bradley CompactLogix L32E components shown below.

Note:	*Components may very depending on the processor provided,*



1. Power Supply
2. PLC Processor
3. Analog Input Card
4. Discrete Output Card
5. Discrete Input Card (Optional)

The appropriate discrete and analog signal cards must be installed in the backplane for each signal terminated. The PLC consists of:

- power supply that provides DC power to PLC Processor and other interface cards,
- PLC processor that contains UV control program and processes all incoming and outgoing data,
- analog input card to receive process control data from plant flow and UV Transmittance signals,
- communication protocol card where required to support existing SCADA networks, and
- additional optional input and output cards as required by the project.

The PLC controller is pre-configured at the factory with inputs and outputs as required for each system. Trojan Technologies configures the functionality of each of the signals in the control strategy.

Power Supply

A 120 VAC supply is filtered, transformed and rectified on-board to supply all circuits with their required power. All logic circuits are powered by +5VDC and +24VDC. A power LED is illuminated on the power supply when power is present.

PLC Processor

A PLC processor continuously runs the UV control program, and polls the analog and discrete input and output cards to transfer data to and from the field.

The standard processor is an Allen Bradley CompactLogix L32E. An onboard serial port is connected to a converter that changes the signal to RS485 and is used to communicate with the PDC and HSC communication boards. This port is specifically configured to talk to the UV CCBs and cannot be used as a PLC programming port unless the processor memory is cleared. An onboard Ethernet network port is used to communicate with the operator interface and optionally a plant supervisory system and to connect a programming PC.

Analog Input Card

A 4 channel analog input card is supplied, and add on cards are available, to allow interfacing with external devices (e.g. plant flowmeter, turbidity meter, etc.).

Optional 2 channel analog output cards are also available to allow the output of process variables (e.g. flow, UV Transmittance, bank intensity) to a plant supervisory (SCADA) system.

Discrete I/O

A 16 channel discrete output card is supplied with every SCC.

Output cards are used for sending status and alarm information to a plant supervisory system, or directly controlling discrete devices (e.g. slide gates). Discrete signals are terminated passed through a form C relay before being terminated to customer interface cabling. Alarm Status outputs (Critical Common Alarm, Major Common Alarm, and Minor Common Alarm) are normally closed contacts that create a fail safe output. The outputs will remain on (closed) while alarm conditions are not active and power is present. If an alarm condition occurs or power is lost the contact will be turned off (open) to signal the alarm active.

Optionally a discrete input card may also be supplied. Input cards are used for receiving system control signals (e.g., gate open) at the controller.

Remote Monitoring

Each SCC panel is equipped with an Ethernet switch to allow interconnection of the PLC, HMI (Human Machine Interface) and Plant SCADA networks. Optionally this switch can be equipped with a dial-in modem/router function.

The modem is used to allow off-site Trojan Technologies service personnel to access the SCC for monitoring and troubleshooting purposes.

A dedicated telephone line must be made available to connect to the modem for this feature.

Specifications

Item	Value
Power	120 VAC input, 60Hz
Communication	Allen Bradley Ethernet/IP to operator interface and plant SCADA, RS485 to bank Communication Control Boards, and Hydraulic Control Boards
Modem	Allen Bradley 9300-RADES Modem Router with 4 port Ethernet switch
Discrete I/O cards	16 -point cards available
Analog I/O cards	4-channel analog input card standard, 2 channel output cards available
PLC power supply fuse	typically 3.15 Amp, 250 Volt

? HOW TO INFO

Maintenance

An AC power supply fuse is located inside the power supply cover door, and may require replacement if a power surge or short circuit occurs.

Remove or Replace Power Supply Fuse

1. Ensure AC supply to power is disconnected.
2. Remove fuse with a small screwdriver and test.
3. Replace fuse with identical spare.

PLC Program Reload

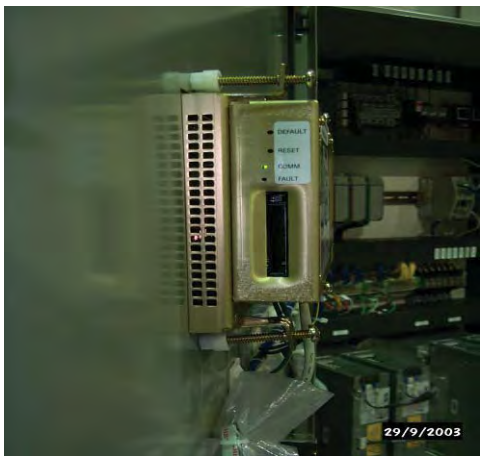
In the event that the program in the UV PLC has been lost or corrupted due to a failed battery or if a new PLC processor is installed, the UV PLC program may be reloaded into the processor by following these steps:

1. Power down the SCC.
2. Remove the CompactFlash card from the operator interface (installed in a slot in the right hand side of the unit inside the cabinet).
3. Install the CompactFlash card in the PLC processor.
4. Restore power to the SCC and wait 2 minutes. The PLC program for the UV PLC will now be restored to the originally shipped program.
5. Remove the CompactFlash card from the PLC and install it back in the operator interface.
6. Power cycle the SCC to restore operator interface data-loggin functionality.

Note:	*A PLC program restored in this manner will return to the shipped program status. Current lamp hours for each bank will need to be reentered on the Bank Overview screen and any other configuration or programming changes made since the original system startup must be reentered on the appropriate System Setting.*

CompactFlash Card

CompactFlash Card Slot in Operator Interface



CompactFlash Card Slot in PLC

Standard Allen Bradley CompactLogix L32E components shown above.

Note:	*Components may very depending on the processor provided,*

4.3 Panelview Plus Operator Interface

Description

The Panelview Plus Operator Interface consists of a graphical active matrix touchscreen display. The entire unit is mounted on the SCC door. The Operator Interface communicates information to the PLC using the Allen Bradley Ethernet/IP network protocol.

Specifications

Item	Value
Power	24 VDC input
Communication	Allen Bradley Ethernet/IP protocol
Display	6.5” color active matrix display – 640 x 480 resolution

? HOW TO INFO

Maintenance

A damp sponge or soft cloth should be used for regular cleaning. Do not use any corrosive cleansers on the Operator Interface.

Operation

The operations available for UV system control through the Panelview Plus Operator Interface are summarized below, and more fully described in the Operator Interface Screens section.

Note:	*The operation of the PLC controller can be fully bypassed by the Bank Mode selector switch(s) on the PDC(s). These switches must be in the Remote position to allow control of the UV banks through the Operator Interface .*

The Operator Interface is controlled through a combination of touchscreen buttons (called pushbuttons in this document).

Select Flow Signal Source

Typically the dose pacing routine will use a plant flow meter as the source of the flow value. If the flow meter has failed or is not used a Manual Flow value must be entered.

Manually Enter Flow Value

1. Access the System Overview Screen.
2. Toggle Flow source selector switch to Manual Flow.
3. Enter desired flow value using pop-up numeric touch pad.

Refer to the System Overview Screen section for further details.

Select UV Transmittance Source

Typically the dose pacing routine will use the optional UV Transmittance Controller and Sensor as the source of the UV transmittance value. If the UV Transmittance Controller or Sensor has failed or is not used a UV Transmittance value must be entered.

Manually Enter UV Transmittance Value

1. Access the System Overview Screen.
2. Toggle UV transmittance source selector switch to Manual UVT if not already selected.
3. Enter desired transmittance value using pop-up numeric touch pad.

Refer to the System Overview Screen section for further details.

Control the ActiClean™ Cleaning System (ACS)

ACS control is initiated through the Wiper Overview Screen. From this screen the operator can manually initiate a wipe sequence for each wiper group, and enable or disable wiping for an entire wiper group.

Initiate a Wipe For One Wiper Group

1. Use the Next and Prev buttons to navigate to the desired Hydraulic Control Board (HCB) and wiper group.
2. Toggle the INITIATE WIPE selector on the screen.

   This selector shares a dual role and will display the message SEQUENCE IN PROGRESS if a wipe has already been initiated on the wiper group currently displayed.

Refer to the Wiper Control Screen section for further details.

Reset Lamp Life Hours

The running time of UV bank lamps is maintained through counters for each bank. When a bank's lamps have been replaced, its lamp counter can be reset.

1. Press the Security menu button and the Login menu button and enter the plant maintenace Username and Password.
2. Access the Bank Overview Screen.
3. Press the Lamp Hours text on the screen and a window will appear that allows entry of a new value.
4. Select the box for the new Lamp Hours value and enter 0. Press the blue enter symbol on the screen to accept the new Lamp Hour value
5. Press the Close button to close the entry window.

Refer to the System Settings Screen section for further details.

Control Banks

All Bank control functions are accessed through the Bank Overview Screen.

From this screen, the operator can set the operational mode for each bank to:

- REMOTE OFF,
- REMOTE HAND,
- REMOTE AUTO, or
- SCADA HAND

Before performing any operation on a bank, make sure the information being displayed is for the desired bank. Use the NEXT BANK and PREV BANK (and NEXT CHAN, PREV CHAN buttons if operating a multi-channel system) pushbuttons to access the correct bank.

Select Bank Control Functions

1. Press the View Bank Control pushbutton at the top right hand corner of the screen to toggle the control button area of the screen from Module Control to Bank Control buttons if necessary.

Operate Bank in REMOTE OFF

1. Press the OFF pushbutton.

   The lamps in that bank will be shut off.

Operate Bank in REMOTE HAND

1. Press the HAND pushbutton.

   The selected bank's lamps will be energized at 100% power for a warm-up period.

   To set power level for that bank, select MANUAL PWR entry field and enter the desired power setting.

2. Push the blue enter symbol on the screen to accept the new manual power value.

Operate Bank in REMOTE AUTO

1. Press the Auto pushbutton.

   The controller will then include that bank in dose pacing routine.

Control Modules

Each module can be individually controlled to allow Enabling/Disabling or Reset functions.

1. Press the HAND pushbutton.

Select Module Control Functions

1. Press the View Module Control pushbutton at the top right hand corner of the screen to toggle the control button area of the screen from Bank Control to Module Control buttons if necessary.
2. Use the left/right arrow symbols to navigate to the desired module.

Enable/Disable Modules

Each module also has an Enable/Disable indicator which shows the current enable status. Push the Enable or Disable button to toggle the status for the selected module. Push and hold the enable button to enable all modules in the selected bank. Disabled modules will not power their lamps.

Note:	*Disabled modules will not operate and may result in inadequate bank disinfection performance.*

Reset Modules

Each module also has a Reset indicator which shows the current reset status. Push the Reset button to initiate a reset sequence for the selected module.

Refer to the Bank Overview Screen section for further details.

Assign the Lead Bank or Channel

The lead and lag UV banks or channels can be rotated through the Priority Assignment Screen. Navigate to the System Overview and select the Next Rotation pushbutton to access this screen.

Assign the desired bank and channel number for the lead, 1st lag and 2nd lag banks and channels. The same bank and channel numbers cannot be assigned more than once. Press the blue Accept Priority Changes button to activate the changes.

Refer to the Priority Assignment Screen section for further details.

Check or Change System Settings

The configuration settings for the UV system are accessed, reviewed or changed through the System Settings Screens.

Press the numeric entry box, for the value you wish to change, followed by the Enter (↵) pushbutton. Use the pop-up numeric touch pad to enter the desired value.

Refer to the System Settings Screen section for further details.

	**CAUTION**
	Do not change any setting without being aware of the consequences to the system operation. Contact Trojan Technologies before making changes.

Set System Clock

The system time and date are accessed through the System Information Screen.

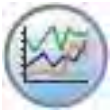
1. Press the desired hour, minute or seconds window.
2. Enter the desired value using the pop-up numeric touch pad.

4.4 Operator Interface Screen

Screen Navigation Bar

All Operator Interface Screens contain a common Screen Navigation Bar at the bottom. This bar contains screen selection buttons to allow the operator to easily move to the desired screen in any area regardless of the currently displayed screen. The navigator can enter any screen by pushing the desired “goto” selector pushbutton on the touchscreen.

The Screen Navigation Bar allows access to the following screens and system information:

Overview 	An operational summary of all UV channels and banks. Allows access to Priority Assignment screen and to manually enter flow and UV Transmittance values
Alarm Status Screen 	Displays a list of the currently active alarms and allows access to Alarm History screen
Trend Screen 	Displays trend data for Flow, UV Tranmittance and Dose
Security 	Pops up Login and Logout buttons on the Navigation bar to allow control of user security level
Information Screen 	Displays current system hardware and software diagnostic information and allows access to change clock time and exit to operator interface maintenance functions.
Settings Screens 	Allows access to system configuration settings as allowed by current security level. Settings are organized in pages by function.
Wiper Overview Screen 	Allows access to control Wiper system.
Bank Overview Screens	Allows access to
	control UV banks and display bank specific information.
Channel Oveview Screen 	Allows access to control slide gates and display channel specific information.
Help 	Displays help text for the currently selected screen.

The sections that follow describe the control and monitoring functions of all of the above screens in detail.

Screen Color Codes and Icons

The Operator Interface screens utilizes the following color codes within all user screens:

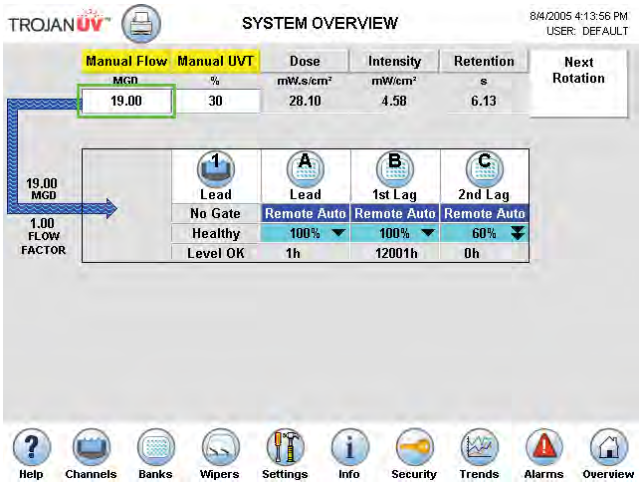
- Black text on a gray background – represents static text or numeric data that is unable to be changed by an operator at the current security level
- Black text on a white background – represents an active button or numeric entry field that will either change the currently displayed screen, or will allow entry of numeric data
- Black text on a yellow background – represents a function that is a manually controlled mode
- Light blue background for text or symbol – represents a running status for UV lamps
- Black background for text or symbol – represents a not running status for UV lamps

- Red background for text or symbol – represent faulted equipment
- White Text on a Blue background – represents a function controlled by the PLC

Icons are used on many screens to visually identify system components and conditions. They are further described in the sections that follow for the screens where they are used.

System Overview Screen

The System Overview screen provides a summary of the operation of all UV banks and reports the current UV Dose and displays associated signals relating to dose calculation.



ICON USE The following icons are used on this display:

- indicates a faulted bank or channel
- indicates a bank is in warm-up mode
- indicates a bank is timing-off
- indicates a bank's power is dampening

The System Overview Screen provides the following information relating to the UV disinfection system.

Across the top of the screen, the following system parameters are displayed:

FLOW / MANUAL FLOW

Displays the current total system flow value used for dose pacing. The Flow / Manual Flow selector above the currently displayed flow value will toggle the current flow signal source between the configured input instrument source, and a manually entered value. If a manually entered value is selected, the background for the flow value turns white and will allow an operator to enter the desired manual flow value. The manual flow value will automatically be used any time there is a flow meter instrument failure either due to a loss of input signal, or a SCADA communication failure when a SCADA Flow source is configured. The flow signal many be configured to be displayed in MGD, L/s, MLD or M^3/Day units.

Note:	*The flow rate units, MGD, L/S, MLD, and M^3/Day are configured by Trojan Technologies in the configuration screens.*

UVT / MANUAL UVT Displays the current UV Transmittance value used for dose pacing. The UVT / Manual UVT selector above the currently displayed UVT value will toggle the current flow signal source between the configured input instrument source, and a manually entered value. If a manually entered value is selected, the background for the UVT value turns white and will allow an operator to enter the desired manual UVT value. The manual UVT value will automatically be used any time there is a UVT meter instrument failure either due to a loss of input signal. UVT is always displayed as a % value.

UV DOSE Displays the average theoretical applied UV dose output of all banks currently in operation. The applied UV dose is calculated based on UV transmittance, operating power levels of the banks, flow, and linear reduction due to lamp aging.

INTENSITY Displays the average theoretical delivered UV intensity output of all banks currently in operation. This is only displayed when the UVDis mode of dose calculation is configured.

RETENTION TIME Displays the retention time of effluent within the UV system. The retention time is the amount of time that the effluent is exposed to the UV disinfection process. This is only displayed when the UVDis mode of dose calculation is configured.

NEXT ROTATION Is a screen navigation selector which will change the display to the Priority Assignment screen. Additionally, this selector will indicate the remaining time until an automatic lead bank and lead channel rotation will occur. This indication will be masked until there is less than 500 hours remaining until the next rotation. An automatic lead rotation will occur when the current lead bank in the lead channel reaches the End of Lamp Life configured for the installed lamp type. The automatic rotation may also be disabled through configuration settings.

Across the middle of the screen, information is displayed in rows for each configured channel relating to the operation of the UV equipment in that channel. A channel icon is displayed with the channel number above a set of channel specific information. To the right of this, a bank icon is displayed with the bank identifier above a set of bank specific information for each configured bank in each channel. The following information is displayed**:**

Channel Information

CHANNEL PRIORITY Displays the current Lead / Lag status for the channel. A lag channel will only be operated when required for high flow conditions.

GATE MODE Displays the current mode of the inlet slide gate for the channel. A slide gate may be in one of the following modes:

- No Gate – not configured for control by the UV PLC
- Local – not currently available for control by the UV PLC
- Hand – available for operator control by the UV PLC
- Auto – automatically controlled as required for dose pacing by the UV PLC

CHANNEL STATUS Displays the current alarm status of the channel. Will display a Healthy status if there are no major or critical faults on any banks or channel slide gates.

CHANNEL LEVEL STATUS Displays the current level status of the channel. If all banks in the channel are experiencing a low level shutdown, a Low Level alarm message will appear. If a configured High level sensor indicates an alarm condition, a High Level alarm message will appear.

Bank Information

BANK PRIORITY Displays the current Lead Lag status for the bank. Lag banks are only operated when required to meet dose conditions. A lag bank that is not required for dose pacing will time off and will display the timing-off icon.

BANK MODE Displays the current control mode of the bank**.** A bank may be in one of the following modes:

- Local Off – set at the control switch on the bank's PDC to force bank to stay off
- Local On – set at the control switch on the bank's PDC to force bank to stay on at full power
- Remote Off – the control switch at the bank's PDC is in the Remote position, and the bank has been selected in the Off mode on the Bank Overview screen
- Remote Hand - the control switch at the bank's PDC is in the Remote position, and the bank has been selected in the Hand mode on the Bank Overview screen. In this mode the bank is operating and the power level is set by the operator
- Remote Auto – the control switch at the bank's PDC is in the Remote position, and the bank has been selected in the Auto mode on the Bank Overview

screen. In this mode the bank's on/off status and power level are controlled as required to meet dose, by the UV PLC

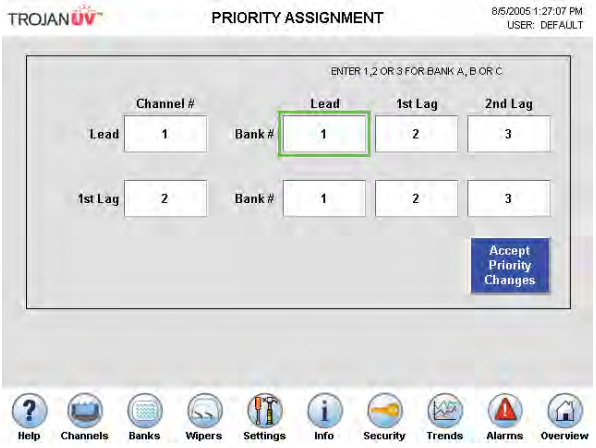
BANK POWER Displays the current power level of the bank**.** An icon is also displayed beside the power level indicator to indicate a condition that may affect the current bank power level as follows:

- Warming Up – when a bank is energized, it will remain at full power for a configured warm-up period (10 min) in order to protect lamp life
- Timing Off – when a bank is no longer required for dose pacing, a time-off timer will run for its configured time period before the bank can be turned off and the power level of the bank will be kept at minimum power (60%)
- Dampening – when the power level of a bank is allowed to reduce due to an overdosing condition, a dampen timer will run for its configured time period (2 min) before the bank power will drop in order to reduce lamp power cycling

LAMP LIFE HOURS Displays the total lamp accumulated runtime. When a bank is placed in either the MANUAL ON or AUTOMATIC ON modes of operation this value will increment by one for every hour of lamp operation. This value will increase throughout the entire life span of a bank's lamps until the lamps are changed and the value is reset to zero.

Priority Assignment Screen

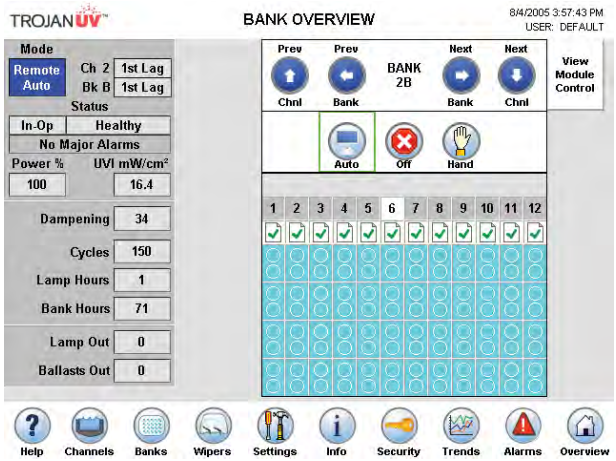
The Priority Assignment Screen allows an operator to manually assign the lead and lag status to channels and banks within each channel**.** Any assignment can be made as required as long as a bank or channel number is not assigned to more than one status. If the automatic Auto Bank Sorting option is enabled, and a bank that has already reached its configured end of lamp life hours is manually assigned to the lead status, it will automatically rotate to a lag status immediately after being manually assigned as lead. Automatic Bank



Sorting will operate any time the lead bank in the lead channel reaches the end of lamp life, and will then assign this bank as the last lag bank and cycle the lead status to the next bank in the channel. The lead channel will also toggle at this time as well in a multi-channel system. If required, a specific bank may be removed from Auto Bank Sorting if desired so that it is always designated as the last lag bank.

Bank Overview Screen

The Bank Overview screen displays information about the selected UV bank and allows control of bank functions.



ICON USE The following icons are used on this display:

- indicates a faulted input
- indicates a module is resetting
- indicates a module is not communicating with the PDC
- indicates a module is enabled
- indicates a module is disabled

The operator is provided the following information relating to each bank.

Starting at top left of the screen a column of data is displayed about the selected bank.

BANK OPERATIONAL MODE INDICATOR Displays the bank's current operational mode as LOCAL OFF, LOCAL ON, REMOTE OFF, REMOTE AUTO, REMOTE HAND, or SCADA HAND. The operator has control over a bank's operational mode with the pushbuttons on the screen and remote selector switch(s) on the PDC(s). The screen illustration displays Bank 2B in the Remote Auto mode of operation.

CHANNEL LEAD/LAG STATUS INDICATOR Indicates if the channel selected is the lead or the lag channel in the system. The screen illustration displays Channel 2 as the 1st Lag channel in the system.

BANK LEAD/LAG STATUS INDICATOR Indicates if the bank selected is the lead or the lag bank in the system. The screen illustration displays Bank 2B as the 1st Lag bank in the system. The automatic dose pacing system cycles the banks to ensure equal lamp life usage and wear. The operator may also change the current lead bank selection manually. See the Priority Assignment Screens section for further information.

OPERATIONAL MODE INDICATOR Represents whether the bank is currently being used for disinfection and will display the message OFF or IN-OP. The screen illustration indicates that Bank 2B is IN-OP.

HEALTH STATUS INDICATOR Represents whether the selected bank is currently in a Healthy or Unhealthy condition. A bank in a Remote mode will be healthy unless it has a low water shutdown, a power loss fault, or is manually shut off.

MAJOR ALARM INDICATOR Indicates if any major alarms are present for the selected bank. A bank will have a major alarm condition if it has a module communication error, multiple ballast fault, multiple lamp fault, is not in remote auto, has a CCB communication fault a power lost fault. A bank with a major alarm condition may be timed-off by the Dose Pacing routine if another bank is available to be operated in it's place.

BANK POWER LEVEL Displays the power level in percent that the bank is currently being requested to run at for all modes of operation. Only one power level can be achieved for all of the lamps and ballasts in a bank.

UVI (UV INTENSITY) Displays the UV Intensity value as measured by the UV Intensity probe in either % or engineering units (mW/cm^2) as configured in the settings screens. The Engineering Units mode is only available when the UVDis dose calculation mode is configured. The UV Intensity value then calculates an average bank intensity value at the current UV Transmittance of the system, based on the measured current from the intensity probe. When the % mode is selected, the UV Intensity value displayed represents the ratio between the currently measured intensity probe value and the predicted theoretical current at the present UV Transmittance and bank power level. A value of 100% would represent a probe that is reading an ideal predicted intensity value at the current conditions.

BANK TRANSITION STATUS INDICATOR Indicates when a bank is in transition between on or off operation. A message box will appear displaying one of the following messages as well as a countdown timer that shows how much time (seconds) is remaining in the current state:

- WARM UP – Indicates the bank has been requested to run and is currently in a 100%

power warm up state. The bank will remain in this state for the duration of the bank warm up period, which is set on a System Settings screen.

- POWER ON RESET – Indicates that a bank had been powered down and is now in the process of reestablishing communication.
- TIMING OFF – Indicates that the bank is no longer requested by the dose pacing routine and will be shut down when bank time off timer has expired. The bank time off delay time is set on a System Settings Screen.
- DAMPENING – Indicates that the power level is allowed to drop to meet dose requirements, but will not do so until the configured Dampening timer has expired.

CYCLES Displays the number of on/off cycles that the bank has experienced over time.

LAMP HOURS When a bank is placed in either the MANUAL ON or AUTOMATIC ON modes of operation this value will increment by one for every hour of operation. This value will increase until it is manually reset to 0 when new lamps are installed in a bank. This value is used to determine the reduction in lamp output as they age.

BANK HOURS When a bank is placed in either the MANUAL ON or AUTOMATIC ON modes of operation this value will increment by one for every hour of operation. This value will increase throughout the entire life span of the UV system.

LAMPS OUT Indicates the number of lamps that are failed in the bank.

BALLASTS OUT Indicates the number of ballasts that are failed in the bank.

Starting at top middle of the screen buttons are available to change the selected bank, and to control bank and module functions. A summary of the operational status of each module appears at the bottom of this area.

PREV CHANNEL 

Changes the selected bank for display to banks in the previous channel. This button is masked on a single channel system.

NEXT CHANNEL 

Changes the selected bank for display to banks in the next channel. This button is masked on a single channel system.

PREV BANK 

Changes the selected bank for display to the previous bank in the channel.

NEXT BANK 

Changes the selected bank for display to the next bank in the channel.

BANK / MODULE CONTROL SELECT

Changes the row of control buttons between Bank and Module control buttons when pressed.

When the Bank Control buttons are selected for display, the following buttons are available:

BANK AUTO MODE SELECTOR 

Changes the mode of operation to Remote Auto if the selected bank is in the Remote mode.

BANK OFF MODE SELECTOR 

Changes the mode of operation to Remote Off if the selected bank is in the Remote mode.

BANK HAND MODE SELECTOR 

Changes the mode of operation to Remote Hand if the selected bank is in the Remote mode. When Remote Hand mode is selected, the Manual Power entry box appears to the right of the Hand mode selector. By touching the power level entry box, the operator can enter the desired bank power level. The blue enter icon must then be pressed to accept the entered power level. A bank in Remote Hand must complete it's warm-up time before it will go to an entered power level other than 100%.

BANK SCADA MODE SELECTOR

Changes the mode of operation to SCADA Hand if the selected bank is in the Remote mode. This option will be masked unless SCADA Control is configured in the System Settings. When SCADA Hand mode is selected, each bank is started and stopped by a bit transmitted by the plant SCADA system, and the bank power level is also sent by SCADA. A bank in SCADA Hand must complete its warm-up time before it will go to a transmitted power level other than 100%.

When the Module Control buttons are selected for display, the following buttons are available:

PREV MODULE

Changes the selected module for to the previous module in the bank. Holding this button will cause the module selection to jump by 1 page to the previous page of modules.

NEXT MODULE

Changes the selected module for to the next module in the bank. Holding this button will cause the module selection to jump by 1 page to the next page of modules.

MODULE ENABLE SELECTOR

Enables the selected module so that it will operate as requested by the bank. Holding this button will cause all modules in the bank to become enabled.

MODULE DISABLE SELECTOR

Disables the selected module so that it will remain off regardless of the operational status of the bank.

MODULE RESET SELECTOR

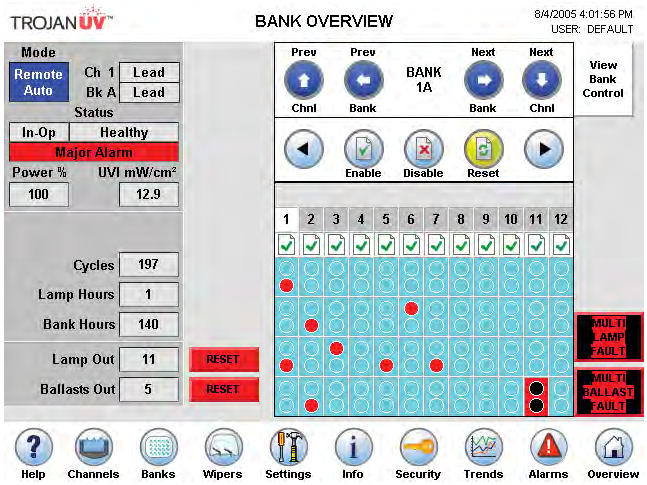
Initiates a reset function on the currently selected module. This function will cause the module to power down and then reinitiate a warm-up cycle. This may be used to try to restart lamps or ballast on a module that have extinguished without having to power cycle the entire bank.

MODULE NUMBER Displays the number assigned to each module. Additional modules can be viewed by using the Next / Prev module buttons. The currently selected module has a white background behind the module number.

MODULE ENABLE/DISABLE INDICATOR Displays a graphical enabled (check) or disabled (X) state of a bank's module. A disabled module will not be energized by the SCC.

LAMP/BALLAST STATUS INDICATOR

An array of rectangles with 2 circles inside, represent the current status of lamps and ballasts in the selected bank. The rectangles represent ballast status and the circles represent lamps. A lamp or ballast that is off is show in black, operating is light blue and failed is red. Failed lamps and ballasts will stay latched as red (faulted) regardless of whether the bank is running or not until the fail status is reset. The graphic below shows several failed lamps and 1 failed ballast with 2 lamps that are off.



Please note there is one ballast for every two lamps.

FAILED LAMP RESET SELECTOR When a failed lamp is reported, a Reset button appears beside the indicator for the number of lamps out. Failed lamps stay latched in a failed state until the Reset button is pushed. The button will disappear if the bank is off or if all lamps in the bank are currently on.

FAILED BALLAST RESET SELECTOR When failed ballast is reported, a Reset button appears beside the indicator for the number of ballasts out. Failed ballasts stay latched in a failed state until the Reset button is pushed. The button will disappear if the bank is off or if all ballasts in the bank are currently on.

MULTIPLE LAMP FAULT RESET SELECTOR

When a Multiple Lamp Fault occurs, a Multi Lamp Fault Reset button appears to the right of the lamp array. A multiple lamp fault condition occurs when the number of lamps that have failed is equal to or greater than a configured value in the System Settings screens. When in Remote Auto, a bank with a multiple lamp fault will be timed off and another bank run in it's place if one is available. If there are not enough banks available for disinfection, a bank with a multiple lamp fault will be run at full power. The Reset button must be pushed in order to clear this condition.

MULTIPLE BALLAST FAULT RESET SELECTOR When a Multiple ballast Fault occurs, a Multi Lamp Fault Reset button appears to the right of the lamp array. A multiple ballast fault condition occurs when the number of lamps that have failed is equal to or greater than a configured value in the System Settings screens. When in Remote Auto, a bank with a multiple ballast fault will be timed off and another bank run in it's place if one is available. If there are not enough banks available for disinfection, a bank with a multiple ballast fault will be run at full power. The Reset button must be pushed in order to clear this condition.

Wiper Overview Screen

The Wiper Overview screen will be accessible through the Screen Navigation bar if Wipers are configured for the system. This screen displays information about the selected Wiper Group and allows control of all remote wiper functions.

The control of wipers on the UV system is divided into Wiper Groups. The Wiper Overview screen allows access to information and control of a single Wiper Group at a time. A Wiper Group usually is associated with a single bank of UV lamps, but on smaller systems may control wiping for 2 or more banks. The information presented starting at the top left of the screen is a follows:

WIPER ENABLE BUTTON 

This button allows control of the enable status of the currently selected wiper group. A disabled wiper group is not able to be wiped from the operator interface, but may still be controlled locally at the HCB. When this button is pushed, the wiper group will become enabled if it is currently disabled.

WIPER DISABLE BUTTON 

This button allows control of the disable status of the currently selected wiper group. When this button is pushed, the wiper group will become disabled if it is currently enabled.

ENABLE STATUS INDICATOR Displays the current Enabled or Disabled status of the selected Wiper Group.

WIPER OPERATIONAL MODE INDICATOR Displays the Wiper Group's current operational mode as LOCAL OFF, LOCAL EXTEND, LOCAL RETRACT, LOCAL SEQUENCE, REMOTE AUTO, or REMOTE AUTO SEQUENCE. The operator has control over a Wiper Group's operational mode with the local selector switch(s) on the Hydraulic System Center (HSC) (or if a Combined PDC/HSC is supplied on the PDC) and can initiate a Remote Auto Sequence when the switch(s) are in the Remote position. A wiping sequence will be initiated for all Wiper Groups in the Remote Auto mode every time the configured Wiper Sequence Cycle time expires. The screen illustration displays Wiper Group 1 on HCB 1 in the Remote Auto Sequence mode of operation.

Starting at top middle of the screen, buttons are available to change the selected Wiper Group. The desired Wiper Group is selected by cycling to the correct HCB number and then cycling to the desired group number. A summary of the alarm status of the Wiper Group is shown at the bottom of this area.

PREV HCB

Changes the selected HCB for display to the previous HCB. If a wiping system is controlled from a single HSC, then this button will not appear.

NEXT CHANNEL

Changes the selected HCB for display to the next HCB. If a wiping system is controlled from a single HSC, then this button will not appear.

PREV WIPER

Changes the selected Wiper Group for display to the previous group in the HCB.

NEXT WIPER

Changes the selected Wiper Group for display to the next group in the HCB.

WIPER FAULT INDICATORS The following fault indicators display any failure conditions for the currently selected Wiper Group. Fault indicators will display black on gray text when they are in a good (OK) condition, and black on red text when in a fault condition.

The first line will display the message FLOW LIMIT FOR WIPING EXCEEDED when the flow through the channel that the Wiper Group is assigned to, exceeds the configured limit setpoint. When this fault is present a wiping sequence will not be initiated when the automatic wiping cycle timer expires, but may still be initiated manually by an operator.

The second line will display the message AUTO WIPING DISABLED DUE TO LOW WATER LEVEL when the level through the channel that the Wiper Group is assigned to, is below the level sensor. When this fault is present a wiping sequence will not be initiated when the automatic wiping cycle timer expires, but may still be initiated manually by an operator.

The third line will display the message COMMUNICATIONS FAULT when the UV PLC loses communication with the HCB. When this occurs, all remote wiping functions are not available.

The fourth line will display the message WIPER FLUID LEVEL FAULT if the hydraulic fluid reservoir signals a low fluid level. This condition is serious and indicates a hydraulic system leak. All local and remote wiping functions are disabled for all wiper groups configured in the effected HSC. This fault must be cleared by restoring the level in the reservoir and then putting the local selector switched for all wiper groups to the Local Off position for 10 seconds.

The fifth line will display the message WIPERS NOT IN REMOTE when the local control switches for the wiper system have not been left in a REMOTE position so that the PLC can control wiper sequences.

The sixth line will display the message HIGH PRESSURE SHUTDOWN if the hydraulic fluid pressure switch signals a high pressure condition at any time while the hydraulic pump is

running. All local and remote wiping functions are disabled for all wiper groups configured in the effected HSC. This fault must be cleared by putting the local selector switch for all wiper groups to the Local Off position for 10 seconds.

The last line will display the message HYDRAULIC OVERLOAD, PUSH TO RESET if the hydraulic pump trips on an overload condition at any time. All local and remote wiping functions are disabled for all wiper groups configured in the effected HSC. This fault must be cleared by putting the local selector switch for all wiper groups to the Local Off position for 10 seconds, and then pushing the displayed Reset button on the screen.

At top right of the screen, the following controls and indicators are displayed:

MANUAL WIPE INITIATE This button allows the operator to manually initiate a wipe sequence for the selected wiper group only, if it is currently in the Remote Auto mode. When a wipe sequence is already in progress, the message WIPE IN PROGRESS is displayed.

Note:	*Once a cleaning sequence has been initiated, it cannot be disabled until the sequence has been completed. (Unless selector switch is put in Local Off).*

WIPER DRIVE STATUS INDICATOR Displays the status of the Wiper Group's wiper drive. When a module is being cleaned, its wiper drive will be extended and then retracted over the lamp's quartz sleeve.

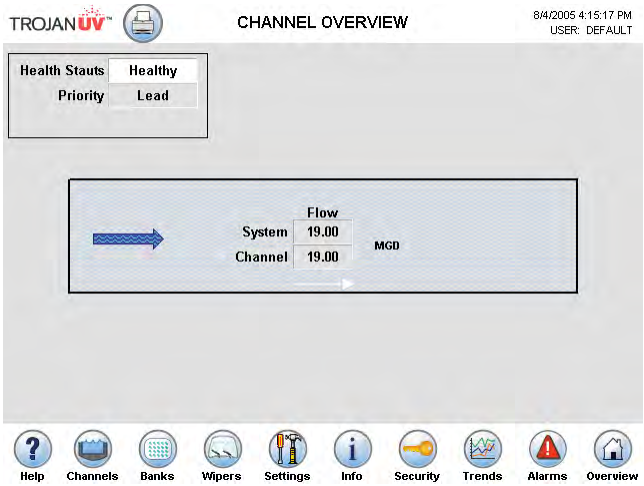
The wiper drive status indicator will change to EXTENDING when the drive is extending and RETRACTING when the drive is retracting. When no modules are being cleaned the status indicator displays IDLE.

The screen illustration displays HCB1, Wiper Group 1s wiper drives as EXTENDING.

WIPER SEQUENCE INDICATOR Displays the time left to the next automatic wipe sequence. When this time period expires, all of a bank's enabled modules will be cleaned simultaneously when in automatic mode of operation. The wiper sequence timer is adjustable and is explained in the System Settings Screen section.

Channel Overview Screen

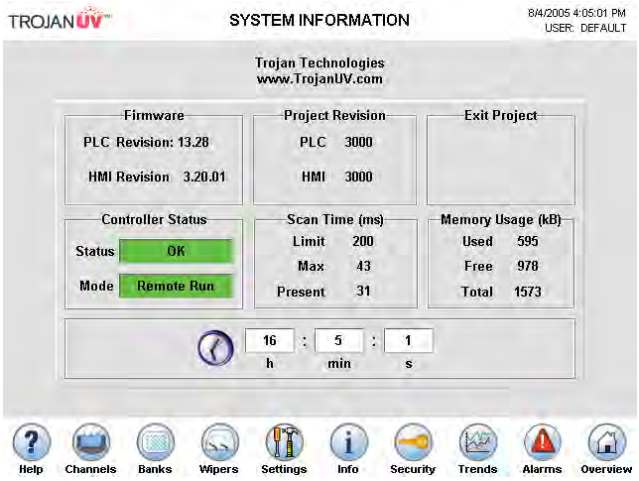
The Channel Overview screen displays information about the selected UV channel and allows control of channel functions.



For a single channel system, this screen is a display only screen and summarizes the channel Healthy status, Lead priority, total system flow and flow through the channel. In addition, a reset button will appear if a Not Enough Healthy Channels alarm condition is present and must be pushed in order to unlatch the alarm. A multi-channel system will have additional options that appear on this screen as described at the end of this manual section.

System Information Screen

The System Information screen displays information about the UV PLC program hardware and software. It is also used to access the operator interface clock setting and other internal maintenance functions. The address of the Trojan Technologies website is displayed at the top of the screen where additional service contact information can be found.



The System Information screen provides the following information:

PLC FIRMWARE REVISION LEVEL Displays the revision level of the operating system currently installed in the UV PLC.

HMI FIRMWARE REVISION LEVEL Displays the revision level of the operating system currently installed in the UV operator interface. When logged in at the OEM security level, this value may be entered if the HMI firmware is upgraded.

APPLICATION PLC SOFTWARE REVISION Displays the software revision level of the current UV PLC program installed.

APPLICATION HMI SOFTWARE REVISION Displays the software revision level of the current UV HMI program installed.

EXIT PROJECT BUTTON When logged in at the plant maintenance or OEM security level, a red exit button appears in this area which allows qualified maintenance persons to access embedded operator interface maintenance functions.

Note:	*When the project exit button is pressed, the UV HMI program will stop operating. When this occurs, the UV system PLC will continue to operate the system in it's last state, and the dose pacing routine will continue to operate banks as required, but the operator will not be able to view UV system alarms or change the remote state of banks or wipers. Power cycling the HMI will restore the operation of the UV HMI.*

CONTROLLER STATUS Displays the current fault status of the UV PLC. A green OK message will appear when the UV PLC is operating normally. A red fault message will appear to identify any failure condition that may occur. When a fault condition is present, the UV PLC program may not operate correctly.

CONTROLLER MODE Displays the current operating mode of the UV PLC. A green Run or Remote Run message will appear when the UV PLC is operating normally. If the PLC has been placed into "program" mode, a light blue PROGRAM or REMOTE PROGRAM message will appear and the UV PLC program will not operate. A red fault message will appear to identify any failure condition that may occur that results in the PLC program being halted. When a fault condition is present, the UV PLC program will not operate correctly.

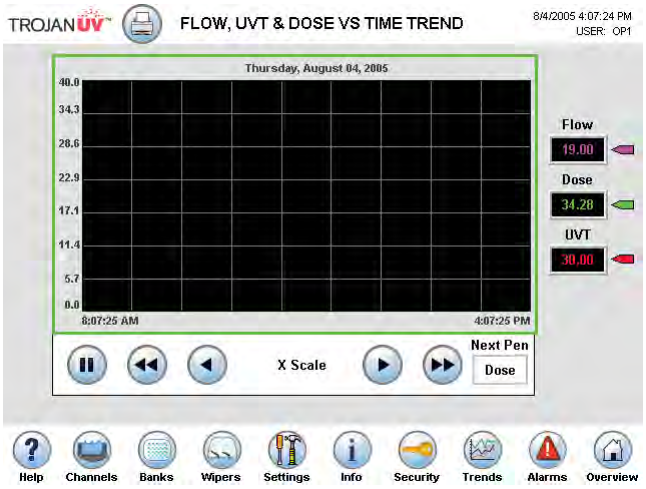
SCAN TIME INDICATOR Displays statistics for the time required for the PLC program to execute. The allowable time limit, maximum time taken and present scan time are all displayed. This information can be used to help troubleshoot PLC programming issues.

MEMORY USAGE Displays statistics for the amount of memory used by the PLC program. The total memory used by the program, memory left free, and total memory installed in the PLC are all displayed. This information can be used to help troubleshoot PLC programming issues or determine the room available for expansion

HMI CLOCK DISPLAY/ENTRY These will display the current hours, minutes and seconds of the operator interface time clock, and will allow modification of these values if logged in at the plant maintenance or OEM security levels. When security access is available, the numeric value will have a white background and touching the value will allow the desired time value to be entered.

Trend Screen

The Trend screen displays a trending line of data logged to an installed operator interface CompactFlash card. Data is displayed for Flow, Dose and UV Transmittance values and is shown in a window that spans an 8 hour period.



The Trend screen displays a colored line in the trending window for each of the 3 variables, and will shows the current value for each at the right hand side of the screen. At the bottom of the screen, the following controls are available:

TREND PAUSE BUTTON

Pushing this button will stop the trend screen from updating. The time scale and the line graphs displayed will stay paused at their current status. Pushing this button again when the trend is paused will resume screen updating.

TREND HOME BUTTON

Pushing this button will pause the trend and moves to the earliest data available trend.

TREND END BUTTON

Pushing this button will resumes the trend updating and moves the display to the current available data.

MOVE LEFT BUTTON

Pauses the trend and scrolls to the left.

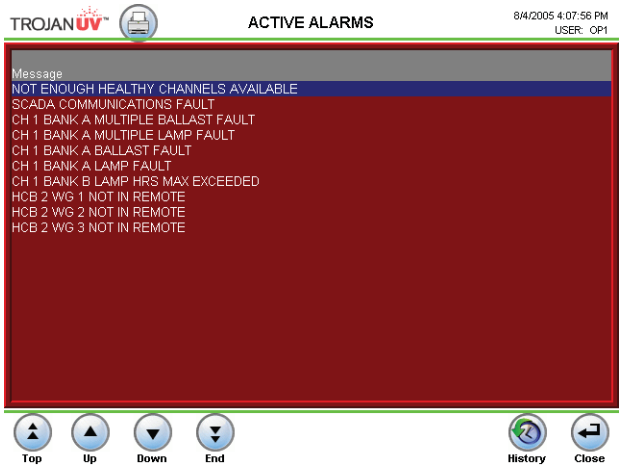
MOVE RIGHT BUTTON

Pauses the trend and scrolls to the right.

NEXT PEN SELECTOR Displays the name of the current pen that is used for Y-axis scale display and changes to the scale for the next pen. The Y-axis scale will move automatically to a scale that is appropriate for the pen that is selected in order to easily view the data displayed.

Alarm Status Screen

The Alarm Status screen is used to display any alarm messages for currently active alarm conditions. This screen is displayed first when the alarm button is pushed when on the Screen Navigation bar.



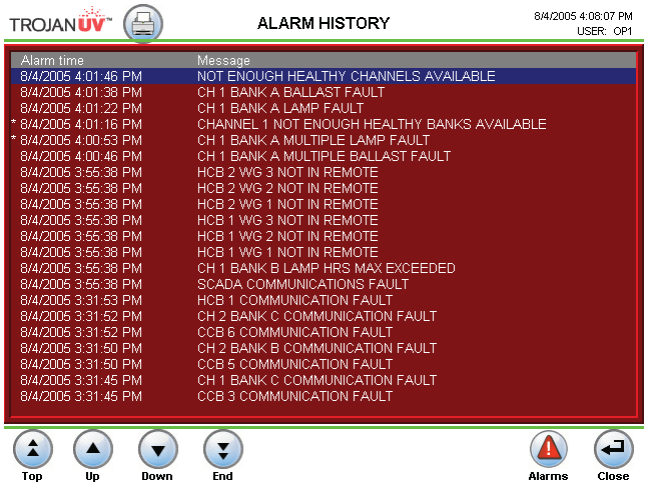
The Alarm Status Screen provides an overview of the current active UV system alarms. The sixty (60) most recent UV alarms are displayed on the Alarm Status Screen. When an alarm condition is rectified and no longer active, it is removed from the Alarm Status Screen.

Note:	*To ensure optimum system performance resolve each alarm as it appears.*

Scroll up or down through the active alarms by using the arrow keys pushbuttons.
The Alarm Status Screen is equipped with a "goto" screen selector for the Alarm History Screen.

Alarm History Screen

Access to the Alarm History Screen is gained from the Alarm Status Screen.



The Alarm History Screen provides an archived history of the last sixty (60) system alarms.

When the alarm buffer is filled with the maximum number of sixty (60) alarms, the oldest alarm is deleted from the archived history on a first in/first out basis. Each alarm is time and date stamped indicating when it occurred. Scroll up or down through the archived alarms by using the arrow keys pushbuttons.

The Alarm History Screen is equipped with a "goto" screen selector for the Alarm Status Screen.

All UV system alarms are displayed on the alarm status screen when active. Most of the standard alarms are divided into three categories: critical, major, and minor alarms. The category into which each alarm falls, is determined by which of the three, user-adjustable alarm delay times it is subject to (critical, major, or minor alarm delay time). A few of the standard alarms do not fall within one of the three categories and therefore have their own adjustable, or fixed alarm delays.

Critical Alarms

The following alarms are part of the common critical alarm, and are subject to the critical alarm delay time unless otherwise specified:

Low UV Dose Indicates that the current calculated UV Dose has dropped below the alarm limit. The alarm limit is determined by the Dose Alarm Offset percentage value entered on the Dose Settings screen, which is the percentage of the design dose at which the alarm is triggered.

Hydraulic Max Exceeded Indicates that the currently measured effluent flow per open channel(s) exceeds the 'Channel Hydraulic Max' entered on the Channel settings screen. This alarm serves as a warning of a possible flooding situation

Not Enough Healthy Channels Available (latched alarm) Indicates that there are not enough "healthy" channels of UV equipment available for disinfection purposes. This will result in the PLC controller attempting to open all available channels (if slide gates are controlled) and turn on all available banks (all non-faulted banks, and banks with multiple lamp, multiple ballast or module communication faults) at full power. This alarm must be reset on the Channel Overview screen after the cause of the alarm has been corrected.

UVT Signal Fault Indicates that the analog input signal for the UV transmittance from the optional UV Transmittance Controller and Sensor has dropped below 2mA. When this alarm is present, the PLC will use the last entered Manual UVT value, which can be changed on the System Overview screen.

Flowmeter Fault Indicates that the analog input signal for the flowmeter has dropped below 2 ma. When this alarm is present, the PLC will use

the last entered Manual Flow value, which can be changed on the System Overview screen.

Channel XX Not Enough Healthy Banks Indicates, that channel "X", when it is requested to run by the PLC controller, does not have enough "healthy" UV banks available, to provide adequate dose in that channel. For each channel in the system in which this alarm is active, 1 will be subtracted from the number of healthy channels available. When the number of channels required, to provide adequate dose or to accommodate the volume of flow, becomes greater than the number of healthy channels available, the "Not Enough Healthy Channels" alarm will be generated and its associated actions will take place, as described above.

Bank XX Low Water Level Shutdown (no delay) Indicates that a bank's level sensor has reported a low water level condition from the CCB. All banks with an active low water condition will be automatically shut down.

Major Alarms

The following alarms are part of the common major alarm, are subject to the major alarm delay time unless otherwise specified:

Low UVT Fault (configurable delay) Indicates the UV Transmittance reading has dropped below the low UVT alarm setpoint configured on the UVT settings screen.

UVT Out of Validation Range Low (60 seconds delay) Indicates that the UV Transmittance reading has dropped below the validated range for the current dose calculation mode. This alarm is only valid for the NWRI dose calculation mode, and will result in all operating banks running at full power.

Flow Rate Out of Validation Range High (60 seconds delay) Indicates that the flow reading has risen above the validated range for the current dose calculation mode. This alarm is only valid for the NWRI dose calculation mode, and will result in all operating banks running at full power.

Bank xx Module Communication Fault Indicates that that a module board for a module attached to bank x is no longer communicating with the bank's CCB. A communication failure icon will appear over the effected module(s) on the Bank Overview screen.

Bank xx Multiple Ballast Failure (latched) Indicates that the total number of failed ballasts in bank xx is equal to or exceeding the configured 'Multiple Ballast Failure Setpoint' on the Bank Settings screen. When this alarm occurs, the bank will be timed off and another bank will be started to replaced the failed bank. This alarm is latched and can only be cleared by pressing an alarm reset button that will appear on the Bank Overview screen for the effected bank. A bank with a multiple ballast failure can be started by the UV PLC when there is a Not Enough Healthy Channels condition.

Bank xx Multiple Lamp Failure (latched) Indicates that the total number of failed lamps in bank xx is equal to or exceeding the configured 'Multiple Lamp Failure Setpoint' on the Bank Settings screen. When this alarm occurs, the bank will be timed off and another bank will be started to replaced the failed bank. This alarm is latched and can only be cleared by pressing an alarm reset button that will appear on the Bank Overview screen for the effected bank. A bank with a multiple lamp failure can be started by the UV PLC when there is a Not Enough Healthy Channels condition.

Bank xx Not in Remote Auto (no delay) Indicates that the PDC Bank Mode Selector switch for a bank is not in the remote position, or that the bank is not set to auto mode at the operator interface. This will prevent the bank from being operated in the automatic dose pacing routine.

Bank xx Communication Failure Indicates that the SCC has not received a communication update from the indicated CCB for the period of the configured major alarm delay setpoint. This alarm will result in a bank being flagged as unhealthy and the bank will be immediately requested to shut down.

Bank xx Lost Power Fault (3x communication cycle time) Indicates that all the lamps in the bank have shut off without being requested to by the PLC controller. This alarm will only appear if the bank is in either Remote Hand or Remote Auto. The failed bank will be immediately requested to go through a warm up period with all lamps at full power. If, at the end of the warm up period, there are no lamps on, the bank will be shut down and another bank will be started in it's place. If a lamp comes on during the warm-up period, then the alarm is cleared.

HCB xx Communication Failure Indicates that the SCC has not received a communication update from the indicated HCB for the period of the configured major alarm delay setpoint.

Wiper Group X Not in Remote Auto (no delay) Indicates that the HSC Wiper Group selector switch is not in the remote position. This will prevent the wiper group from being automatically wiped.

Wiper Group X High Pressure Shutdown (no delay) This alarm condition occurs if a high pressure switch input is triggered at any time when the hydraulic pump is operated during a wiping function. When this alarm occurs, the hydraulic pump is shut down, and all wiping functions are suspended for all groups on the HSC. In order to clear this alarm, all wiper groups must simultaneously be put to the Local Off position for 10 seconds, and can then be returned to the desired status.

Wiper Group X Low Fluid Level Shutdown (no delay) This alarm condition occurs if a low level switch input on the hydraulic fluid tank is triggered at any time when the hydraulic pump is operated during a wiping function. When this alarm occurs, the hydraulic pump is shut down, and all wiping functions are suspended for all groups on the HSC. In order to clear this alarm, all wiper groups must simultaneously be put to the Local Off position for 10 seconds, and can then be returned to the desired status.

Wiper Group X Hydraulic Overload (no delay) This alarm condition occurs if the pump overload switch input is triggered at any time when the hydraulic pump is operated during a wiping function. When this alarm occurs, the hydraulic pump is shut down, and all wiping functions are suspended for all groups on the HSC. In order to clear this alarm, all wiper groups must simultaneously be put to the Local Off position for 10 seconds, and a reset button is then pushed on the operator interface Wiper Overview screen. The wiper group mode switches may then be returned to the desired status.

Minor Alarms

The following alarms are part of the common minor alarm, are subject to the minor alarm delay time unless otherwise specified:

Low Flow Fault (configurable alarm delay) Indicates that the current measured flow rate has dropped below the configured alarm limit for the configured alarm delay time. If the minimum number of banks per channel is configured as 0, then all banks will time off when this alarm occurs.

UVT Out of Validation Range High (60 second delay) Indicates that the UV Transmittance reading has risen above the validated range for the current dose calculation mode. This alarm is only valid for the NWRI dose calculation mode, and will result in the maximum validation range UVT value being used for dose pacing.

Flow Rate Out of Validation Range Low (60 second delay) Indicates that the flow reading has fallen below the validated range for the current dose calculation mode. This alarm is only valid for the NWRI dose calculation mode, and will result in the minimum validation range flow value being used for dose pacing.

PLC Battery Low (10 second delay) Indicates that the PLC battery is no longer able to back up the PLC memory in case of a power failure and should be replaced.

Bank XX Ballast Failure Indicates that one or more ballast have failed on the effected bank. The Bank Overview screen will graphically display the failed ballast(s) as a red rectangle and a reset button will appear on the screen. The ballast(s) continue to be reported as failed

until the reset button is pushed, and will then display their current state if they have been repaired and are now reporting the proper status.

Bank XX Lamp Failure Indicates that one or more lamps have failed on the effected bank. The Bank Overview screen will graphically display the failed lamp(s) as a red circle and a reset button will appear on the screen. The lamp(s) continue to be reported as failed until the reset button is pushed, and will then display their current state if they have been repaired and are now reporting the proper status.

Bank XX Lamp Hours Exceeded (no delay) Indicates that the lamp hours in bank XX have exceeded the configured end of lamp life setpoint. This alarm is for information purposes only and indicates that lamps are at their lowest UV intensity output and should be changed.

Bank XX Low UV Intensity Alarm Indicates that the current UV intensity reading for the reported bank has dropped below the configured alarm limit. The alarm limit is entered as the percentage of the expected intensity value at the present UV Transmittance and lamp output conditions.

Other Alarms

The following alarms are subject to the individual alarm delay times:

PLC Fault (no delay) Indicates that there is a PLC hardware failure condition present.

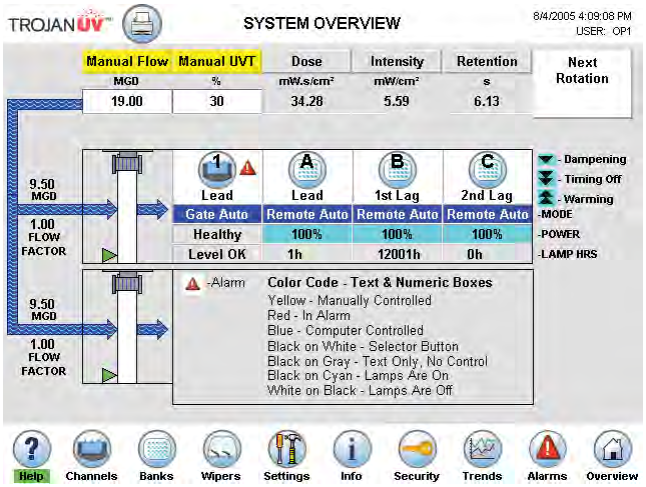
SCADA Communications Fault (20 second delay) Indicates that the UV PLC has not received a communication update from the SCADA system in the last 20 seconds

Winterization Mode (no delay) This alarm is set when the Winterization Mode option is enabled in the General Settings screen. When this alarm is present, all other alarm messages are masked and the SCADA system fault bits will all be set to a ‘good’ status.

Bank XX Power on Reset (no delay) Indicates that the CCB for a bank is recovering from a power failure. This alarm will be active for 1 minute following a power cycle to a CCB.

Online Help

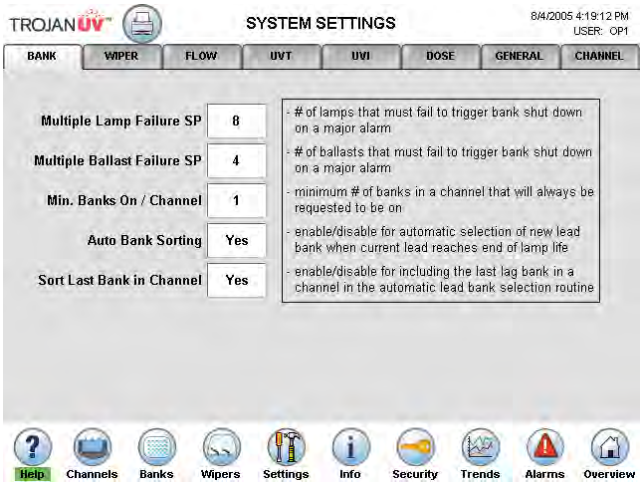
Context sensitive help text is available on most screens by selecting the Help (?) key on the Screen Navigation bar. When the 'help' text is displayed, the Help key text will be backlit in green. The screenshot below shows help text displayed on System Overview screen.



System Settings Screens

The System Settings Screens are accessible through the Screen Navigation bar if the user is logged in with a sufficient security level. The variables on these screens are selected by pressing the numeric entry box, and changed by using the pop-up numeric touch pad followed by enter (↵) key. All settings are organized by system function which are selected using the tab buttons at the top of each setting screen. Settings are organized by Bank, Wiper (optional), Flow, UV Transmittance, UV Intensity, Dose, General and Channel categories. Online help is available for each of the plant maintenance settings that can be accessed.

Bank Settings



The following settings are available on the Bank Settings screen:

Multiple Lamp Failure SP Setpoint for the number of lamps that must fail in a bank before it is considered to have a major alarm condition and will trigger the Multiple Lamp Failure alarm. Banks with this condition will be timed off and another bank will be operated in it's place if there is an available healthy bank.

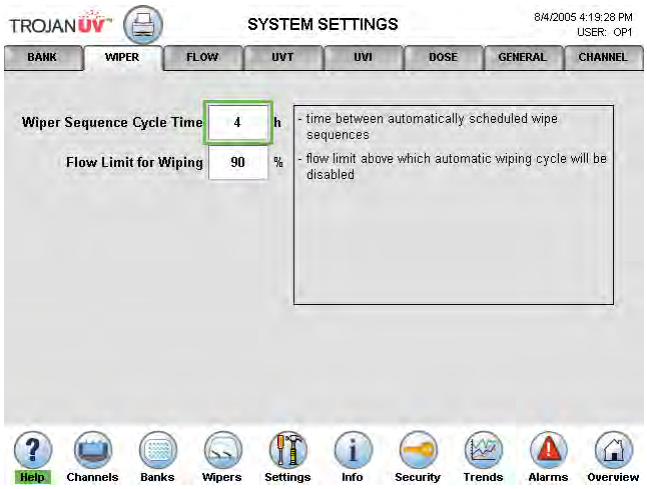
Multiple Ballast Failure SP Setpoint for the number of ballasts that must fail in a bank before it is considered to have a major alarm condition and will trigger the Multiple Ballast Failure alarm. Banks with this condition will be timed off and another bank will be operated in it's place if there is an available healthy bank.

Min. Banks On / Channel Setpoint for the minimum number of banks in a channel that will always be requested to run by the dose pacing routine, regardless of current process conditions. If this value is set to 0, then all banks in a channel may be shut off if there is a Low Flow alarm condition.

Auto Bank Sorting Determines whether an automatic rotation of the lead bank will occur when the current lead bank's lamp life reaches the End of Lamp Life hours setpoint.

Sort Last Bank in Channel Determines whether the last lag bank in each channel will be sorted when an automatic rotation occurs. This is used to permanently assign a desired bank to a lag or standby position.

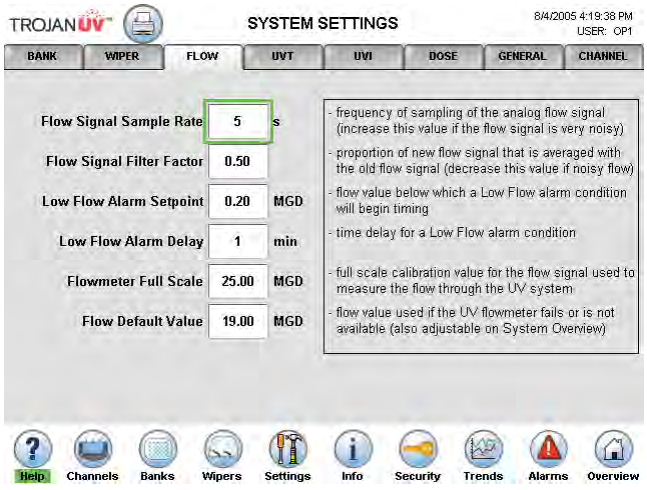
Wiper Settings



Wiper Sequence Cycle Time Determines the time between automatically schedule wipe sequences. When an automatic wipe sequence occurs, all wiper groups on a HSC will be requested to wipe one at a time if they are not in an alarm condition.

Flow Limit for Wiping Determines the flow percentage of the peak channel flow that can be reached before automatic wiping is disabled.

Flow Settings



Flow Signal Sample Rate Determines the frequency at which the total flow on the Flowmeter analog input is measured. This value should be increased if there is a very noisy plant flow signal that cannot be dampened by using the Flow Signal Filter Factor.

Flow Signal Filter Factor Used to set the proportion of the currently sampled flow signal that is averaged with the historically saved flow value in order to determine the current flow value. An entered value of 0.5 represent 50% of the current flow averaged with 50% of the stored flow. In order to dampen out a noisy plant flow signal, this value should be reduced in 0.1 increments.

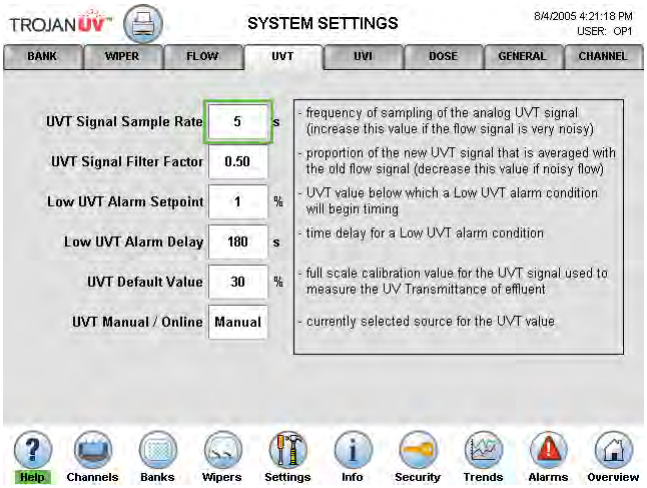
Low Flow Alarm Setpoint Determines the setpoint that the currently measured flow must drop below in order to initiate a Low Flow alarm timer.

Low Flow Alarm Delay Determines the setpoint for the Low Flow alarm timer.

Flowmeter Full Scale Used to enter the value in engineering units at which the plant flow meter is outputting 20mA. This represents the full scale of the Flowmeter signal.

Flowmeter Default Value Determines the flow value that is used for dose pacing if there is a Flowmeter signal fault, or if the source of signal input for flow is set to manual.

UVT (Transmittance) Settings



UVT Signal Sample Rate Determines the frequency at which the UV Transmittance signal analog input is measured. This value should be increased if there is a very noisy plant UVT signal that cannot be dampened by using the UVT Signal Filter Factor.

UVT Signal Filter Factor Used to set the proportion of the currently sampled UV Transmittance signal that is averaged with the historically saved UVT value in order to determine the current UVT value. An entered value of 0.5 represent 50% of the current UVT averaged with 50% of the stored UVT. In order to dampen out a noisy plant UVT signal, this value should be reduced in 0.1 increments.

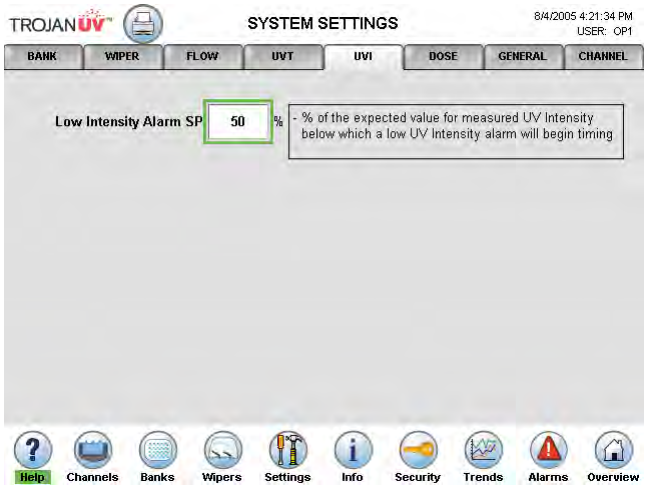
Low UVT Alarm Setpoint Determines the setpoint that the currently measured UV Transmittance must drop below in order to initiate a Low UVT alarm timer.

Low UVT Alarm Delay Determines the setpoint for the Low UV Transmittance alarm timer.

UVT Default Value Determines the UV Transmittance value that is used for dose pacing if there is a UVT signal fault, or if the source of signal input for UVT is set to manual.

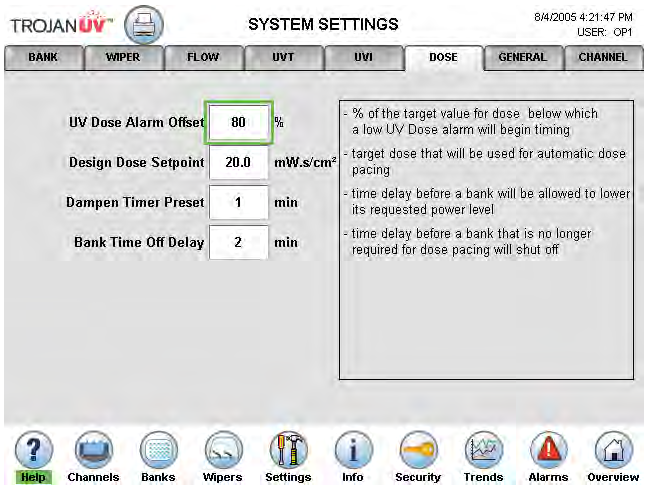
UVT Manual / Online Used to toggle the source of the UV Transmittance signal between a manually entered value and a measured analog value.

UVI (Intensity) Settings



Low Intensity Alarm SP Determines the setpoint in percentage below which a Low Intensity alarm will be generated for a particular bank. The currently measured analog intensity signal current is compared against the predicted signal current at the present UV Transmittance and lamp output conditions in order to calculate a percentage value that is compared against the alarm limit.

Dose Settings



UV Dose Alarm Offset Determines the percentage setpoint below which a Low UV Dose alarm will be generated. The currently calculated dose value is compared against the configured Design Dose Setpoint in order to calculate a percentage value which is compared against the alarm setpoint.

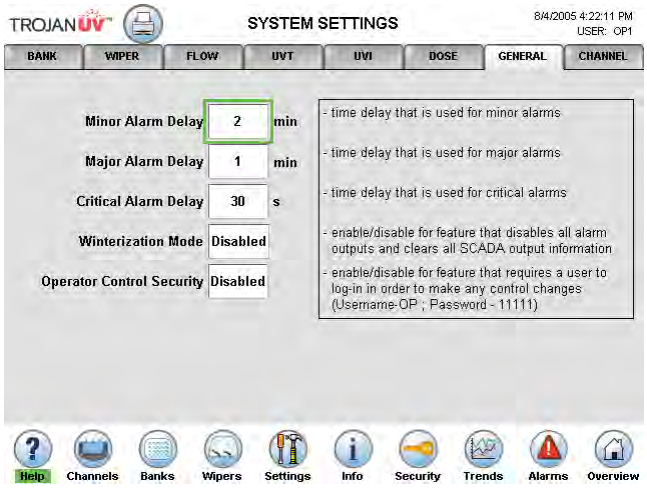
Design Dose Setpoint Determines the setpoint for UV Dose control of the Dose Pacing routine. The Dose Pacing routine will modulate bank power level and bring banks and channel in and out of operation as required in order to maintain the dose a value just above this setpoint.

Dampen Timer Preset Determines the amount of time that the Dose Pacing routine must be calling for a bank's power level to be reduced before a lower power level will be used. This feature is used to minimize bank power cycling.

Bank Time Off Delay Determines the amount of time that the Dose Pacing routine must be calling for a bank to be turned off before it will be

allowed to deenergize. While this timer is running, a bank will typically be operated at minimum power. This feature is used to minimize bank on/off cycling.

General Settings



Minor Alarm Delay Determines the setpoint for the alarm delay for minor alarms.

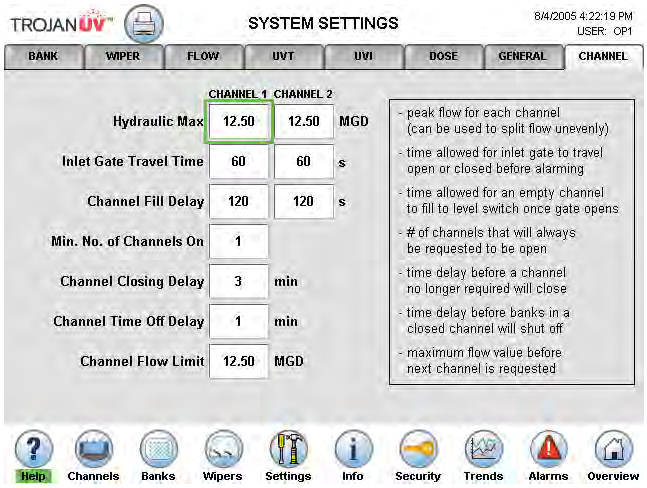
Major Alarm Delay Determines the setpoint for the alarm delay for major alarms.

Critical Alarm Delay Determines the setpoint for the alarm delay for critical alarms.

Winterization Mode Used to toggle the Winterization Mode selector between Enabled and Disabled. When this option is enabled, all operator interface and SCADA alarms are cleared. This option is used to mask nuisance alarms during seasonal equipment shutdown periods.

Operator Control Security Used to toggle the Operator Control Security mode selector between Enabled and Disabled. When this option is enabled, the operator must log in to be able to change any system modes or enter any values on the operator interface. The default operator Username is OP and Password is 11111. After ½ hour of inactivity, the currently entered Username and Password is cleared and must be reentered to continue operating the system. This option is used to prevent unauthorized changes to system operating parameters.

Channel Settings



Unless the system is configured as a multi-channel control system, all Channel Settings will not appear, except for the Hydraulic Max setting.

Hydraulic Max Represents the peak flow (in engineering units) that a channel can pass before a Hydraulic Max alarm will be generated. This value is also used to allow uneven flow splitting on multi-channel systems. Normally the Hydraulic Max value is set to the same value for each channel and the flow through each open channel is assumed to be the total flow divided by the number of open channels. These values may be set differently for uneven flow splitting, in which case the flow through a channel is equal to the total flow times the Hydraulic Max for that channel divided by the total Hydraulic Max for all channels.

Inlet Gate Travel Time (N/A) Represents the maximum time required for the inlet slide gate to complete its travel from a fully open or closed position. This setpoint is used to determine how long to wait when a gate is commanded to move before checking for alarm conditions.

Channel Fill Delay Represents the amount of time that will pass after an inlet slide gate is commanded to open before a Channel Low Level alarm condition will be set. When an operating channel is in a Low Level alarm

condition, it is not considered healthy and available to the Dose Pacing routine.

Min No. of Channels On (N/A) Represents the minimum number of channels that will be open and operating regardless of the current system flow. This value must always be equal to or greater than 1.

Channel Closing Delay Determines the amount of time that the Dose Pacing routine must be calling for a channel to close before it is taken out of operation.

Channel Time off Delay Determines how much time banks in a closed channel will continue to time off before they are requested to shut down. This feature allows disinfection to continue in a channel that has been taken out of operation, until all effluent has had a chance to drain down past the UV banks.

Channel Flow Limit (N/A) Determines the flow setpoint at which an additional channel will be called to open. This value should be set to the minimum flow that a channel will be able to disinfect at the lowest UV Transmittance value that a plant will experience and is typically set to the plant design peak flow divided by the total number of configured channels.

Note:	*The control system is designed to be run automatically, such that the controller's dose pacing routine can call the required channels and associated banks, based on current effluent flow conditions and take appropriate corrective action in the event of bank and/or gate faults. In order for the system to do this effectively, all banks and gates should normally be left in Remote Auto mode. Once any bank or gate is taken out of Remote Auto, the system will do what is possible to prevent undesired operation, but it is the responsibility of the operator to ensure that situations such as discharging undisinfected effluent or flooding do not occur.*

Chapter 5

COMBINED PDC/HSC

5 Combined PDC/HSC 5-1

5 COMBINED PDC/HSC

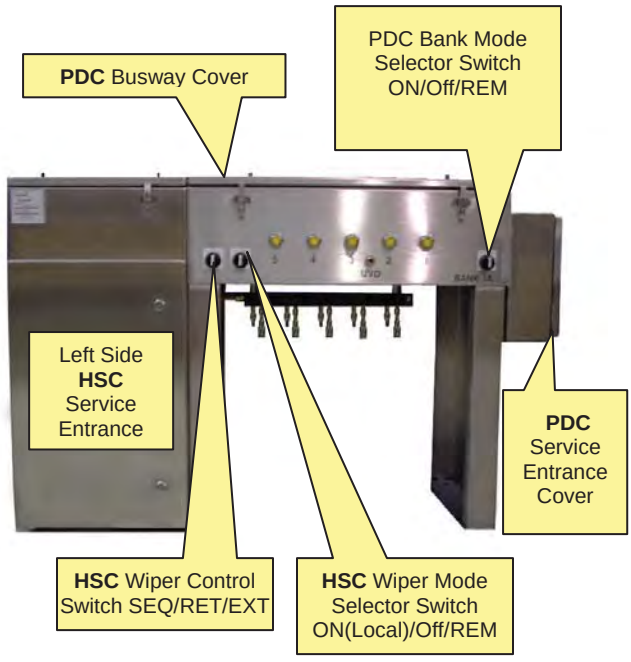
5.1 Introduction

As the name suggests, the Combined PDC/HSC consists of a Power Distribution Center (PDC) and a Hydraulic System Center (HSC). The HSC is attached to the PDC opposite the service entrance and shares common power. Both the PDC and HSC are described in this chapter.

5.2 Power Distribution Center

Description

The PDC spans the top of the channel and distributes power from the main electrical service to the modules in the UV bank(s). The PDC can be single sided to serve one bank of lamps or double sided to serve two banks. A double-sided PDC has module receptacles on both sides of the PDC.

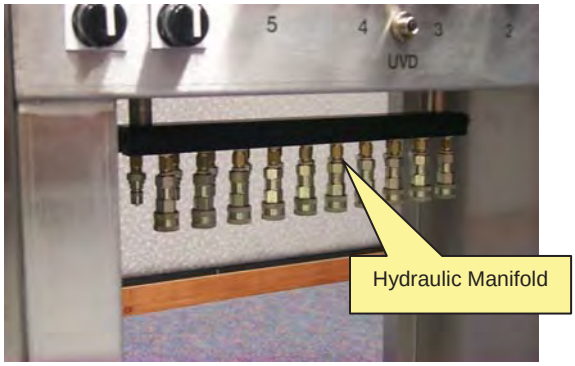


The PDC houses the power distribution bus bars that supply power to the UV modules. Removing the bus way cover on the top of the PDC allows access to the bus bars. The electrical service is connected to the bus bars inside the Service Entrance, located at the end of the PDC.

Each module plugs into a receptacle on the side of the PDC. These receptacles are connected to Relay Control Boards (RCBs) that switch the power for the modules. The receptacles are typically numbered beginning with '1' at the end closest to the service entrance. The UV Sensor (which measures UV intensity), plugs into the center receptacle, labeled (UVD for UV Detection). The center receptacle is located slightly below the other receptacles.

Communication cables from each relay control board are interconnected to the Communications Control Board (CCB), which sits on a hinged plate above the bus bars and relay boards. The CCB transmits lamp, ballast and UV intensity status to the System Control Center (SCC). The CCB also receives data from the SCC for setting the appropriate ballast power settings based on flow, UV Transmittance (if a UVT is used) and lamp life data.

ActiClean™ Cleaning System



A hydraulic manifold is mounted to the bottom of the PDC as shown. The manifold distributes hydraulic fluid to each module for use by the ActiClean™ Cleaning System. See the ActiClean™ Cleaning Section in O+M manual for complete description.

PDC Bank Mode Selector

A Bank Mode Selector switch is included on the PDC. It allows you to choose between ON, OFF and REMOTE operation of the bank.

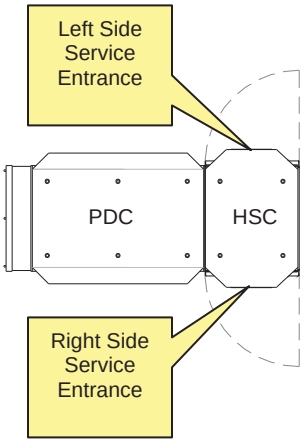
Communications

Communication between the PDC and SCC is achieved through a RS485 Serial Communication Link, which terminates inside the service entrance.

5.3 Combined PDC/HSC Enclosure

Description

The PDC enclosure has two hinged covers. The Service Entrance Cover is located at the end of the PDC opposite the HSC. The PDC busway Cover is on the top of the PDC. The HSC has three hinged doors, two side doors for hydraulic system access and a top door for electrical access.



Top View of Combined PDC/HSC.

Specifications

The enclosures are made from welded stainless steel, and are UL Listed to U.S. and Canadian standards. They also meet the Type 4X requirements for watertight enclosures.

? HOW TO INFO

Maintenance

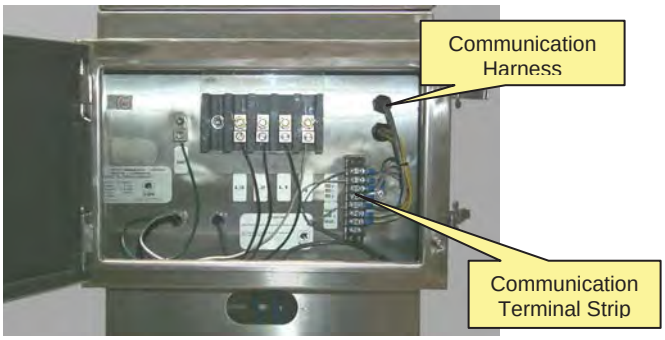
Like all stainless steel exposed to the outdoor environment, the enclosure's exterior should be washed monthly with a mild soap and water solution. A damp sponge or soft cloth should be used for regular cleaning.

CAUTION

Do not spray water in or around the power distribution center when lids are open.

5.4 PDC Service Entrance

Description



A 480Y/277 VAC 3 phase, 4 wire, (plus ground) power supply is connected to the service lugs, accessible from the electrical service panel at the end of the PDC. The three phases, neutral and ground wires are fastened to lugs at the power terminal. These are attached to copper bus bars, which distribute power to the relay control boards. If a double-sided PDC is used to power two UV Banks, the neutral wire is connected to the outer copper bus bars using the neutral wire link.

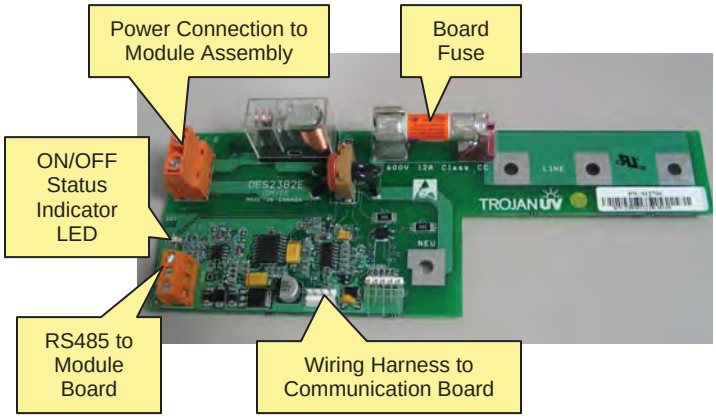
The communications terminal strip is also accessible at the service entrance. Communication cables from the SCC are

interconnected to this strip and for multiple bank systems with more than one PDC, the communications between PDCs are 'daisy chained' at these terminal strips.

Specifications

Item	Value
Service Entrance Panel	Hinged Lid with latches for opening.

5.5 Relay Control Board (RCB)



Description

An RCB switches the single phase 277 VAC to the UV module for powering the lamps and ballast. It also sends UV lamp and ballast control/status signals to the Communication Controller Board (CCB) from the module control board.

The RCBs are arranged evenly to balance the current draw between the three phases on the power service.

The RCBs have features for equipment protection. If more than 34mA of ground fault leakage current is sensed, the relay will de-energize.

The relay board also has zero-crossing detection to protect the relay, and an interlock to de-energize the relay when the module cable is disconnected. An LED illuminates when the relay is closed.

Specifications

Item	Value
Input power	277 VAC and +24 VDC from the CCB
Fuse	12A, 600 V

? HOW TO INFO

Maintenance

Replace Relay Board Fuse

1. Determine module number with fault at SCC for Relay Board Fuse replacement.
2. Turn PDC Bank Mode Selector switch to OFF.
3. Lock out and tag power at disconnect(s) to PDC. (See General Lockout Procedure in the Preface chapter at the front of this manual).

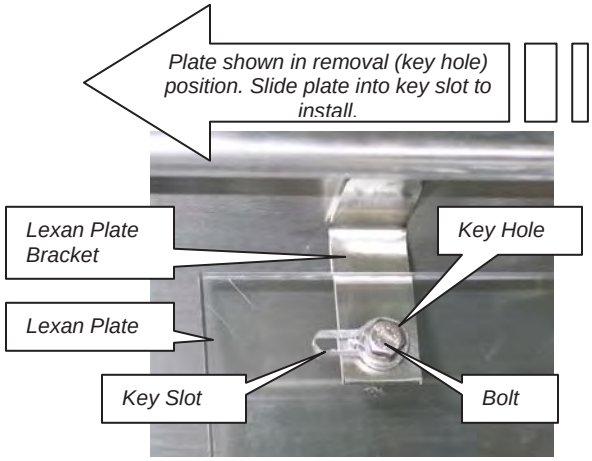
DANGER

Electrical Hazard!

LOCK OUT and TAG all sources of power before performing any maintenance, cleaning or repairs on any piece of equipment. The power sources may include electrical, hydraulic, or stored energy. Refer to the general lock out and tag procedures in this manual.

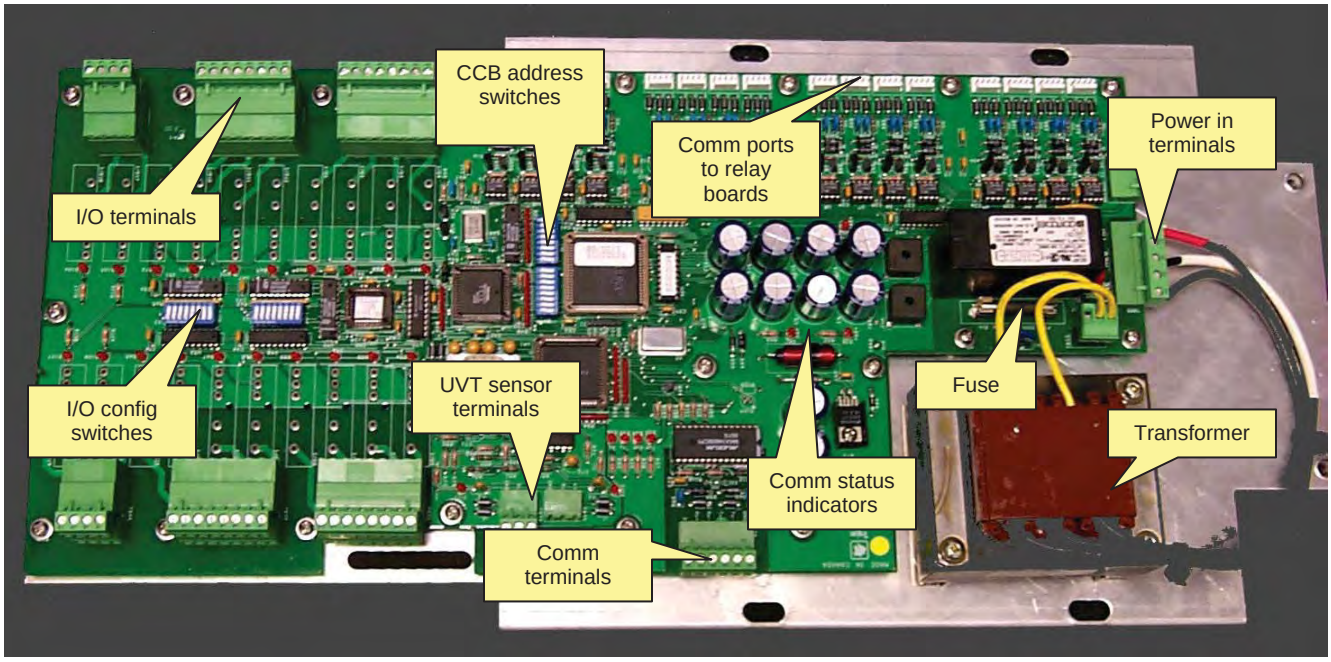
4. Open the PDC Busbar cover to access the Relay Board Fuse. Ensure cover is adequately supported open - telescopic cover stays (opening support linkages) should be straight and rigid.

5. Remove the Lexan Plate cover to access the Relay Board Fuse. Loosen all Lexan plate ¼" bolts, but do not remove – loosened bolts can remain in position for the removal of the plate. Remove plate by sliding it over to locate plate key holes over bolts, then carefullly lift plate to remove.



6. Store Lexan plate in a safe location for future use.
7. Locate appropriate Relay Control Board.
8. Remove and test fuse.
9. Replace fuse on relay board, if necessary.
10. Reinstall Lexan plate. Align plate key holes over bolts. Slide plate to push bolts into plate key slots. Tighten all bolts.
11. Close Busbar cover – press button in the in telescopic cover stay (support linkages) to unlock.
12. Restore power to the PDC disconnect(s) and set the Bank Mode Selector closest to the PDC service enterance to ON or REM (Remote).
13. Check alarm status at SCC.

5.6 Communication Control Board (CCB)



Description

The CCB is attached to a hinged plate that rests above the relay boards.

The CCB receives 277 VAC power from the bus bars. The CCB provides +24VDC to each of the relay boards and includes LEDs to indicate the presence of the rectified DC voltages.

The board has two analog inputs for UV Sensor(s), which sense UV intensity in each bank of modules. Both inputs are used if the PDC provides power to two banks. Serial communication lines are routed from the module ports to each of the relay boards. On-board LEDs are included to indicate communication status for the RS485 port. This connects with the communication harness to provide communication with the SCC. A pair of LEDs is also included to indicate CCB to RCB communications. All control commands are sent from the SCC to the PDC via this serial link.

Twenty (20) digital I/O ports are available for digital input or output modules. The ports may be configured as an input or output using DIP switches. I/O modules will be present depending on the specific system (e.g., low water level).

Specifications

Item	Value
Input power	480Y/277 VAC
CCB Fuse	5 Amp, 250V Slo Blow
Analog inputs	Two for UV Sensor (s)
I/O ports	Twenty (20) digital (two for Bank Mode Selector Switch, one for low water plus spares)
Module ports	8 - RS485 Module Ports
Status LED's	Power and communications
Serial Ports	RS232 (Service Port) RS485 (SCC Communication)

? HOW TO INFO

Maintenance

Replace CCB Fuse

1. Confirm at SCC Operator interface that there is a Bank Communication Fault.
2. Turn PDC Bank Mode Selector switch to OFF.
3. Lock out and tag power at disconnect(s) to PDC. (See General Lockout Procedure in the Preface chapter at the front of this manual).

DANGER

Electrical Hazard! LOCK OUT and TAG all sources of power before performing any maintenance, cleaning or repairs on any piece of equipment.

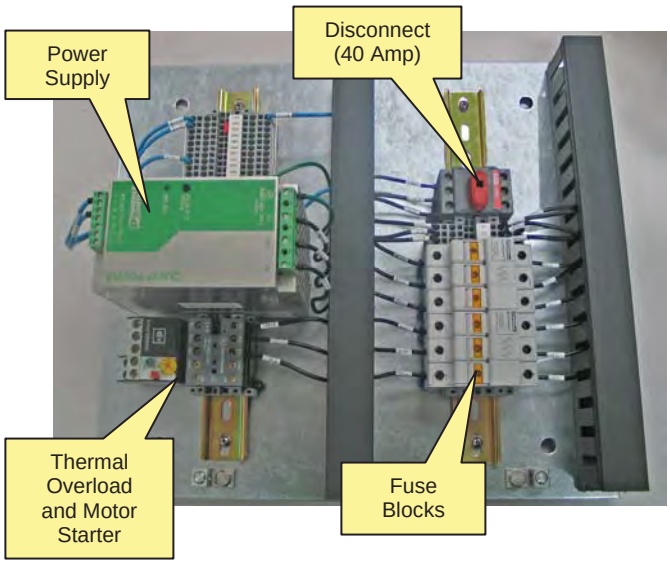
4. Remove and test fuse for failure. Replace as required.
5. Restore power to the PDC disconnect(s) and set the Bank Mode Selector closest to the PDC service enterance to ON or REM (Remote).
6. Check alarm status at SCC.

5.7 Hydraulic System Center (HSC)

Description

The HSC provides hydraulic power for up to 32 Trojan UV3000^{TM}Plus modules, at one time, in any configuration.

Electrical Enclosure



The HSC enclosure is a stainless steel cabinet with separate compartments for hydraulic and electrical components. The hydraulic components are located through the two side doors. Two-quarter turn latches secure each hinged door. The electrical components are located under the top access door. Latches secure the top hinged door.

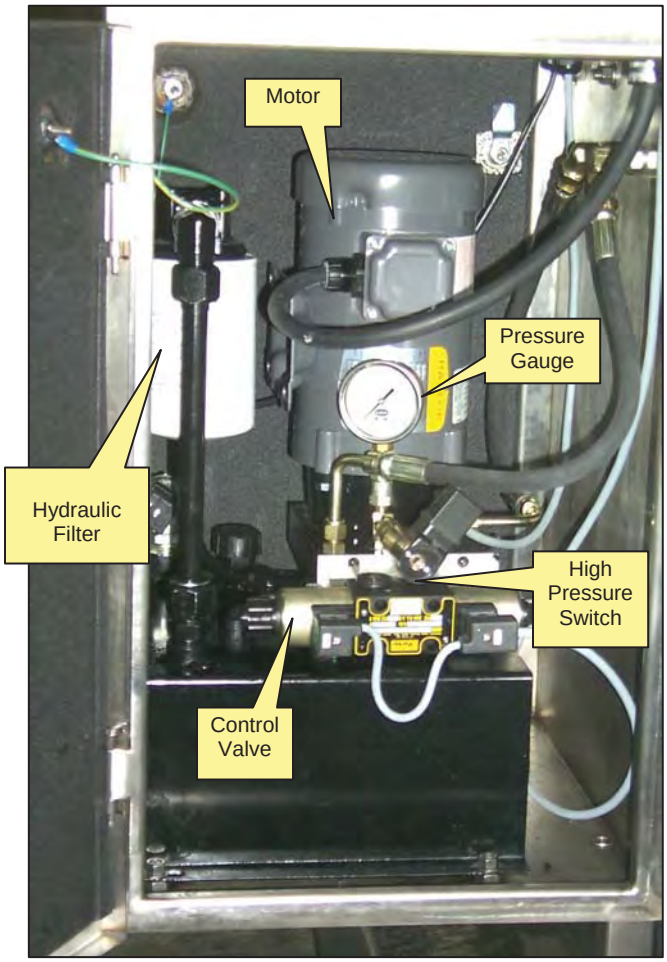
Electrical Components

The incoming electrical service terminates at the 40 Amp Disconnect and feeds three-phase power to the hydraulic pump and 24VDC Power Supply, protected by individual Fuse Blocks.

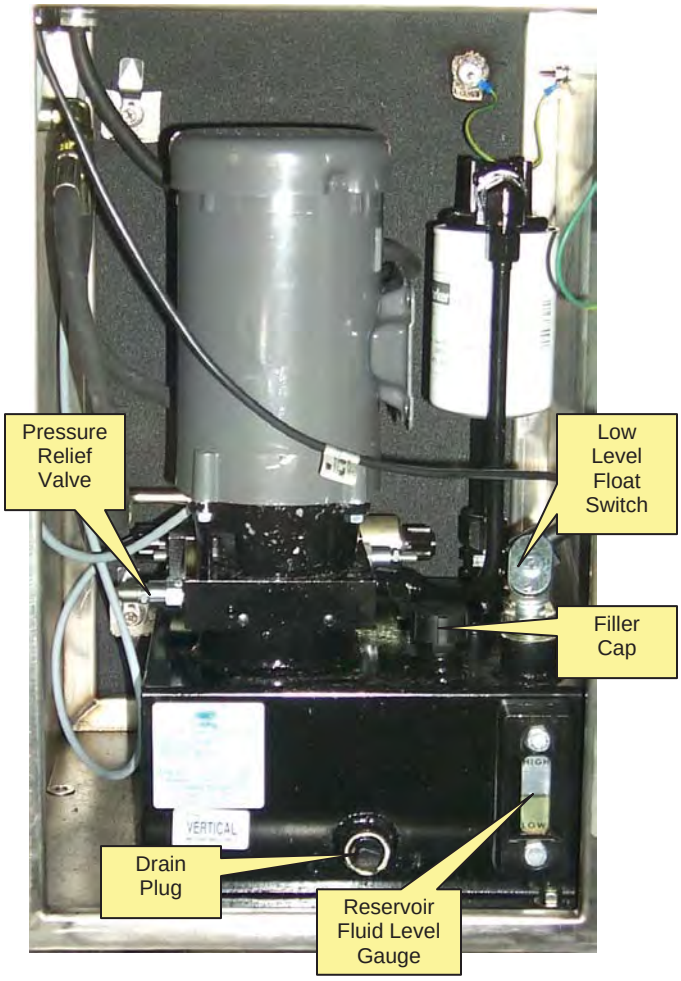
Hydraulic Pump Motor Starter and Thermal Overload

The Motor Starter and Thermal Overload control and protect the pump. The Thermal Overload is located beside the Motor Starter, and senses if the pump is drawing too much current, under which condition the hydraulic overload alarm is set. The dial setting on the Thermal Overload is preset by the manufacturer and should not be modified.

Hydraulic Components



Left Side HSC Service Entrance



Right Side HSC Service Entrance

The hydraulic components consist of the hydraulic pump, pressure switch, low-level float switch, pressure gauge, filter, directional valve and hydraulic reservoir.

The pump is used to pump hydraulic fluid from the reservoir to the manifolds located on the PDC. The solenoid directional valve determines fluid direction.

A sight glass gauge is provided on the reservoir inside the HSC enclosure for checking the hydraulic fluid level.

Pressure Gauge

The pressure gauge is located on the high-pressure side of the pump. The normal operating pressure is between 150-200 PSI.

DANGER

The pressure gauge should be checked when a high alarm is present at the SCC.

Hydraulic Pressure Switch

If the pressure in the hydraulic line reaches 250 PSI, an emergency stop condition will apply and the hydraulic system will automatically shut off. The high-pressure alarm relay will be triggered and an alarm will be displayed on the operator interface at the SCC.

If the level in the reservoir falls below the required level for pump operation the low-level float switch will set off a control relay to trigger a low-level alarm on the operator interface at the SCC.

Hydraulic Reservoir

Hydraulic fluid is stored in the reservoir in the HSC. The hydraulic reservoir is a rectangular metal tank located directly beneath the hydraulic pump. The tank is filled using a 6-inch diameter galvanized steel funnel provided in the operator's kit.

CAUTION

Use only a Trojan-approved hydraulic fluid. Please refer to MSDS in Appendix or label on reservoir for details.

Specifications

Item	Value
Pump	3.0 GPM US
Pressure gauge	0-600 PSI
Reservoir	3.7 gallons
Filter	SPE 15-BTA -10 Micron element B10=75 Synthetic
Hydraulic fluid	Shell Tellus T15, Refer to MSDS sheets in Appendix B for your site's Specified Oil.
Operating pressure	150-200 PSI
Low Fluid Level	Low-Level Float Switch
High pressure	250 PSI

Operation

When a wipe sequence is initiated, the pump turns on and the directional control value switches to EXTEND. Hydraulic fluid is pushed through lines that extend from the valve block in the HSC to a manifold found below the PDC. The individual modules have two hydraulic lines that plug into the manifold. The hydraulic fluid drives an internal piston located inside the rod on each module in a bank. All the modules in a bank (or both banks on double-sided PDCs) are extended simultaneously during a cleaning operation. After the EXTEND operation finishes, the solenoid in the directional control valve switches and the wipers retract.

? HOW TO INFO

Maintenance

Check Pressure Gauge and Reservoir Fluid Level

The hydraulic fluid level should be checked monthly using the sight gauge on the reservoir located in the HSC right side door. The fluid level should be in the top half of the gauge. If the fluid level is in the lower half and is still visible in the sight gauge, the system will still function. Low level float switch will activate and shut pump down.

Check Pressure Gauge

The pressure gauge should be checked when a low-level or high-pressure alarm is present, or whenever the enclosure panel is open. The pressure should be within the operating range between 150-200PSI.

Flushing and Filling Hydraulic Fluid

During the first two months of operation, as air is working its way out of the system, the hydraulic fluid may need to be topped up. The reservoir is located beneath the pump and is equipped with a removable cap. The funnel included in the operator's kit should be used to reduce the possibility of spilling fluid in the HSC enclosure.

The hydraulic fluid should be changed every two (2) years to help the system function efficiently.

CAUTION

Use only a Trojan-approved hydraulic fluid. Please refer to MSDS in Appendix or label on reservoir for details.

1. Disable wiping by switching HSC Wiper Mode Selector switch to OFF.
2. Set PDC Bank Mode Selector switch to OFF.
3. Lock out and tag power at disconnect(s) to PDC. (See General Lockout Procedure in the Preface chapter at the front of this manual).

DANGER

Electrical Hazard! LOCK OUT and TAG all sources of power before performing any maintenance, cleaning or repairs on any piece of equipment.

4. Remove fill cap.

5. If flushing the system, suction out the hydraulic fluid sitting the reservoir.

Note:	Low-level float may shut down system if the fluid level in the reservoir is too low.

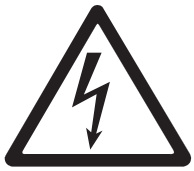
6. Insert funnel (from Operator's Kit) into reservoir.
7. Slowly pour hydraulic fluid into funnel and continue filling reservoir until level gauge reads high.
8. Restore power to the PDC disconnect(s) and set the Bank Mode Selector closest to the PDC service enterance to ON or REM (Remote).
9. Re-enable wiping by switching the HSC Wiper Mode Selector switch closest to the HSC to ON (Local) or REM (remote).

Remove and Replace the Hydraulic Filter

The hydraulic filter should be replaced:

- after the first 2 days of system use,
- once a year every thereafter

1. Set HSC Wiper Mode Selector switch to OFF to disable wiping.
2. Set PDC Bank Mode Selector switch to OFF.
3. Lock out and tag power at disconnect(s) to PDC. (See General Lockout Procedure in the Preface chapter at the front of this manual).

	**DANGER**
	Electrical Hazard! LOCK OUT and TAG all sources of power before performing any maintenance, cleaning or repairs on any piece of equipment.

4. Place a suitable container beneath the filter to catch drips.
5. Unscrew the filter by hand and discard the old filter.
6. Wipe the sealing face on the new filter with a dry clean cloth.
7. Apply a light film of hydraulic fluid to the gasket on the new filter.
8. Turn the filter to the casting by hand and then apply an additional 2/3 to full turn by hand to tighten.
9. Restore power to the PDC disconnect(s) and set the Bank Mode Selector closest to the PDC service enterance to ON or REM (Remote).
10. Re-enable wiping by switching the HSC Wiper Mode Selector switch closest to the HSC to ON (Local) or REM (remote).

Chapter 6

UV MODULE

6 UV MODULE 6-1

6 UV MODULE

6.1 Introduction

Description

The TrojanUV3000Plus™ uses horizontal Lamps in a modular arrangement with parallel Modules grouped to form a Bank across the open channel. This modular approach allows for simple maintenance and troubleshooting.

Low pressure, high intensity amalgam Lamps are mounted to Modules, which hold 8 vertically spaced Lamps enclosed in Quartz Sleeves.

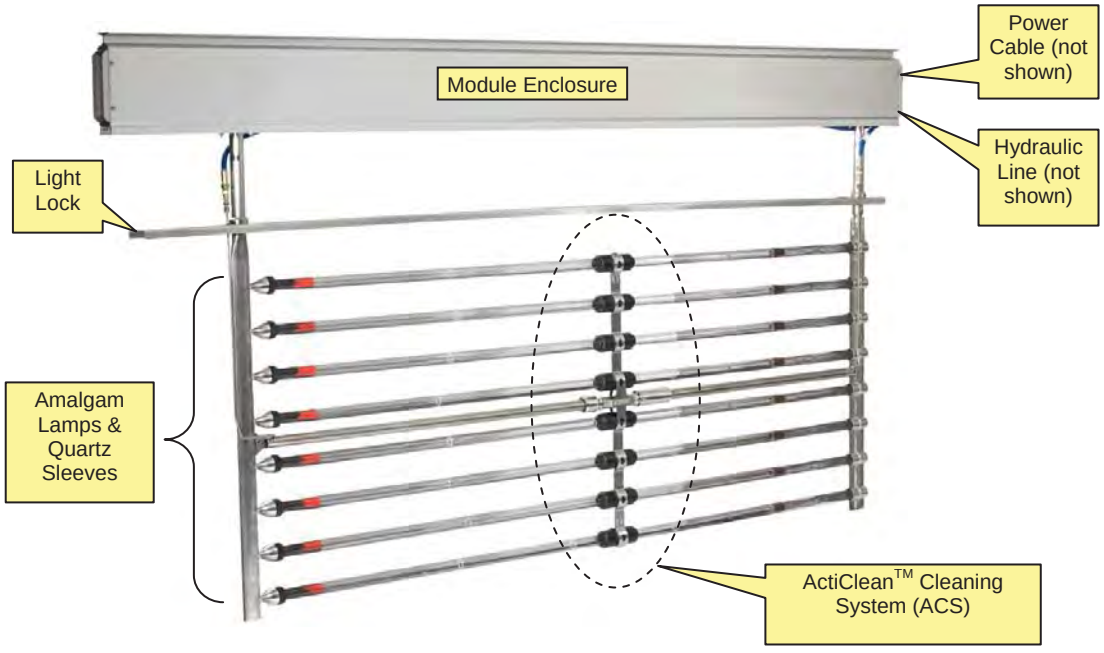
The closed end of the Quartz Sleeve slides into the formed Module leg and the open end of the sleeve fastens to a molded Lamp Holder assembly that is attached to the other Module leg. The Module legs feature a streamlined design to minimize headloss along the length of the Module.

All wiring between the Ballast and Lamps is contained within the Module leg. No wiring is exposed to water. The Modules are supported by a Module rack, which is anchored to the channel walls. The rack suspends the Modules in the channel so that the lowest Lamp is located just above the bottom of the channel and the Module Enclosure sits above the water.

The Modules are suspended from the rack by the Module Enclosure. Below the Module Enclosure is a 'light lock'. As the name suggests, the 'light lock' is used to prevent UV light from escaping above the Lamps.

Note:	***Do not*** *submerge Module Enclosures under water or the electrical components within may be damaged. Module Enclosures are water resistant not waterproof.*

The TrojanUV3000Plus™ optional ActiClean™ Cleaning System provides in-channel cleaning of the Lamp sleeves while the Lamps remain submersed in the channel. The system is hydraulically actuated via hydraulic lines that connect to a manifold suspended below the Power Distribution Center (PDC). The hydraulics are powered from the Hydraulic System Center (HSC), which houses the pump, solenoid two-way directional valve, reservoir, and associated equipment.



The Module Enclosure is an anodized aluminum extrusion. The top of the enclosure is designed with a lip for lifting a single Module by hand from the channel.

Variable output electronic Ballasts and a Module control board are housed in the Module Enclosure. A Ballast is provided for every two Lamps. The Ballasts are mounted on a Ballast tray that slides in and out of the enclosure.

The Module Control Board (MCB) is used to monitor the status of the Lamps and Ballasts. Information is sent between the MCB and the Communications Control Board (CCB) via the Relay Control Board (RCB). One RCB is provided for each Module. Both the RCBs and the CCB are located in the PDC.

The Modules are connected to the PDC using a power cable, which extends from one end of the Module Enclosure. The power cable for each Module is plugged into a labeled receptacle on the PDC.

If the ActiClean™ Cleaning System is used, two hydraulic lines run in a channel along the bottom of the Module Enclosure. The hydraulic lines are used to extend and retract the wiper system.

Specifications

Item	Value
Module leg and light lock	Stainless steel
Module Enclosure	Anodized aluminum

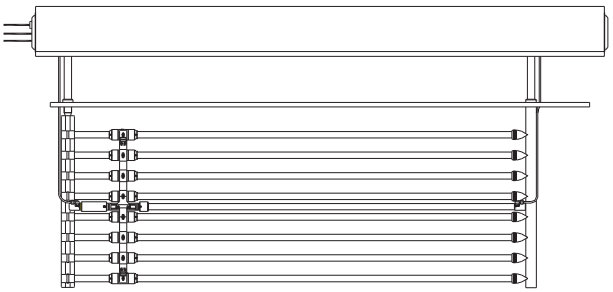
? HOW TO INFO

Maintenance

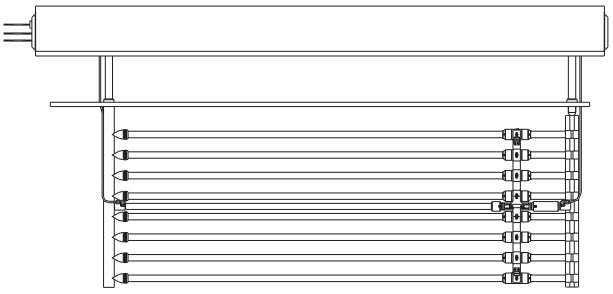
Maintaining Staggered Module Configuration

Each UV Bank of modules consists of two types of module configurations. The two types of module configurations are:

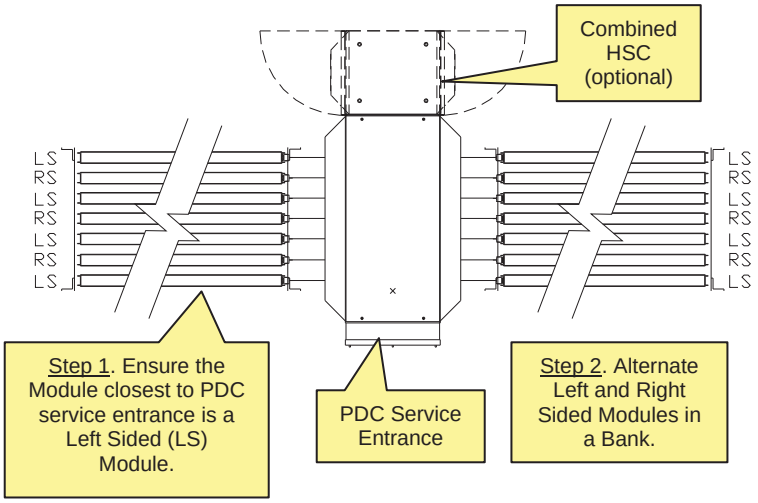
- Right Sided (RS) (Blue Hydraulic Lines)



- Left Sided (LS) (Black Hydraulic Lines)



Modules must be installed as follows:



Note:	One (1) module per bank will contain the UV Sensor. This module must be located in the middle of the bank. All UV Sensor Modules are Right Sided. For a bank containing: • *An odd number of modules, the UV Sensor Module will be the center most module.* • *An even number of modules, the UV Sensor Module will be the center most Right Sided Module.*

Note:	The number of banks per PDC and the side of the PDC the bank is located on may vary from site to site.

Removing and Disconnecting the Module From the System

CAUTION

Flooding Module Enclosures constitutes improper operation of the equipment and may cause extensive damage.

1. Determine the Bank and Module number requiring service from labels on PDC.
2. Go to Bank Control screen at System Control Center (SCC) and disable the Module to be repaired.

CAUTION

Electrical Hazard!

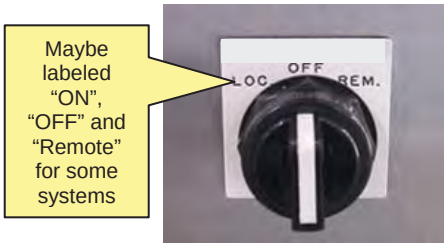
Ensure correct module has been disabled prior to disconnecting the module power cable.

3. Lockout and tag power to Module. Refer to the General Lockout Procedure in the Preface Chapter found at the front of this manual.

WARNING

Lockout Electrical Power

4. Set Wiper Mode Selector switch to OFF for Bank containing the Module that requires service.



WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

WARNING

Wear UV Resistant Face Shield!

Unprotected exposure to ultraviolet light can cause severe burns to the eyes and skin. Face shield should be worn as the primary protection against such exposure. Never look directly at the energized lamps unless you are wearing ultraviolet resistant face shield or glasses (for short-term exposure)

5. Unscrew appropriate Module power cord (and if applicable UV Sensor power cord – labeled UVD) at PDC.

CAUTION

Make sure the power cord and hydraulic lines do not fall into the channel.

6. Unplug Module power cord (and if applicable UV Sensor power cord – labeled UVD) at PDC.

⚠	**CAUTION** *Do not connect or disconnect hydraulic hoses while system is pressurized. Shut down system and relieve HSC pressure. Couplings are not designed to connect under pressure.*

7. Disconnect Module coupler from PDC manifold by aligning locking ball on female coupler. Cover ends of couplers with protective caps when couplers are not in use.

Note:	*The pressure gauge will always read some pressure, however the lines to the Modules should be purged of pressure.*

⚠	**CAUTION** *If protective caps are not used when couplers are not in use, damage can occur to the coupler.*

8. Carefully lift the Module from the channel. Hang the Module from a maintenance rack or carefully lay the Module on a clean, dry work surface. The Module is now ready for servicing.

⚠	**CAUTION** *Modules can weigh up to 112 lbs. Ensure use of proper lifting techniques and/or lifting device.*

Note:	*The Module must be placed in a clean, dry location for servicing.*

Installing and Reconnecting the Module to the System

WARNING

Wear UV Resistant Face Shield!

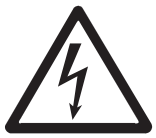
Unprotected exposure to ultraviolet light can cause severe burns to the eyes and skin. Face shield should be worn as the primary protection against such exposure. Never look directly at the energized lamps unless you are wearing ultraviolet resistant face shield or glasses (for short-term exposure)

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

1. Ensure that the module being inserted into the channel is the correct orientation. Refer to the Maintaining Staggered Module Configuration found in this chapter.
2. Place Module into channel. Verify light lock is properly seated in UV Module support rack.



CAUTION

Electrical Hazard!

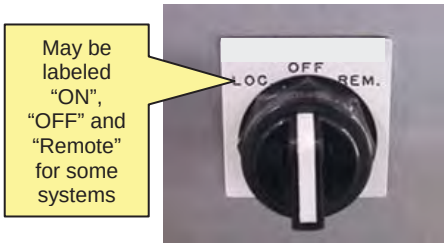
Ensure correct module has been disabled prior to reconnecting the module power cable.

3. Ensure Module is disabled at SCC.

WARNING

Lockout Electrical Power

4. Lockout and tag power to Module. Refer to the General Lockout Procedure in the Preface Chapter found at the front of this manual.
5. Ensure the Wiper Mode Selector switch is set to OFF for the Bank containing the Module being serviced.



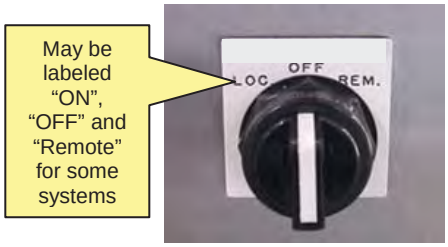
6. Reconnect Module coupler to PDC manifold by aligning locking ball on female coupler.The extend and retract lines are keyed so that they cannot be connected incorrectly.

Note:	*After reconnecting the Modules to the PDC, the HSC reservoir hydraulic fluid level will need to be monitored and filled as necessary when cycling the cylinders to replace the lost fluid. Manually cycle the cylinders twice to remove remaining air from the system.*

Note:	*Protective caps can be snapped together when not in use to protect them from damage and contamination.*

7. Plug Module power cord (and if applicable UV Sensor power cord – labeled UVD) into PDC.

8. Set Wiper Mode Selector switch at to REM (Remote).



9. Ensure the Module is enabled at SCC.

6.2 Electronic Ballast

Description

One Ballast powers two Lamps. The Ballasts are located within the Module Enclosure found on the top of the Module over the channel. The Ballasts have a total harmonic distortion of less than 5% when operated within the normal range.

Specifications

Item	Value
Input	277 VAC ±10%, 2.5 – 1.8 A, 60 Hz; 500W
Output	2 x 240W

? HOW TO INFO

Maintenance

Remove Ballast Tray

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

TOOLS REQUIRED

- #2 Phillips Screwdriver or 5/16" Hex Driver (or flathead)
- Soft bristle brush or clean lint free cloth.
- Household Cleaner (Fantastic, Simple Green, Lime-a-way or other)
- Dow Corning Lubricant 111 (non curing silicone lube)
- Isopropyl Alcohol (spray bottle)

Note: *The Module must be placed in a clean, dry location for servicing.*

1. Remove Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in this Chapter.

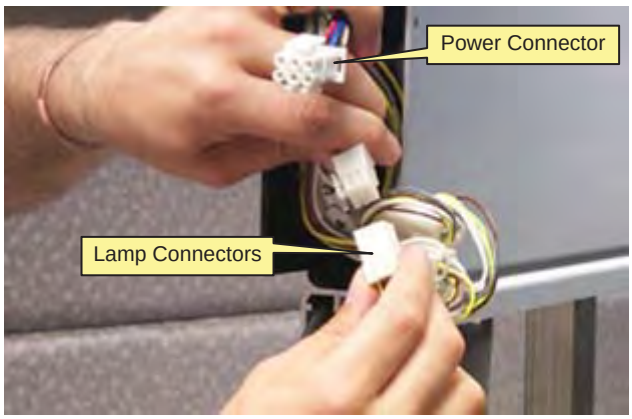
Note: ***Every time you open the Ballast Enclosure be sure to replace the old Desiccant Paks with new ones. There should always be four (4) Paks within the enclosure. These Desiccant Paks absorb any moisture trapped within the enclosure.***

2. Brush or wipe away any large debris from the endcap using a soft bristled brush or rag.

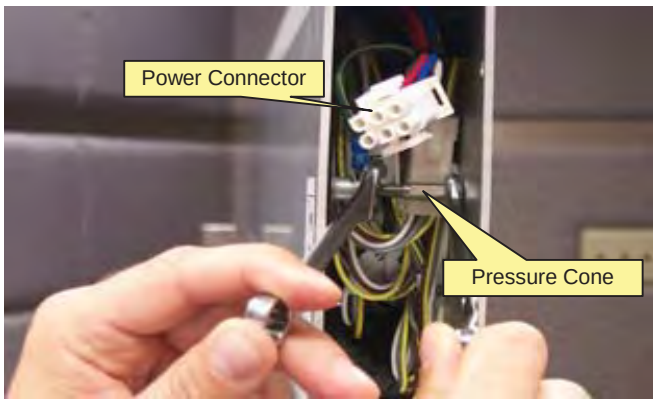
3. Remove screws on the sides of ***both*** endcaps using a 5/16" Hex driver (or Flathead screwdriver).

4. Gently pull endcaps out of Module Enclosure. If the endcaps are tight, a #2 Phillips screwdriver can be inserted into the available cross holes to act as a T-handle.

5. Disconnect Lamp connectors at cable end of enclosure.



Note:	*The Ballast tray cannot be pulled out through the cable end of the enclosure as the Lamp cables interfere with the Ballasts.*



6. Loosen pressure cone at cable end of enclosure using a ¼" wrench for the pressure cone and 7/16" wrench for the nut.

7. Pull Ballast Tray toward cable end until Lamp connectors are exposed. Place Ballast tray on clean workbench for servicing.
8. Disconnect Lamp connections at cable end of enclosure.

9. At module enclosure power cable end, push ballast tray back into the enclosure and continue by pulling Ballast tray out of the

opposite end of the enclosure.

10. Place Ballast tray on clean workbench for servicing.

⚠	**CAUTION** *Handle Ballast tray in upright position.*

Reinstall Ballast Tray

TOOLS REQUIRED

- #2 Phillips Screwdriver or 5/16” Nut Driver
- Spray Bottle of Isopropyl Alcohol
- Loctite® 222MS Threadlocker

1. To reinstall, slide the Ballast tray into Module Enclosure through back end of enclosure (non-cable end).
2. Pull Ballast tray at cable end of enclosure so Lamp connectors are exposed.
3. Connect Lamp and power connectors by matching labels on connector cords.
4. Push Ballast tray back into enclosure. Line up pressure cone with indentation on inside of enclosure.

⚠	**CAUTION** *Be careful not to over-tighten pressure cone as this will damage (bow) extrusion outward and potentially affect sealing performance.*

5. Tighten pressure cone (to 3 in lb) and grounding nut using ¼” and 7/16” wrenches.
6. Remove Silicone Seal from endcap and inspect sealing groove. Use household cleaner and lint free cloth to wipe groove clean. If groove is damaged, replace the endcap.

7. Inspect Silicone Seal for damage along sealing edge. Any cuts or excessive wear marks will require the seal to be replaced. It is recommended that the seal always be replaced during Enclosure servicing. If using original seal, ensure it has been cleaned and dried thoroughly using household cleaners (Fantastic, Simple Green, Lime-a-way or other) and a lint free cloth. Keep new seals protected in sealed bags until required for installation.

⚠	**CAUTION** *It is imperative that the enclosure be properly sealed from the elements to ensure that the ballasts and MCB are dry and free of any debris.*

8. Install Silicone seal onto endcap groove with open side (lip) facing towards the outside of the endcap.
9. Using Dow Corning 111 Silicone lubricant, apply a thin film of lubricant to outside of seal. The best way to lubricant the seal is to apply a small dab of lubricant between finger and thumb, rub together and apply to entire perimeter of sealing edge. Keep seal clean and free of debris until installation.

Note:	*Endcap and Seal preparation:* *To maintain factory sealing performance, it is critical that endcap sealing groove, and Enclosure be clean and free of debris. Inspect Silicone Seal for any damage or nicks on sealing edge of seal. Pay particular attention to the corners of the seal, as this is the most likely area for damage to occur. It is recommended that seals be replaced any time the Enclosure is serviced. Inspect Enclosure for damage to sealing areas (first 2" inside, from end of extrusion)*

10. Inspect the inside of Enclosure. Clean the first 2 inches of any debris. Inspect for any deep gouges which will affect sealing performance. If there are any sharp edges or gouges, it is recommended to use emery cloth or 220 grit sandpaper to smooth them out. Pay particular attention to the cross drilled holes as this is a likely area where sharp edges may be present. Once inspected, clean the inside perimeter with Isopropyl Alcohol to ensure it is clean and free of debris. Ensure power cord strain relief is hand-tight.

11. Connect Endcap Power Connector.

12. Install Endcap gently into enclosure, rocking back and forth (up and down) slightly to aid in seal insertion. The seal has a large "interference" with the enclosure, and needs to be inserted slowly to allow seal time to react. Pay attention to the corners of the seal as this it the most likely area where the seal may be pinched if inserted too fast. Once seal has entered the enclosure, push the endcap all the way in until it bottoms out on Enclosure end.

13. Install screws on sides of endcaps, hand tighten all 4 screws until contact is made with enclosure. Endcap should "self align" in enclosure.

14. Once Endcap is installed, finish by tightening each screw one half turn.

15. Ensure power cord strain relief is tight.

16. Once inspection and required service is complete, return the Module to the channel. Follow the Installation and Reconnecting the Module to the System procedure found in this chapter.

Note:	*When reinstalling endcap, the power cord strain relief must be installed towards the top of the enclosure.*

Remove and Replace Ballast

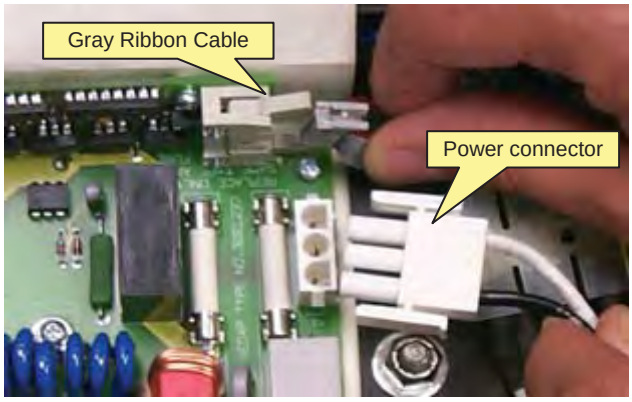
1. Remove Ballast tray from Module. Follow the Remove Ballast Tray procedure found in this Chapter.
2. Orient Ballast tray so Module Board is on left side, facing up.
3. Verify which Ballast requires replacement.

WARNING

Wear Protective Gloves!

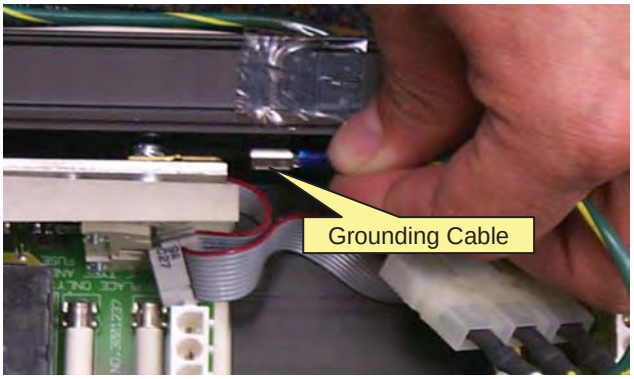
Always wear protective gloves when working on equipment.

4. Disconnect gray ribbon cable and power cable connector on right side of Ballast.

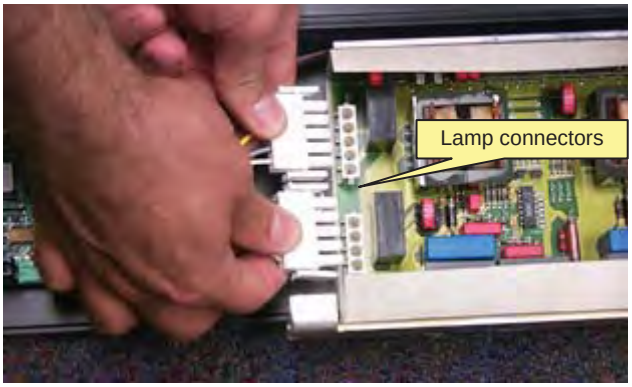


Note: *The Ballast furthest away from MCB powers Lamps 1 and 2. The next closest Ballast to the MCB powers Lamps 3 and 4. The Ballast closest to the MCB supplies power to the two lowest Lamps in the Module.*

5. Disconnect grounding cable on top of Ballast.



6. Disconnect 2 Lamp connectors on left side of Ballast.



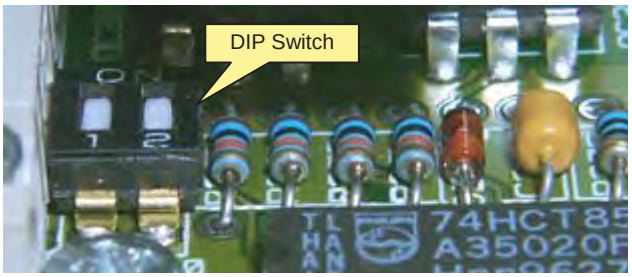
7. Remove the 4 Ballast-mounting nuts (2 on each side)of Ballast using a 7/16" socket.

8. Lift Ballast tray up to remove Ballast.

CAUTION

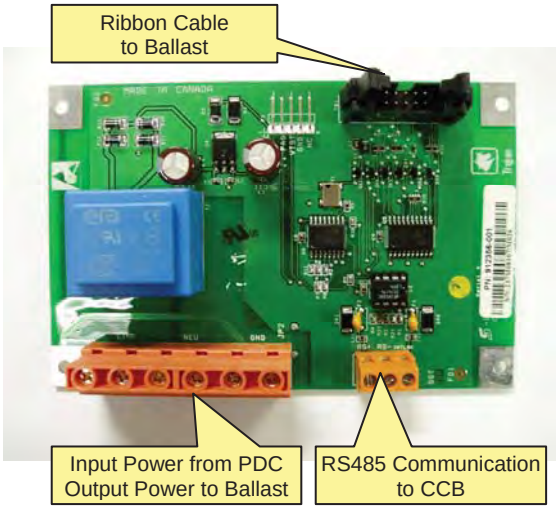
Ballast trays must be carried in an upright position only.

9. Locate DIP Switch on Ballast, next to ribbon cable connector. Ensure switches are set to same position on new Ballast.



10. Install new Ballast and tighten the 4 spare Ballast-mounting nuts using a 7/16" socket.
11. Connect ribbon cable, power, and 2 Lamp connectors to Ballast.
12. Reinstall the Ballast tray. Follow the Reinstall Ballast Tray procedure found in this Chapter.

6.3 Module Control Board (MCB)



Description

The MCB is a circuit board that is powered (220 or 277 VAC) from the RCB located in the PDC. The MCB controls the Ballast on/off and variable output power settings. The microcontroller on the MCB processes serial data from the Communication Control Board (CCB) and passes on the proper signals for Ballast control.

Specifications

Item	Value
Input power	277 Volts AC
Other inputs	RS485 Serial data
	Ballast/Lamp Status
Outputs	RS485 Serial Data
	Ballast PWM Control

? HOW TO INFO

Maintenance

Remove and Replace Module Board

1. Remove Ballast tray from Module Follow the Remove Ballast Tray procedure found in this Chapter.
2. Orient ballast tray so module board is on left side, facing up.
3. Disconnect ribbon cable connector, communication lines and power lines from Module board.
4. Carefully depress plastic tab on standoff. The Module board should come free.
5. Remove and replace Module board.
6. Firmly snap new board into place.
7. Connect ribbon cable connector, communication lines and power lines to Module board.
8. Reinstall the Ballast tray. Follow the Reinstall Ballast Tray procedure found in this Chapter.

6.4 Lamp Assembly

Description

The TrojanUV3000Plus™ germicidal Lamp is a low pressure, high intensity amalgam Lamp. The Lamps are designed to produce zero levels of ozone, withstand shock and vibration and are constructed of materials resistant to UV. The Lamps use a 4 wire hot cathode, pre heat design.

Specifications

Item	Value
Type	GA64T6 Amalgam
Outside diameter	3/4”
Inner diameter	11/16”
Arc length	58”
Overall length	62”

? HOW TO INFO

Maintenance

- Clean Quartz Sleeves – refer to the Inspect Quartz Sleeve for Cleanliness and Manual Quartz Sleeve Cleaning procedures.
- Replace Expired Lamps – refer to the Remove and Replace Quartz Sleeve and Lamp procedures.

The frequency of Lamp replacement depends on factors such as:

- temperature of effluent,
- power level of Lamps,
- frequency of switching Lamps ON and OFF.

To minimize the frequency of on/off cycles, a Bank timer is included in the control strategy. The timer must expire before a Bank is turned off. This potentially reduces the frequency of on/off cycles and preserves Lamp life.

Description

UV Lamps are enclosed in cylindrical Quartz Sleeves that protect the Lamp. One end of the sleeve is a closed dome shape. The other flared and open end is sealed against the Lamp Holder assembly. Each Lamp is isolated from all other Lamps to prevent moisture from entering the Module frame and each Lamp is rated for continuous submergence.

To prevent any water from entering and contacting the Lamps, it is very important to use the proper size O-rings and firmly tighten the sleeve-securing nut when replacing Lamps.

Specifications

Item	Value
Lamp sleeve	type 214 clear fused quartz
	transmits no less than 89% UV light

? HOW TO INFO

Maintenance

Inspect Quartz Sleeve for Cleanliness

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

WARNING

Wear UV Resistant Face Shield!

Always wear goggles or face shield when working with lamps or sleeves to protect against cuts in the event of breakage

1. Select Module and perform manual wipe sequence.
2. Remove the Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in this Chapter.
3. Allow Quartz Sleeves to dry for 10 minutes, as some coatings are not easily seen when sleeve is wet.
4. Inspect outside of dry sleeves for coating. The coating may be uniform or streaked, heavy or light. The color of the coating may be white, brown or yellow depending on wastewater quality and chemicals used in treatment.

A coating on the sleeves may result from:

- **Mechanical failure** – trapped debris prevents completion of the wiper stroke.
- **Hydraulic failure** – wiper stroke does not extend over the full length of the Lamp. The stroke time may not be long enough, or a hydraulic problem may exist. The most likely hydraulic problems could be low fluid, clogged filter or clogged pressure relief valve in the HSC.
- **Chemical failure** – diluted or weak cleaning agent or absence of cleaning agent in the wiper canister. If there is no fluid in the canister, the mechanical action of the moving wiper will leave a track over the length of the wiper stroke.

5. Unclean sleeves must be cleaned. Follow the Manual Quartz Sleeve Cleaning procedure found in this chapter.

6. Once inspection and required service is complete, return the Module to channel. Follow the Installing and Reconnecting the Module to the System procedure found in this Chapter.

Manual Quartz Sleeve Cleaning

WARNING

Corrosive! *ActiClean™ Cleaning Agent is acidic. Avoid inhalation, ingestion or exposure to eyes and skin.*

WARNING

Wear UV Resistant Face Shield!

Always wear goggles or face shield when working with lamps or sleeves to protect against cuts in the event of breakage

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

CAUTION

Do not use abrasive pads such as steel wool, copper wire or SOS pads since they will scratch the sleeves and cause damage to the system.

CAUTION

The lamps in this system emit ultraviolet light. Exposure to ultraviolet light can cause serious burns to unprotected eyes and skin.

CAUTION

O-rings must be free of nicks, dirt or water. Replace if needed.

1. Remove Module from channel for inspection. Follow the Removing and Disconnecting the Module from the System procedure found in this Chapter.
2. Apply Trojan approved cleaning agent to sponge, paper towel, or plastic scrub pad and rub outside of sleeve until deposits are removed.
3. Return Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in this Chapter.

Remove Quartz Sleeve and Lamp

WARNING

Wear UV Resistant Face Shield!

Always wear goggles or face shield when working with lamps or sleeves to protect against cuts in the event of breakage

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

1. Remove Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in this Chapter. Ensure ActiClean™ Cleaning System is parked at dome end of Quartz Sleeve.

CAUTION

Wear cotton gloves when handling new Lamps to protect Lamps and sleeve.

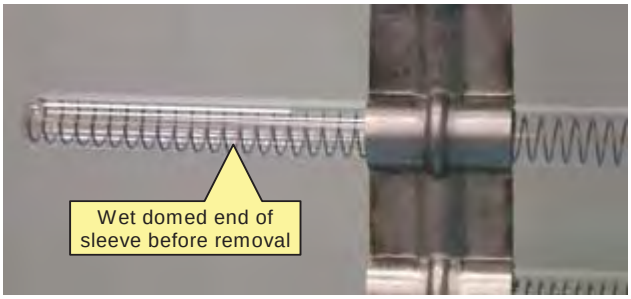
CAUTION

Ensure ActiClean™ Cleaning System is parked at dome end of Quartz Sleeve.

2. Unthread sleeve nut until it loosens from sleeve cup.

3. Carefully slide sleeve nut and O-ring along Quartz Sleeve

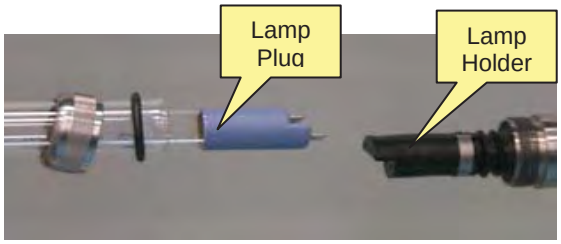
4. Carefully remove Quartz Sleeve from sleeve cup by pulling and rotating the Quartz Sleeve at the same time. To facilitate removal of sleeve, wet domed end along length of the spring.



CAUTION

Lamp connectors and Lamp Holders must be clean and dry. Clean with isopropyl alcohol if required.

5. Carefully disconnect the Lamp by pulling it from the Lamp Holder. Ensure the Wiper Canister and the Quartz Sleeve are supported.



6. Remove the Quartz Sleeve from the Module by pulling the Quartz Sleeve with Lamp inside out from the formed Module leg and through wiper canister. (If replacing the Lamp and not the sleeve, it is not necessary to remove the Quartz Sleeve from the Module. Slide Quartz Sleeve over only as far as necessary to provide adequate room to remove and replace the Lamp then proceed to procedural step # 4 of the Replace Quartz Sleeve Procedure found in this chapter.)
7. Remove the sleeve nut and the O-ring from the Quartz Sleeve. The nut can only be removed from domed end of sleeve because the other end is flared. Discard the O-ring.

8. Remove both the Lamp and spring from the Quartz Sleeve.

Replace Quartz Sleeve and Lamp

1. Insert the spring then Lamp into the Quartz Sleeve.
2. Install the Sleeve Nut and a new O-ring onto the Quartz Sleeve.
3. Install the Quartz Sleeve by sliding it through the wiper canister and then the formed Module leg.
4. Carefully reconnect the Lamp to the Lamp Plug.

NOTE: *Ensure the Quartz Sleeve comes in full contact with the rubber sleeve stop on the Lamp Holder plug after connecting the Lamp to the socket.*

5. Carefully slide the Sleeve Nut up the sleeve to the Sleeve Cup. Hand tighten the Sleeve Nut to ensure assembly is water tight.

CAUTION

When replacing the sleeve nut, ONLY hand-tighten to prevent damage to Module.

6. Return Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in this Chapter.

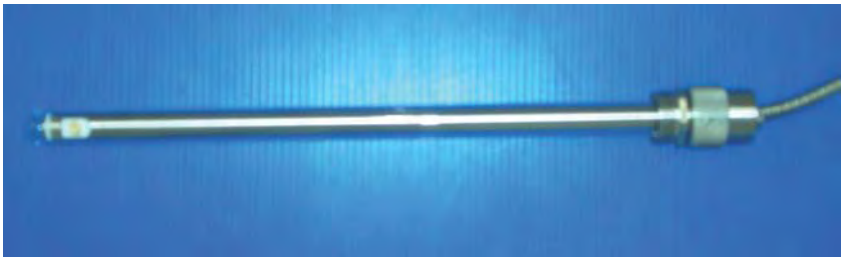
6.5 ActiClean™ Cleaning System (ACS)

See ActiClean™ Cleaning System (ACS) Chapter for maintenance instructions.

Note:	*Lamps must be fully submerged before initiating a wipe cycle.* *Operation of the ACS without the lamps fully submerged may result in damage to the ACS system.*

Chapter 7

UV SENSOR

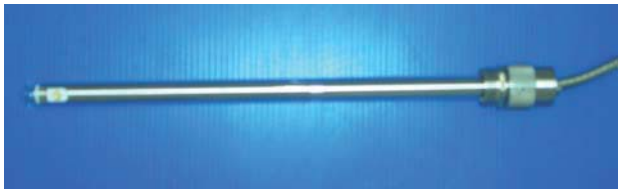


7 UV SENSOR

7.1 Introduction

Description

Trojan Technologies' UV Sensor patented technology, measures the UV intensity produced in each bank of modules.



As only one UV Sensor (also referred to as sensor) is required per bank of modules, the sensor is used in the module in the middle of the bank. If there are an odd number of modules in the bank, the UV Sensor is positioned in the middle module. If an even number of modules is used, the sensor is located in one of the two middle modules.

On 8-lamp modules, the sensor is positioned between the fifth and sixth lamp from the top.

The UV Sensor is maintenance free, since the entire unit remains clean and dry within the quartz sleeve. In systems that use the ActiClean™ Cleaning System (ACS), the quartz sleeve is automatically cleaned at regular intervals. In systems that require manual cleaning or cleaning in a portable or permanent cleaning tank, the sleeve is cleaned according to the maintenance schedule.

The UV Sensor incorporates a photodiode that gathers UV light from the lamp underneath the sensor. The light is then converted into an analog signal displayed in mW/cm^2 at the Operator Interface in the SCC.

The UV Sensor is inserted into a special sensor sleeve domed at one end and open and flared at the sensor end.

The whole sensor-sleeve assembly is sealed using o-rings and standard sleeve nuts to prevent water from entering the sensor sleeve.

The sleeve end that is opposite of the UV Sensor is supported by a special bracket. The sensor end is mounted on the module leg using a sensor support and a clamping bracket.

The power cord for the UV Sensor extends from the end of the sensor, routes up through the module leg light lock, and follows along a groove on the bottom of the module enclosure. The sensor cord plugs into a receptacle, labeled UVD (for UV Detection), located on the Power Distribution Center (PDC).

The receptacle is connected to an analog input on the Communications Controller Board (CCB) in the PDC. The UV Sensor is operated as a two-wire 4-20mA current loop transmitter. The 4-20 mA signal is converted in the microcontroller into units of intensity (i.e., mW/cm^2) and the resulting value is displayed on the UV Intensity Screen at the Operator Interface in the SCC.

Specifications

Item	Value
Input power	UV Sensor is designed to function with a supply voltage between 15 and 30 VDC
Cable	Twisted pair, shielded
Wavelength	UV Sensor responds only to ultraviolet energy
Storage temperature	-40ºF to 176ºF
Operating temperature	33ºF to 140ºF

Maintenance

Remove and Replace UV Sensor

1. Remove the Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in the UV Module Chapter.
2. Remove the Drive Bar. Follow the Disconnect Wiper Drive Bar procedure found in the ActiClean™ Cleaning System chapter.

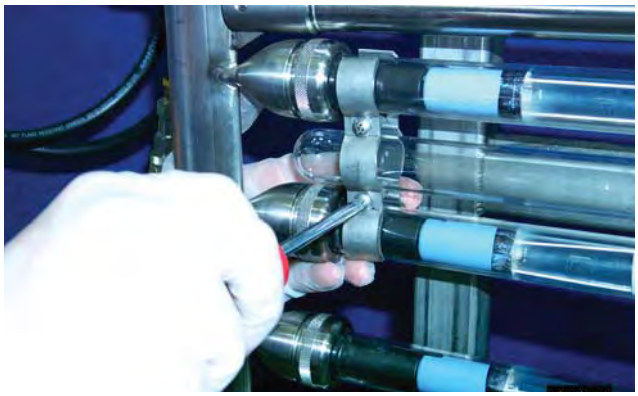
Note:	*For some installations, removing the Wiper Drive Bar to replace the UV Sensor will not be necessary. Assess your system to determine if adequate space is available.*

3. If the Drive Bar has not been removed, release the Sensor Canister from the Drive Bar by centering the canister lug in the Drive Bar slot. Gently pull the Drive Bar away from canister to release.

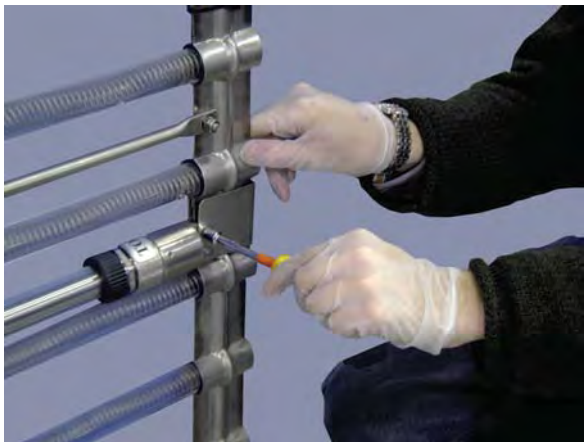
4. Place drip tray under Wiper System. Disconnect the tubing.

5. Slide cable with plastic bushing and strain relief through module light lock until completely free from module.

6. Loosen screws on sleeve bracket at the end opposite of the sensor.



7. Disassemble the 4 hex head screws.



8. Slide sensor assembly inwards to clear module leg and then swing out and slide outwards to allow for further disassembly.
9. Undo sleeve nut.

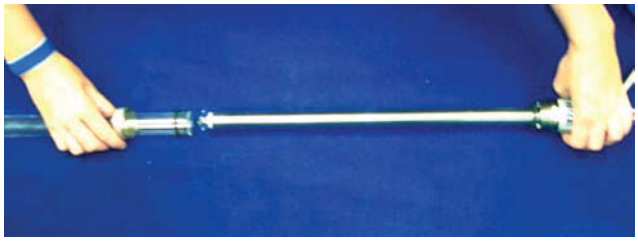
Note:	*Wiper Canister can remain on Quartz Sleeve while replacing UV Sensor.*

10. Slide sensor assembly out from sensor sleeve. Remove rubber washer seated at the bottom of the sensor sleeve.

11. Undo 2 set screws and remove clamping piece from sensor assembly. DO NOT disassemble any further.

12. Ensure inside of sensor sleeve is clean. If the UV Sensor has become soiled, gently clean the quartz optics with alcohol and then reinstall UV Sensor.

13. Place rubber washer on replacement UV Sensor. Insert replacement UV Sensor into sleeve, making sure all sealing surfaces are clean and undamaged.

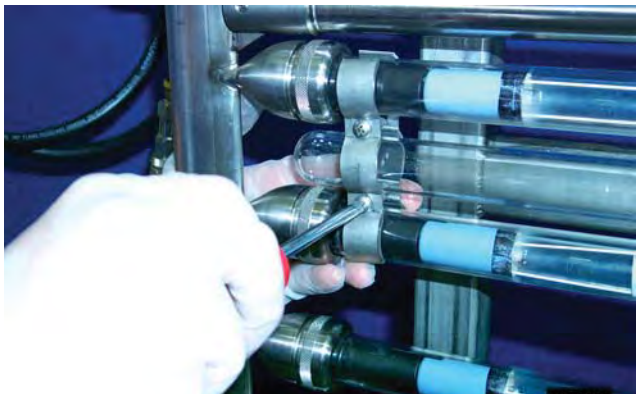


14. Use Anti-seize on sleeve nut. Ensure sleeve nut and all screws are tightened properly.

15. Ensure that the detector on the UV Sensor is facing the lamp below the sensor.

Note:	*On 3" spacing modules the sensor is equally spaced from the two adjacent lamps. On 3.5" & 4" spacing modules the sensor is positioned closer to the lamp below.*

16. Tighten screws on sleeve bracket at the opposite end.



17. Slide cable with bushing and strain relief through module light lock. Tighten strain relief on plastic bushing.

18. If the Wiper Drive Bar was not removed, procede to the next step. If the Drive Bar was removed, follow the Reconnect Wiper Drive Bar procedure found in the ActiClean™ Cleaning System chapter.

19. If the Drive Bar has been reconnected, procede to the next step. If not, center the Canister lug with the Drive Bar slot. Centering the lug in the slot will allow enough clearance to pass the lug through the hole.

20. Reconnect UV Sensor Wiper Canister tubing.

21. Top up the Wiper System. Follow the Fill Wiper System procedure found in this Chapter.

22. Clean off any hydraulic residue and/or ActiClean™ gel from the Quartz Sleeves, Wiper Canisters and module legs.

23. Return the Module to the channel by following the Reinsert Module into the Channel (Reconnect Module Power and Hydraulics) procedure found in the UV Module Chapter.

24. Return Wiping System to park position.

Chapter 8

WATER LEVEL CONTROL

8 Water Level Control 8-1

8 WATER LEVEL CONTROL

8.1 Weirs

Description

In most TrojanUV3000Plus™ applications, a weir is used to control the water level.

To achieve proper disinfection, the top of the weir is set at an elevation to control the depth of water above the top lamp. The weir height ensures the lamps will remain submerged in zero or low flow conditions. The Healdsburg, CA project weir is set to an elevation of 97.05' creating a weir height of 30.6".

The headloss associated with a fixed weir is dependent on the length of the weir plate. The shorter the weir plate, the greater the headloss or depth of water over the weir for a given flow. The Healdsburg, CA is a Trapezoidal style serpentine weir and has an overall crest length of 527". This weir length will provide proper effluent levels to allow for disinfection for up to peak flows of 4 MGD.

As effluent depth increases over the weir plate downstream of the UV system, effluent depth upstream of the reactor increases a corresponding amount. Therefore, when using a fixed weir, the hydraulic capacity of the plant upstream of the reactor must be considered under peak flow conditions.

Specifications

Item	Value
Weir	stainless steel. fabrication.
	A drain is usually installed at the bottom of the weir to completely empty the channel if required.

Maintenance

The crest of the weir should be inspected periodically.

If necessary, a high-pressure spray can be used to remove algae or other build-up on the weir.

Chapter 9

ACTICLEAN™ CLEANING SYSTEM – (ACS)

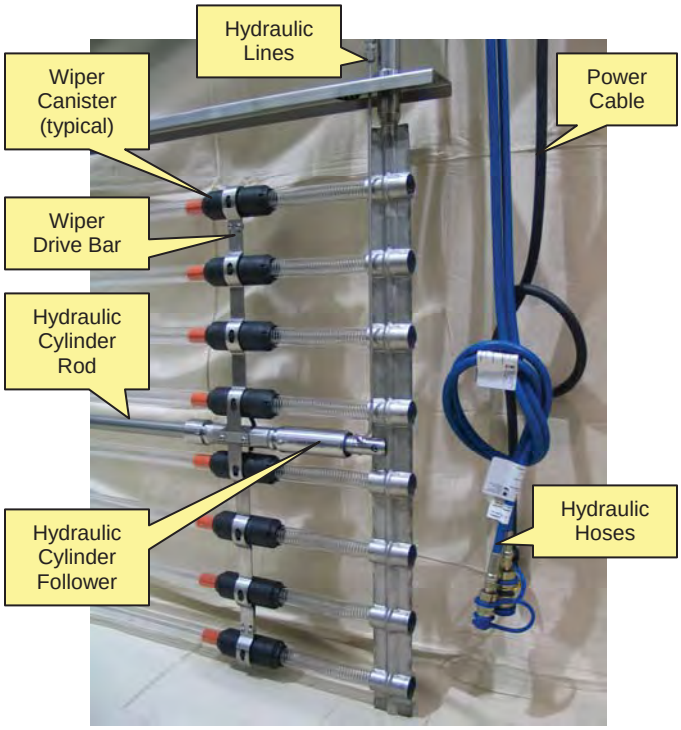
9 ActiClean™ Cleaning System (ACS)..... 9-1

9 ACTICLEAN™ CLEANING SYSTEM (ACS)

9.1 Wiper System

Description

The Trojan UV3000™Plus uses the patented magnetically coupled submersible Wiper Drive to clean the Lamp sleeves. This Wiper Drive is hydraulically actuated, fully automatic and programmable using the System Control Center (SCC). The Hydraulic System Center (HSC) contains the pump and associated equipment needed to drive the ActiClean™ Cleaning System (ACS).



Sleeve cleaning is achieved by:

- the mechanical scraping action of the Wiper Canister seals, and
- the chemical action of the cleaning agent within the Wiper Canister.

When a wiping sequence is initiated (either automatically or manually) all the Modules in the Bank are cleaned at once.

Each Module is fitted with a magnetically coupled submersible Wiper Drive. Hydraulic fluid is used within the enclosed rod to push an internal piston in both directions along the rod.

Magnets on the internal piston couple with magnets on the follower. The follower fits like a sleeve over the rod. As the internal piston in the rod is hydraulically pushed, the magnetic follower follows on the outside of the rod.

The Wiper Drive Bar is attached to the Hydraulic Cylinder. The Drive Bar also connects to the Wiper Canisters around each Lamp sleeve. As the Hydraulic Cylinder advances along the Module, it pulls the Drive Bar and Wiper Canisters along. The hydraulic fluid in the rod can be pushed in either direction to achieve a Wiper extend or Wiper retract function along the Module's length.

The Wiper Canisters are filled with a cleaning agent, which is in contact with the Lamp sleeve between the two Wiper Seals. The combined mechanical and chemical wiping of the sleeves effectively cleans the sleeves while they are submersed in the channel.

Specifications

Item	Value
Canister	Plastic Molded
Bar	Stamped Stainless Steel
Wiper Drive	Stainless Steel 290 PSI rated

Cleaning Agent

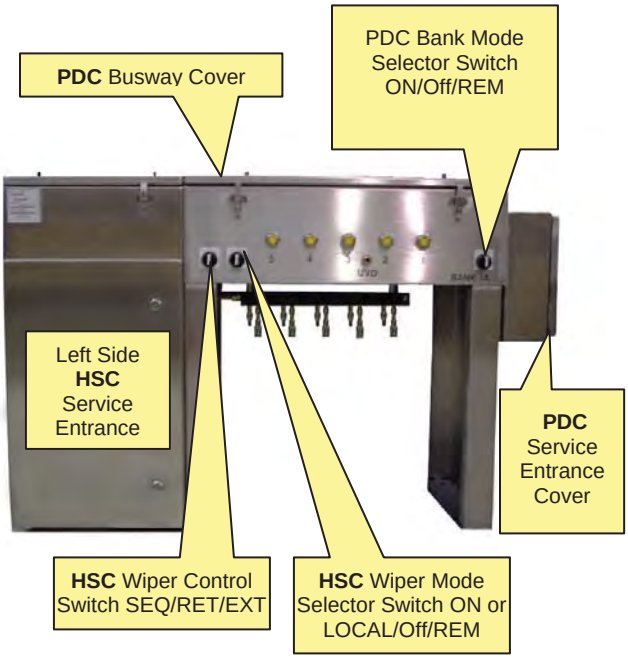
Only Trojan ActiClean™ Gel is recommended as a cleaning agent. Specifications are listed in the Material Safety Data Sheets (MSDS) Appendix.

Trojan ActiClean™ Gel is required to remove hard water scale. Other commercially available cleaning agents are not recommended. Some ingredients in other cleaning chemicals may react with UV and form a coating on the sleeve that is difficult to remove and will impair UV Transmittance.

Note:	*ActiClean™ Gel should be stored in a tightly sealed container located in a warm, dry environment. This environment should be between 32°F-122°F. If gel freezes, discard and replace*

Operation

For automatic cleaning, the system operates in the Remote Automatic Mode and cleaning occurs at preset intervals determined by the programmed settings in the SCC.



Each HSC has two selector switches (each with 3-positions) on the side of the PDC. There is always one Wiper Control switch and one Wiper Mode Selector switch.

The automatic wiping sequence is typically initiated once a day or as a maximum every 12 hours. However, depending on the wastewater characteristics, the interval between cleaning events can be adjusted at the SCC.

For testing, or troubleshooting, it may be necessary to manually extend or retract the Wipers in a Bank.

Note:	*The cleaning system will operate whether or not the Lamps for the Bank are energized.*

9.2 ActiClean™ Cleaning System (ACS)

The ActiClean™ Cleaning System (ACS) uses a patented submersible wiper drive to clean the lamp sleeves while they remain submersed in the channel and disinfection continues. The wiper drive is hydraulically actuated by the HSC and programmed through the System Control Center (SCC).

Cleaning of UV lamp sleeves is achieved by the following:

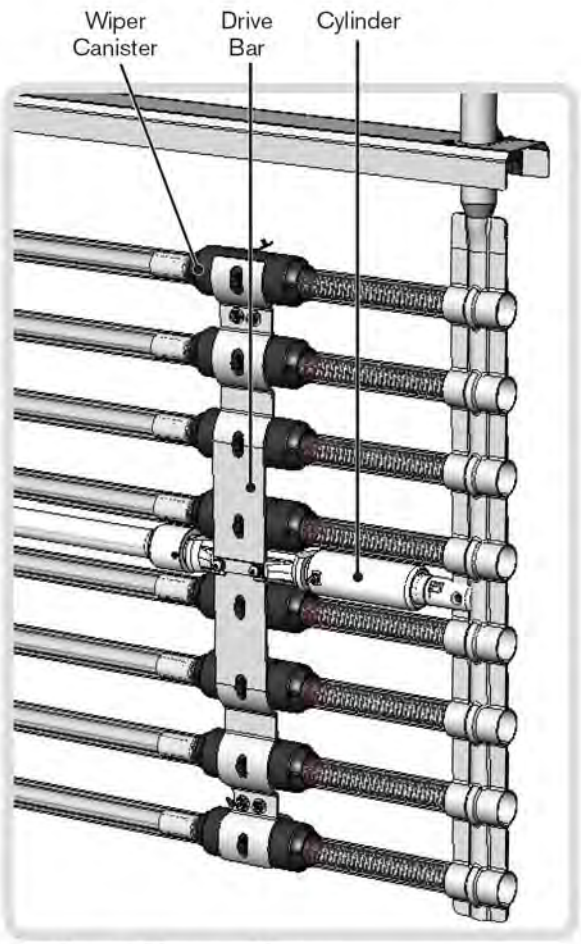
- The mechanical scraping action of the wiper canister seals
- The chemical cleaning action of the agent within the wiper canisters

The HSC pumps hydraulic fluid to manifolds resting below the PDC(s). Extend and retract hoses from each module are plugged into the manifold to complete the hydraulic loop.

Each module is fitted with a magnetically coupled submersible wiper drive. Hydraulic fluid is used within the enclosed rod to push an internal piston in both directions along the rod. Magnets on the internal piston couple with magnets on the wiper drive cylinder, which fits like a sleeve over the rod. As the internal piston in the rod is hydraulically pushed, the magnetic wiper drive cylinder follows on the outside of the rod.

The wiper drive cylinder is attached to a Wiper Drive Bar, which is connected to the wiper canisters filled with a cleaning agent. As the wiper drive advances along the module, the wiper canisters are pulled along and the cleaning agent comes in contact with the lamp sleeve between the two wiper seals.

The combined mechanical and chemical wiping of the lamp sleeves effectively cleans the lamp sleeves while they remain submersed in the channel.



ActiClean™ Cleaning System

In remote mode, the ACS is controlled by the SCC which implements the cleaning cycle to all connected banks and then repeats the cycle at regular time intervals pre-selected by the operator. The ACS wiping sequence can be manually initiated from the SCC.

Specifications: Wiper System

Item	Value
Canister	Plastic Molded
Bar	Stamped Stainless Steel
Wiper Drive	Stainless Steel 290 PSI (2000 kPa) rated
Cylinder	316 SST. Magnetically Coupled Hydraulic Actuated Cylinder

The ACS can also be manually controlled by moving the Wiper Mode Selector switch on the HSC to LOC (local) mode. Placing the Wiper Control switch in the SEQ (sequence) position will initiate the cleaning cycle one bank at a time. The RET (return) and EXT (extend) positions are used primarily for performing maintenance checks on the wiper system.

Cleaning Agent

Only Trojan ActiClean™ Gel is recommended as a cleaning agent. Specifications are listed in the Material Safety Data Sheets (MSDS) Chapter.

Trojan ActiClean™ Gel is required to remove hard water scale. Other commercially available cleaning agents are not recommended. Some ingredients in other cleaning chemicals may react with UV and form a coating on the sleeve that is difficult to remove and will impair UV Transmittance.

Note:	*ActiClean™ Gel should be stored in a tightly sealed container located in a warm, dry environment. This environment should be between 32°F-122°F. If gel freezes, discard and replace*

Operation

For automatic cleaning, the system operates in the Remote Automatic Mode and cleaning occurs at preset intervals determined by the programmed settings in the SCC.

Each UV system has at least two selector switches (each with 3-positions) on the side of the HSC. There is always one Wiper Control switch on the top and there can be between one to eight Wiper Mode Selector switches below. As one HSC is capable of providing automatic cleaning for a maximum of eight Banks and each Bank of Lamps has its own Wiper Mode Selector switch, there can be up to eight Wiper Mode Selector switches.

The automatic wiping sequence is typically initiated once a day or as a maximum every 2 hours. However, depending on the wastewater characteristics, the interval between cleaning events can be adjusted at the SCC.

For testing, or troubleshooting, it may be necessary to manually extend or retract the Wipers in a Bank.

Note:	*The cleaning system will operate whether or not the Lamps for the Bank are energized.*
Note:	*Lamps must be fully submerged before initiating a wipe cycle.* *Operation of the ACS without the lamps fully submerged may result in damage to the ACS system.*

To Manually extend (EXT) or retract (RET) all Wipers in a Bank

1. Move the Wiper Mode Selector switch to OFF position

2. Set Wiper Control switch to EXT or RET position depending on which direction you want Wiper to move.

Note:	*In Remote Automatic Mode (when Wiper Mode Selector switch is turned to REM) all the Modules in the Bank are cleaned simultaneously.* ***For automatic cleaning to occur while in Remote Automatic Mode, ensure the Wiper Control switch is set to RET.***

3. Move Wiper Mode Selector switch to the LOCAL position to initiate stroke for that Bank.
4. When complete, return Wiper Mode Selector switch to OFF.

Note:	*If more than one Bank needs to be cleaned manually, the Banks will be cleaned in the order in which the Wiper Mode Selector switches are moved to the LOC or ON position.*

To manually initiate a complete wipe sequence (SEQ)

5. Move Wiper Mode Selector switch for all Banks into the OFF position.
6. Set Wiper Control switch to SEQ position.
7. Move Wiper Mode Selector switch for Bank requiring cleaning to the LOCAL position.

The wiping mechanism will now fully extend, rest at the opposite side until wiping timer has expired (approx. 120 seconds for complete traverse), and then fully retract (within 130 seconds) to home position.

8. When the wipe sequence is complete, return the Wiper Mode Selector switch to OFF.

To Set for Automatic Cleaning (REMOTE)

1. Set Wiper Control switch to RET for home position.
2. Set Wiper Mode Selector switch to REMOTE for remote SCC wiper control.
3. HSC will be operated by automatic control..

Wiper Control Switch (RET/EXT/SEQ)

Wiper Mode Selector Switches (OFF/REMOTE/LOCAL)

9.3 Maintenance

A regular inspection of the Wipers and sleeves is recommended for early detection of possible cleaning problems. Dirty sleeves will inhibit the amount of UV light that can enter the wastewater and possibly compromise disinfection. Refer to Regular Maintenance Requirements in the Log Book Appendix for maintenance frequencies.

Note:	*If draining the Wiper System for Winterization, follow this procedure then refer to the Winterization of the Cleaning System procedure found in theStart Up and Shut Down chapter of this manual.*

WARNING

Wear Protective Gloves!

Always wear protective gloves when working on equipment.

WARNING

Wear UV Resistant Face Shield!

Always wear goggles or face shield when working with lamps or sleeves to protect against cuts in the event of breakage.

Drain Wiper System

1. Remove the Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in the UV Module Chapter.
2. Place a bucket underneath wiping system to

catch Trojan ActiClean™ Gel.

3. Disconnect the bottom Quartz Sleeve Nut, slide sleeve back and unplug the Lamp.

CAUTION

Wet sleeve before sliding through Wiper Canister.

4. Slowly slide the Quartz Sleeve and Lamp out of the Module Leg, then through the bottom Wiper Canister until the sleeve is completely removed. Store sleeve and lamp in a safe location to prevent breakage.
5. Open the top Wiper Filler Plug to facilitate drainage and drain spent Trojan ActiCleanTM Gel into bucket.

6. Once the Wiper System has been completely drained, inspect the bottom Canister for residue or debris. Clean with potable water if necessary or if preparing the system for winterization.

	CAUTION
⚠	*Use only warm water to rinse the inside of the wiper canister. Other cleaning agents may affect UV transmittance through the sleeve.*

7. Slide the Quartz Sleeve and Lamp back through the Wiper Canister and Mocule Leg. Plug in the Lamp and reconnect the Quartz Sleeve with the Sleeve Cup. Tighten and secure the Sleeve Cup.
8. If the Module is being prepared for winterization, proceed to the Winterization of Cleaning System procedure in the Start Up and Shut Down Chapter. If not preparing for winterization, proceed to the Fill the Wiper System procedure found in this chapter.

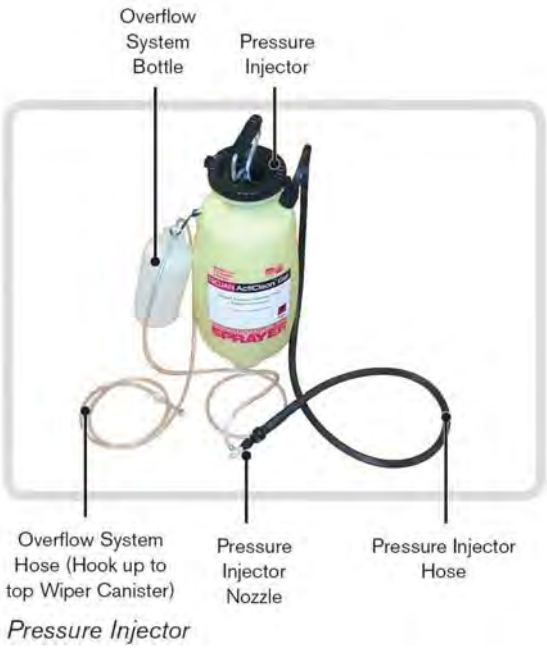
Note:	*If a sleeve breaks, the cleaning agent will need to be topped up.* *If the bottom sleeve breaks the entire system will have to be refilled.* *If a middle or top sleeve breaks, the system will only need to be topped up to replace the fluid that was lost.*

Fill Wiper System

1. Use the Pressure Injector with Overflow System as provided in the Operators Kit to fill the Wiper System as the following steps describe.
2. Open Wiper Filler Plug of the top canister. Insert the Overflow System Hose into the filler plug hole.
3. Insert the Pressure Injector Nozzle into the bottom canister filler plug hole. The Cut-out in the wiper bar provides access to the canister

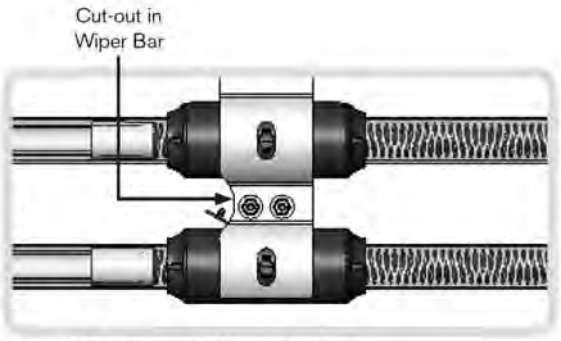
from the front. Ensure that the Overflow System Clamp is closed.

4. Fill until the gel overflows out the top of the filler plug hole, into the Overflow System Bottle.
5. When finished filling, open the Overflow System Clamp at the bottom Wiper Canister to allow trapped pressure and excess gel to empty into the overflow bottle.
6. Slowly remove the Overflow System Hose from the top filler plug hole.



Pressure Injector

7. Wipe away excess gel from around the top Wiper Filler Plug and close by firmly pushing the plug end into the hole until it snaps together.
8. Remove the Pressure Injector Nozzle slowly from bottom canister filler plug hole to relieve pressure.
9. Wipe away excess gel from around bottom canister filler plug and close by firmly pushing the plug end into the hole until it snaps together.
10. Ensure all surfaces are free from excess gel.
11. If no other Module maintenance is required, return the Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in the UV Module Chapter.



Front (Bottom) of Wiper System

9.4 Wiper Canister Maintenance/Removal

Remove and Replace Wiper Seal

Tools Required:
Cap Removal Tool,
Small Slotted Screw Driver,
3/16" Allen Key.

1. Disconnect Module power and hydraulic lines at PDC. Follow the Removing and Disconnecting the Module from the System procedure found in the UV Module Chapter
2. Drain the Wiper System. Follow the Drain Wiper System procedure found in this Chapter.

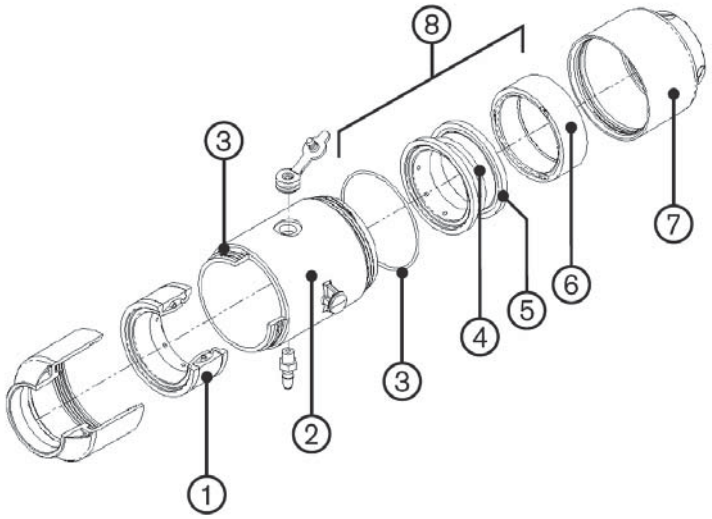
CAUTION

Ensure all inner parts of Wiper Canister are reinserted in the proper orientation. Failure to do so will result in an incomplete seal.

3. Disconnect the tubing between the Wiper Canisters.
4. Disconnect the Wiper Canister from the Drive Bar. Follow either Step **4a** or **4b** for each Wiper Canister that will be removed:

4a. Top and Bottom Wiper Canisters:
Loosen the top or bottom bracket nuts. Bracket will slide away to release the canister.

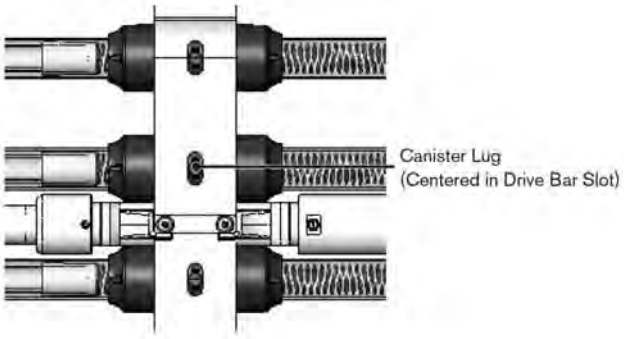
Carefully rotate the canister and center the canister lug within its drive bar slot. Proceed to Step #5 to remove Quartz Sleeve and wiper canister.



① Wiper Seal (Assembly)
② Canister Body
③ O-Ring
④ Wiper Seal Spring
⑤ Wiper Seal
⑥ Seal Spacer
⑦ Endcap
⑧ Wiper Seal (Exploded)

4b. Middle Wiper Canisters:

Release all middle canisters by centering each canister lug within its Drive Bar slot. Proceed to Step #5 to remove Quartz Sleeve and wiper canister.



5. Remove the Quartz Sleeve. Disconnect the Sleeve Nut, slide sleeve back and unplug the Lamp.
6. Slowly slide the Quartz Sleeve with wiper canister attached out of the Module Leg.
7. Carefully detach gel hoses between canisters.
8. Slide the Wiper Canister off the domed end of the Quartz Sleeve over a bucket to catch any remaining . Ensure the length of the sleeve is supported.

Note:	*When removing any inner Canister parts, replace all inner parts included in seal replacement kit for each Canister.*

9. Store the lamp and Quartz Sleeve in a secure location to prevent breakage.

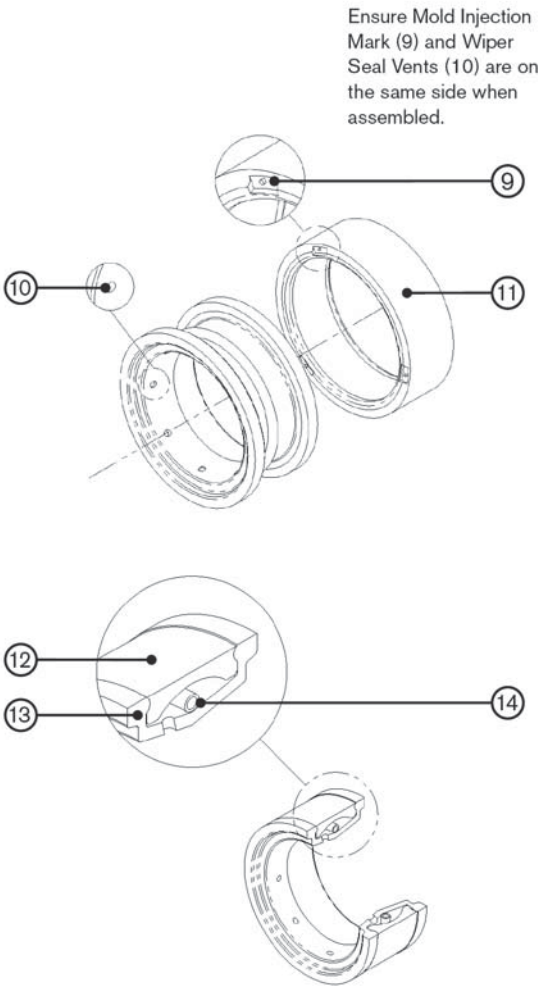
	CAUTION
⚠	*Wet the sleeve before sliding it through Module leg.* *Wet the sleeve before sliding Wiper Canister off.*

10. Clean canister with warm water.
11. Unscrew the endcap from the body using the end cap tool and 3/16” Allen head tool.
12. Remove seal assembly from the endcap.
13. Insert a small screw driver under the O-ring to remove it from the Canister Body. Discard the O-ring. Repeat for other O-ring.

14. Rinse inside of the End Caps and Canister Body to ensure the inside of each is free of debris.

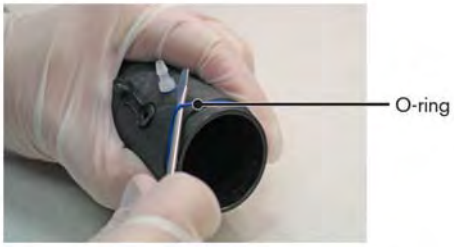
15. Stretch a new O-ring over the threads of each end of the Canister Body. Ensure the O-rings are not rolled or twisted and that they fit in each Canister Body groove.

16. Slip the Tension Spring and Seal Spacer over



Wiper Seal Orientation

⑨ Mold Injection Mark
⑩ Wiper Seal Vent (Typ.)
⑪ Seal Spacer
⑫ Seal Spacer
⑬ Wiper Seal
⑭ Tension Spring



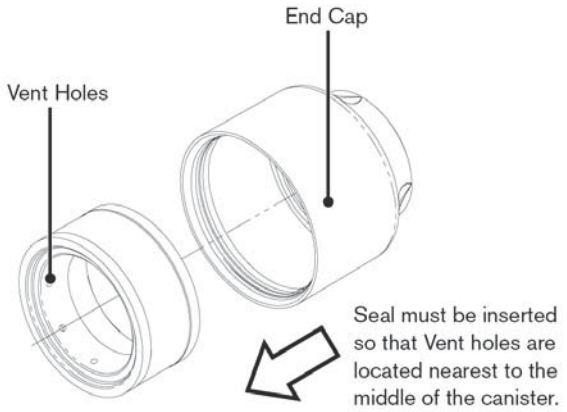
the Wiper Seal by folding the Wiper Seal slightly. Ensure the vent holes and mold insertion marks face the canister body – see image of *Wiper Seal Orientation*.

17. Install the Wiper Seal with Spring into Seal Spacer to form the Seal Assembly.

18. Lubricate Seal ends with soapy water.

19. Slide new Seal Assembly into each End Cap. Ensure Wiper Seal vent holes face out of cap. See image *Wiper Seal Cap Orientation*.

20. Thread on Cap Assembly by hand tightening until resistance is felt. **Do not** over tighten Caps



Wiper Seal Cap Orientation - Vent Holes

21. Using Cap Tool finish tightening cap by turning tool clockwise until it bottoms out.

CAUTION

Do not over tighten End Cap to Canister Body.

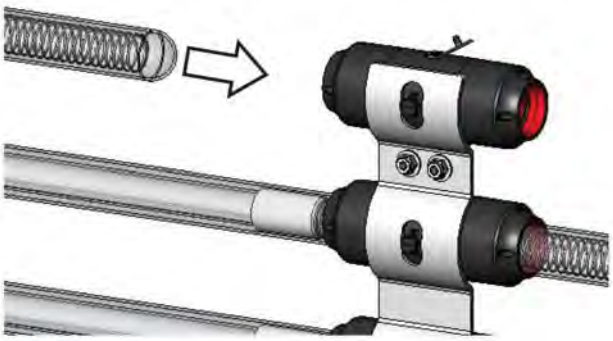
22. Reinstall the Canister back onto the drive bar assembly. Follow Step 22a for Top and Bottom Canisters, or Step 22b for Middle Wiper Canisters.

22a. Top and Bottom Wiper Canisters:

CAUTION

Ensure Canister Lug is locked into Drive Bar Slot before installing the Quartz Sleeve.

Slide the top or bottom bracket away from the Canister. Slide canister in between wiper bar and bracket.



Slide the Quartz Sleeve and Lamp through the Wiper Canister and Module Leg. Plug in the Lamp and reconnect the Quartz Sleeve with the Sleeve Cup. Tighten and secure the Sleeve Cup Nut. Inspect tubing for damage or wear and tear and replace as required. Reconnect the canister tubing.

Once the sleeve is installed, slide the top or bottom bracket against the back of the canister. Tighten the bracket nuts to lock the canister lug into place making sure the canister lug is centered within the drive bar slot. Once tight, ensure canister slides freely in the slot.

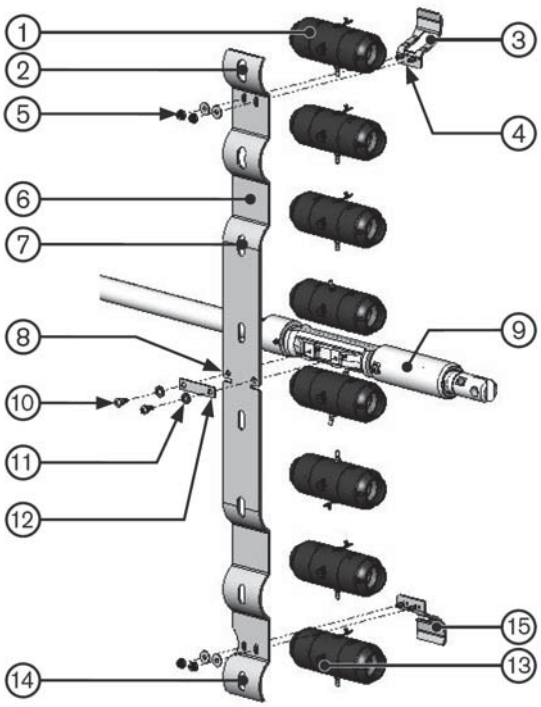
22b. Middle Wiper Canisters:

- Center each Canister lug with its Drive Bar slot.
- Inspect tubing for damage or wear and tear and replace as required. Reconnect the canister tubing.

Ensure canister lug is in slot before installing the sleeve. Connected hose will hold canister in place. Slide the Quartz Sleeve and Lamp back through the Wiper Canister and Module Leg. Plug in the Lamp and reconnect the Quartz Sleeve with the Sleeve Cup. Tighten and secure the Sleeve Cup.

23. Refill the Wiper System. Follow the Fill Wiper System procedure found in this Chapter.

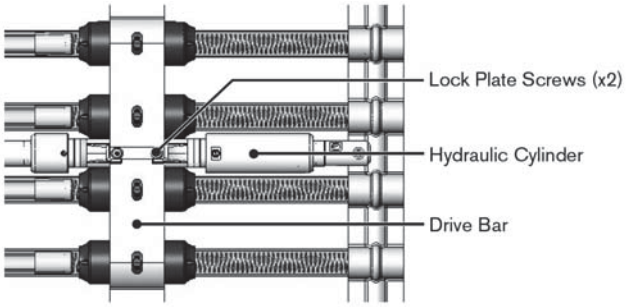
24. Return the Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in the UV Module Chapter.



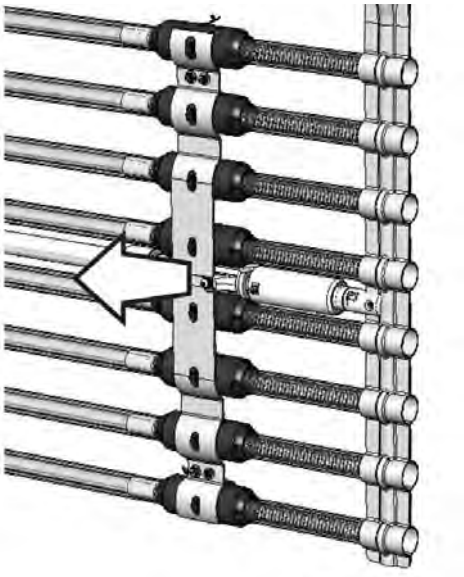
① Wiper Canister
② Top Slot
③ Bracket (Upper)
④ Bracket Screws
⑤ Bracket Nuts
⑥ Drive Bar
⑦ Slot (Typ.)
⑧ Drive Bar Mount
⑨ Hydraulic Cylinder
⑩ Lock Plate Screws
⑪ Lock Plate Washers
⑫ Lock Plate
⑬ Canister Lug (Typ.)
⑭ Bottom Slot
⑮ Bracket (Lower)

Disconnect Wiper Drive Bar

1. Loosen the Wiper Drive Bar top (3) and bottom bracket(15). Brackets will slide away from canisters (note: brackets will be trapped by the hose)
2. Align all middle canister lugs with Drive Bar slots.
3. Remove the lock plate (12), screws (10) and washers (11) to release the Drive Bar from the Hydraulic Cylinder. Save the plate, screws and washers in a safe location.



4. Remove bracket (Upper and Lower) by removing the bracket nuts.
5. Remove the Drive Bar by gently pulling it away from the canisters.

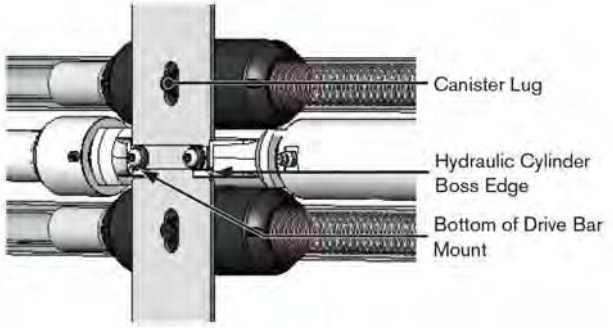


Reconnect the Wiper Drive Bar

CAUTION

Ensure all canister lugs face the Drive Bar side of the module before lining up the Drive Bar with the canisters.

1. Insert Drive Bar top slot onto the top canister lug by sliding back the bracket and rotating the lug into the slot.
2. Drop the Drive Bar Down and align all the middle and bottom canisters with the Drive Bar slots.
3. Pre-align the bottom of the Drive Bar Mount with the Hydraulic Cylinder boss edge.



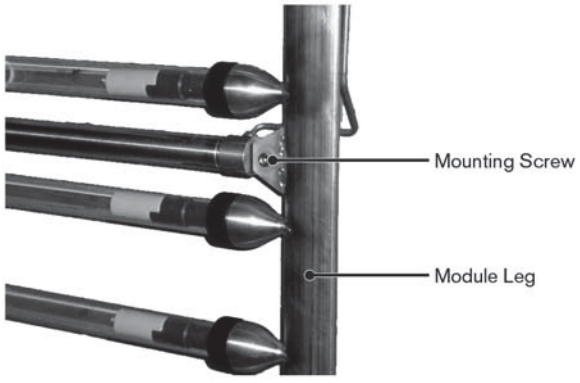
4. **For Sensor Module Only:** Once the Drive Bar Mount and each Canister lug is aligned, rotate the bottom canister lug into the clearance hole behind the bracket.
5. Ensure the Drive Bar Mount is still aligned with the Hydraulic Cylinder boss edge.
6. Apply Blue Loctite to lock plate screws.
7. Refasten the lock plate, screws and washers. Torque lock plate screws to 40 in. lbs.
8. Slide the Quartz Sleeve and Lamp through the Wiper Canister and Module Leg. Once the sleeve is installed, slide the top or bottom bracket against the back of the canister. Tighten the bracket nuts to lock the canister lug into place making sure the canister lug is centered within the drive bar slot. Once tight, ensure canister slides freely in the slot.

Remove and Replace Hydraulic Cleaning Cylinder

1. Remove the Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in the UV Module Chapter.
2. Place drip tray under hydraulic line connections.
3. Remove the Drive Bar. Follow the Disconnect Wiper Drive Bar procedure found in this chapter.
4. Disconnect the tubing between canisters on either side of the Hydraulic Cylinder.

Note: *Disconnecting the tubing between canisters is not always necessary. Tubing only needs to be disconnected if it will provide easier access to the Hydraulic Cylinder for removal.*

5. Disconnect the steel hydraulic lines from either end of the Hydraulic Cylinder. Pull away to drain into drip tray.
6. Remove screws securing the Hydraulic Cylinder to each of the Module legs.

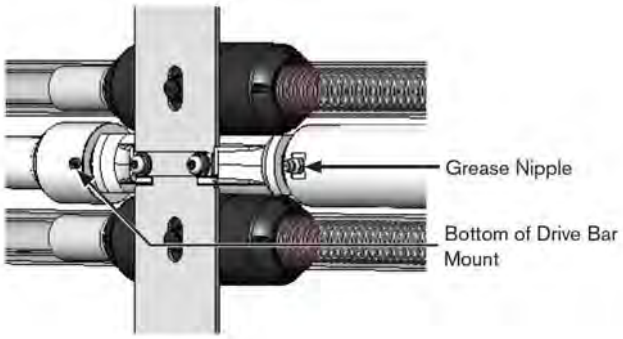


7. Carefully remove the Hydraulic Cylinder by pushing the open end away from the Module and sliding the slot end out of the frame.
8. Apply Blue Loctite to all screws.
9. Install the new Hydraulic Cylinder onto the Module leg by following steps 5 – 7 in reverse order.
10. If tubing between Wiper Canisters was not disconnected, proceed to next step. Otherwise, replace and reconnect tubing between the canisters. Top up Wiper System gel as required. Follow the Fill Wiper System procedure found in this chapter.
11. Reconnect the Hydraulic Cylinder and the Drive Bar. Follow the Reconnect Wiper Drive Bar procedure found in this chapter.
12. Clean off any hydraulic residue and/or ActiClean™ gel from the Quartz Sleeves, Wiper Canisters and module legs.
13. Top up hydraulic fluid in HSC as required. Follow the Add Hydraulic Fluid or Flushing and Filling Hydraulic Fluid instructions in this Chapter for full details.
14. Return the Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in the UV Module Chapter.

Grease the Hydraulic Cleaning Cylinder

Tools Required:
-Grease Gun
-Biodegradable Grease (Provided with Kit)

1. Remove the Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in the UV Module Chapter.
2. Remove the vent screw from the Hydraulic Cylinder with the Allen key provided. Retain screw.
3. Grease the Hydraulic Cylinder, using the grease gun containing supplied grease (both provided in the grease kit) through the nipple until new clean grease squirts out of the vent hole. Old grease will be grey whereas new grease is white.



4. Wipe off excessive grease.
5. Replace vent screw. Do not over tighten.
6. Return the Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in the UV Module Chapter.

Note:	*Hydraulic Cylinders must be greased every 6 months.* *For seasonal disinfection sites, every time the system is removed from the channel or shut down for winter maintenance, the actuators have to be filled up with grease.*

Note:	*Use only Jet Lube biodegradable grease in cylinder*

Remove and Replace Hydraulic Hoses

1. Remove the Module from the channel. Follow the Removing and Disconnecting the Module from the System procedure found in the UV Module Chapter.
2. Place a pail for oil drainage under appropriate connection end.

WARNING

Wear UV Resistant Face Shield!

Always wear goggles or face shield when working with lamps or sleeves to protect against cuts in the event of breakage.

3. Remove or all four (4) T - Clamps on the underside of the Module Enclosure by loosening the T-Clamp nut till it reaches the end of the stud. Pull down the T-Clamp and twist to clear the hose. Leave the Clamp Assembly attached to prevent lose of parts.

4. Gently pull the hoses down from the underside of the Module Enclosure along the entire Module length.

5. Place ½" wrench on the adaptor nut and hold rigid. Undo hose swivel nut with 9/16" wrench.

6. Slowly detach the hose. Take care not to damage threads, and ensure that no pressure is trapped in the hose.
7. Allow the drip tray to catch all oil.

8. Detach existing hose coupler from the existing hose if one is not provided on the new hose assembly.
9. Transfer existing coupler to new hose assembly if new coupler is not provided.
10. Apply pipe sealant to new hose fittings. Finger tighten coupler until snug and tighten 1 (one) additional turn with wrench.
11. To reinstall the new hose assembly finger tighten the hose swivel nut onto adaptor. Wiggle hose if necessary to ensure alignment.

12. Hold the adaptor and tighten the hose swivel nut until it seats, tighten an additional ¼ turn.

13. Re-route and press fit hose back into slot on underside of Module Enclosure.

14. Twist T-Clamps back into position and tighten the nut.
15. Ensure all connections are tight and hose is clamped into the underside of the Module Enclosure (hose must be pushed into Module grooves for proper clearance and to reduce pinching of hose).
16. Ensure hoses are not kinked, twisted or bent and ensure adequate slack while hoses are in use.
17. Remove oil residue from Module and work surface.
18. Repeat previous procedures for remaining Module hoses.
19. When all hoses have been replaced, return the Module to the channel. Follow the Installing and Reconnecting the Module to the System procedure found in the UV Module Chapter.

Apply Rust Inhibitor (Safegard M1)

To prolong the quick disconnect hydraulic fittings useful life, Trojan recommends that a water based coating be applied to these fittings. Components should be sprayed every six months to prevent corrosion.

1. Identify components to be coated (Hydraulic Components)
2. Prior to application, clean components with clean potable water spray.
3. Let components dry before applying rust inhibitor. Ensure that all components are connected (as in normal operation) before spraying to prevent the ends of the hydraulic quick disconnects from being contaminated.
4. Replace the bottle cap with spray head supplied, and spray components until components are wet.
5. Let components dry for 24 hours.
6. Repeat the process every 6 months.

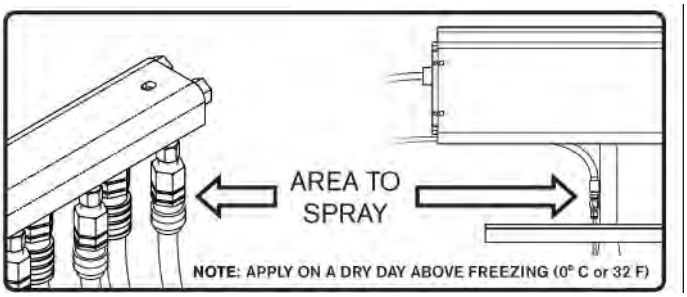
Additional information about the SAFEGARD M1 and distributors in your area can be found on the manufacturer's website or through distributors such as McMaster Carr.

http://www.sanchem.com/
http://www.mcmaster.com/

Note:	*If product thickens, dilute with clear potable water, shake and apply.*

Note:	*Apply on a dry day above freezing (32F)*

For more details refer to product bulletin 07-PB3P-00



9.5 Hydraulic System Center (HSC)

Description

The wiper drive on the ACS is hydraulically actuated using hydraulic fluid pumped from the HSC.

For a details on the operation and maintenance of the HSC refer to the Combined PDC/HSC Chapter of this O+M Manual.

Appendix ER-B. UV Disinfection System Performance Test Results

TROJAN UV
WATER CONFIDENCE™

February 11, 2009

Jeff Naff
Overaa Construction
340 Foreman Lane
Healdsburg, Ca 95448
Ph: 510-234-0926

Subject: Performance Test Results on the Trojan UV3000+ at Healdsburg California WWTP

Jeff

This letter is intended to summarize the test results on the Trojan Technologies UV3000+ UV Disinfection system at the Healdsburg California Wastewater Treatment Plant.

The Performance test was conducted by Overaa Construction. UV system operating conditions during the performance test were collected through the Healdsburg plant SCADA system. Water samples were taken by composite sampler and the water samples were analyzed by Alpha Analytical Laboratories Inc. 208 Mason St. Ukiah, CA 95482.

Included with this letter is Table 1 – Healdsburg California Performance Test Data Summary Sheet – February 11, 2009. This table summarizes all data and laboratory results provided to Trojan Technologies for the performance testing. The table only includes data taken when the Trojan UVsystem was operated within the performance requirements of section 11300 2.3 of the specification.

From the data included in Table 1, the effluent (post UV) results for total coliform from the performance test indicate:

Median: Non-detect
Maximum: 9

The Trojan Technologies UV3000+ UV Disinfection system at the Healdsburg California Wastewater Treatment Plant meets the performance requirements for UV Effluent limits as specified in specification section 11300 2.3 B UV Effluent Limits.

Sincerely,

Carl McDonald
Municipal Project Manager
Trojan Technologies

Table 1 - Healdsburg California Performance Test Data Summary Sheet - February 11, 2009

DateTime	Flow	Flow	Bank A On/Off Status	Bank A Lamp Hours	Bank B On/Off Status	Bank B Lamp hours	Bank C ON/Off Status	Bank C Lamp Hours	Cleaning Time	Dose	Transmittance	UV Influent		UV Effluent
	(gpm)	(MGD)							(Minutes to next clean)	mW-Sec/cm^2	%	Total Coliform (MPN/100 mL)	TSS (mg/L)	Total Coliform (MPN/100 mL)
10/20/08 8:00 AM	676.10	0.97	ON	4401	OFF	361	OFF	936	1033	102.57	74.8	2.0	ND	ND
10/20/08 11:00 AM	1807.89	2.60	ON	4404	OFF	361	OFF	936	852	83	74.6	2.0	ND	ND
10/21/08 8:00 AM	349.83	0.50	ON	4425	OFF	361	OFF	936	1032	119.35	74.7	2.0	1.0	ND
10/21/08 11:00 AM	1391.23	2.00	ON	4428	OFF	361	OFF	936	852	82.09	74.4	4.0	1.0	ND
10/22/08 8:00 AM	688.52	0.99	ON	4449	OFF	361	OFF	936	1032	100.61	74.3	8.0	ND	ND
10/22/08 11:00 AM	1080.60	1.56	ON	4452	OFF	361	OFF	936	852	84.25	74.7	ND	1.2	ND
10/23/08 8:00 AM	0.00	0.00	ON	4473	OFF	361	OFF	936	1032	159.54	75.5	4.0	ND	ND
10/23/08 11:00 AM	1477.39	2.13	ON	4476	OFF	361	OFF	936	852	85.6	74.1	900.0	ND	ND
10/24/08 8:00 AM	683.06	0.98	ON	4497	OFF	361	OFF	936	1032	99.53	74.1	4.0	1.2	ND
10/24/08 11:00 AM	1348.03	1.94	ON	4500	OFF	361	OFF	936	852	83.43	73.9	4.0	2.3	ND
10/27/08 8:00 AM	608.56	0.88	ON	4569	OFF	361	OFF	936	1032	107.98	74.2	ND	2.8	ND
10/27/08 11:00 AM	1375.59	1.98	ON	4572	OFF	361	OFF	936	852	113.78	74.1	ND	ND	ND
10/28/08 8:00 AM	668.41	0.96	ON	4593	OFF	361	OFF	936	1032	153.38	74.5	2.0	1.6	ND
10/28/08 11:00 AM	1156.33	1.67	ON	4596	OFF	361	OFF	936	852	113.54	74.1	ND	2.1	ND
10/29/08 8:00 AM	364.72	0.53	ON	4617	OFF	375	OFF	950	1032	118.72	74.6	ND	1.4	ND
10/29/08 11:00 AM	1221.64	1.76	ON	4620	OFF	375	OFF	950	852	81.95	74.5	ND	2.0	ND
10/30/08 8:00 AM	636.87	0.92	ON	4641	OFF	375	OFF	950	1032	110.22	74.7	ND	1.4	ND
10/30/08 11:00 AM	1148.39	1.65	ON	4644	OFF	375	OFF	950	852	83.65	74.5	ND	2.0	ND
10/31/08 8:00 AM	746.87	1.08	ON	4665	OFF	375	OFF	950	1032	97.28	75.2	2.0	ND	ND
10/31/08 11:00 AM	833.03	1.20	ON	4668	OFF	375	OFF	950	852	98.62	74.5	ND	ND	ND
11/3/08 8:00 AM	937.82	1.35	ON	4737	OFF	398	OFF	952	972	83.53	72.1	7.0	ND	ND
11/3/08 11:00 AM	1086.06	1.56	ON	4740	OFF	398	OFF	952	792	84.24	73.1	2.0	ND	ND
11/4/08 8:00 AM	1191.34	1.72	ON	4761	OFF	403	OFF	952	972	82.77	72.2	2.0	1.0	ND
11/4/08 11:00 AM	1596.09	2.30	ON	4764	OFF	405	OFF	952	792	93.97	72.2	7.0	ND	ND
11/5/08 8:00 AM	543.75	0.78	ON	4785	OFF	405	OFF	952	972	141.25	72.4	2.0	ND	ND
11/5/08 11:00 AM	1488.82	2.14	ON	4788	OFF	405	OFF	952	792	85.4	72.8	ND	ND	ND
11/6/08 8:00 AM	643.57	0.93	ON	4809	OFF	405	OFF	952	972	94.21	74.1	ND	ND	ND
11/6/08 11:00 AM	1376.08	1.98	ON	4812	OFF	405	OFF	952	792	80	74.3	50.0	ND	ND
11/7/08 8:00 AM	913.98	1.32	ON	4833	OFF	405	OFF	952	972	85.83	74.9	2.0	ND	ND
11/7/08 11:00 AM	899.08	1.29	ON	4836	OFF	405	OFF	952	792	90.6	75	4.0	ND	ND
11/10/08 8:00 AM	689.51	0.99	ON	4905	OFF	405	OFF	952	972	103.74	75.1	6.0	1.0	ND
11/10/08 11:00 AM	1503.96	2.17	ON	4908	OFF	405	OFF	952	792	81.46	75	2.0	ND	ND
11/11/08 8:00 AM	352.31	0.51	ON	4929	OFF	405	OFF	952	972	133.44	75.2	2.0	2.0	ND
11/11/08 11:00 AM	1421.28	2.05	ON	4932	OFF	405	OFF	952	792	86.18	74.8	30.0	1.0	ND
11/12/08 8:00 AM	684.30	0.99	ON	4953	OFF	405	OFF	952	972	100.53	74.3	ND	ND	ND
11/12/08 11:00 AM	1502.97	2.16	ON	4956	OFF	405	OFF	952	792	80.04	74	7.0	ND	ND
11/13/08 8:00 AM	536.06	0.77	ON	4977	OFF	405	OFF	952	972	118.23	74.5	2.0	1.0	ND
11/13/08 11:00 AM	514.70	0.74	ON	4980	OFF	405	OFF	952	792	148.14	74	13.0	ND	4.0
11/14/08 8:00 AM	549.71	0.79	ON	5001	OFF	406	OFF	952	972	110.12	74.8	ND	1.9	ND
11/14/08 11:00 AM	1013.31	1.46	ON	5004	OFF	406	OFF	952	792	80.83	73.9	17.0	1.0	ND
12/8/08 8:30 AM	15.35	0.02	ON	5574	ON	436	OFF	978	943	292.48	73.2	300.0		9.0
12/9/08 8:30 AM	2246.41	3.23	ON	5598	ON	436	OFF	978	943	151.09	73.5	300.0		ND
1/13/09 10:13 AM	2718.9	3.92	ON	6430	ON	520	OFF				71.9	2.0	1.0	2.0
1/13/09 10:28 AM	2188.6	3.15	ON	6430	ON	520	OFF				72.3	2.0	1.0	2.0
1/13/09 10:50 AM	2416	3.48	ON	6431	ON	520	OFF				72.5	2.0	1.0	2.0
1/13/09 2:06 PM	2766.4	3.98	ON	6434	ON	522	OFF				72.3	2.0	1.0	2.0
1/13/09 2:22 PM	2448	3.53	ON	6434	ON	522	OFF				72.2	2.0	1.0	2.0
												Median		ND
												Max		9.0

Appendix ER-C. Process Monitoring Alarms

PROCESS MONITOR ALARM SUMMARY

Headworks

- Coarse screen fail
- Coarse screen conveyor fail
- Fine screen fail
- Fine screen conveyor fail
- Grit system fail
- Grit washer fail

NPW Pumping

- Pump fail
- Low pressure
- High pressure
- Wet well high level

Extended air process

- Pre-anoxic basin 1 mixer fail
- Pre-anoxic basin 1 mixer fail
- Pre-anoxic basin 2 mixer fail
- Pre-anoxic basin 2 mixer fail
- Influent return pump fail
- Anoxic basin 1a mixer fail
- Anoxic basin 1b mixer fail
- Anoxic basin 2a mixer fail
- Anoxic basin 2b mixer fail
- Recycle pump 1 fail

- Recycle pump 2 fail
- Scum pump 1 fail
- Scum pump 2 fail
- Scum wetwell high level
- Aeration air blower 1 fail
- Aeration air blower 2 fail
- Aeration air blower 3 fail
- Aeration air blower 4 fail

UV Disinfection system

- Lamp failure, identified by bank, module and lamp address
- Low UV intensity
- Multiple lamp failure
- Module communication alarm
- High temperature alarm
- Low water level alarm

Centrifuge dewatering system

- Centrifuge system general alarm
- Sludge screw conveyor stop
- Sludge feed pump stop
- Polymer feed pump stop
- Diverter gate failure, closed
- High torque
- Centrifuge cover open
- Low differential speed

- Centrifuge bowl overspeed

Plant drain system

- Plant drain pump 1 fail
- Plant drain pump 2 fail
- Plant drain wetwell high level

Equalization storage system

- Equalization pump 1 fail
- Equalization pump 2 fail
- Equalization wetwell high level
- Stormwater pump fail
- Stormwater wetwell high level
- Standby generator fail

Alarm List

Project: Healdsburg WWTP Upgrade
Client: City of Healdsburg
Location: Healdsburg, CA
Project No.: 42251
Revision: 0
Date: 6-Aug-07

SIEMENS

Alarm No.	Tag No.	Description	Warning	Cell Shutdown	CIP Hold	Delay	setpoint	Units	Notes
Alarm 00		Plant Shutdown Occurred							
Alarm 01		Emergency Stop Button	YES	YES					
Alarm 02	204-ZCV-XXX	Limit Switch Open Failure		YES	YES	>3 sec			Valve failure typical for all
Alarm 03	204-ZCV-XXX	Limit Switch Close Failure		YES	YES	>3 sec			Valve failure typical for all
Alarm 04	204-FCV-X01	Air Scour Valve Failure		YES		5 sec			Valve failure typical for all
Alarm 05	204-FP-150	Filtrate Pump Failed To Run		YES		5 sec			
Alarm 06		Filtrate Pump Failed To Stop		YES		5 sec			
Alarm 07		Filtrate Pump General Drive Shutdown		YES		5 sec			
Alarm 08		Filtrate Pump Speed Fail		YES		5 sec			
Alarm 09	204-FP-250	Filtrate Pump Failed To Run		YES		5 sec			
Alarm 10		Filtrate Pump Failed To Stop		YES		5 sec			
Alarm 11		Filtrate Pump General Drive Shutdown		YES		5 sec			
Alarm 12		Filtrate Pump Speed Fail		YES		5 sec			
Alarm 13	204-FP-350	Filtrate Pump Failed To Run		YES		5 sec			
Alarm 14		Filtrate Pump Failed To Stop		YES		5 sec			
Alarm 15		Filtrate Pump General Drive Shutdown		YES		5 sec			
Alarm 16		Filtrate Pump Speed Fail		YES		5 sec			
Alarm 17	204-FP-450	Filtrate Pump Failed To Run		YES		5 sec			
Alarm 18		Filtrate Pump Failed To Stop		YES		5 sec			
Alarm 19		Filtrate Pump General Drive Shutdown		YES		5 sec			
Alarm 20		Filtrate Pump Speed Fail		YES		5 sec			
Alarm 21	204-FP-550	Filtrate Pump Failed To Run		YES		5 sec			
Alarm 22		Filtrate Pump Failed To Stop		YES		5 sec			
Alarm 23		Filtrate Pump General Drive Shutdown		YES		5 sec			
Alarm 24		Filtrate Pump Speed Fail		YES		5 sec			
Alarm 25	205-AC-160	Air Compressor, Fail	Yes						Start other compressor
Alarm 26	205-AC-260	Air Compressor	Yes						Start other compressor
Alarm 27	204-PSH-104	MF Filtrate Pump, High Pressure (Filtrate mode)		YES			20	PSI	Shutdown Filtrate Pump
Alarm 28	204-PSH-204	MF Filtrate Pump, High Pressure (Filtrate mode)		YES			20	PSI	Shutdown Filtrate Pump
Alarm 29	204-PSH-304	MF Filtrate Pump, High Pressure (Filtrate mode)		YES			20	PSI	Shutdown Filtrate Pump
Alarm 30	204-PSH-404	MF Filtrate Pump, High Pressure (Filtrate mode)		YES			20	PSI	Shutdown Filtrate Pump
Alarm 31	204-PSH-504	MF Filtrate Pump, High Pressure (Filtrate mode)		YES			20	PSI	Shutdown Filtrate Pump
Alarm 32	204-PSH-105	MF Filtrate Pump, High Pressure (MC, CIP, SIP mode)		YES	YES		9	PSI	Shutdown Filtrate Pump
Alarm 33	204-PSH-205	MF Filtrate Pump, High Pressure (MC, CIP, SIP mode)		YES	YES		9	PSI	Shutdown Filtrate Pump
Alarm 34	204-PSH-305	MF Filtrate Pump, High Pressure (MC, CIP, SIP mode)		YES	YES		9	PSI	Shutdown Filtrate Pump
Alarm 35	204-PSH-405	MF Filtrate Pump, High Pressure (MC, CIP, SIP mode)		YES	YES		9	PSI	Shutdown Filtrate Pump
Alarm 36	204-PSH-505	MF Filtrate Pump, High Pressure (MC, CIP, SIP mode)		YES	YES		9	PSI	Shutdown Filtrate Pump
Alarm 37	205-PSL-061	Pressure Switch, MF Compressed Air Receiver	YES				60	PSI	
Alarm 38	205-PSL-062	Pressure Switch, MF Compressed Air Instrument Line	YES				60	PSI	
Alarm 39	205-PSL-063	Pressure Switch, MF Compressed Air Test Line	YES				10	PSI	Close Solenoid 204-XY-X11
Alarm 40	204-LSH-001	MOS Tank Level High, High, High		YES					Shut down entire MOS System
Alarm 41	204-LSH-110	Filtrate Prime Failure 1	YES			30 sec			
Alarm 42		Filtrate Prime Failure 2	YES			30 sec			
Alarm 43		Filtrate Prime Failure 3		YES		30 sec			
Alarm 44	204-LSH-210	Filtrate Prime Failure 1	YES			30 sec			
Alarm 45		Filtrate Prime Failure 2	YES			30 sec			
Alarm 46		Filtrate Prime Failure 3		YES		30 sec			
Alarm 47	204-LSH-310	Filtrate Prime Failure 1	YES			30 sec			
Alarm 48		Filtrate Prime Failure 2	YES			30 sec			
Alarm 49		Filtrate Prime Failure 3		YES		30 sec			
Alarm 50	204-LSH-410	Filtrate Prime Failure 1	YES			30 sec			
Alarm 51		Filtrate Prime Failure 2	YES			30 sec			
Alarm 52		Filtrate Prime Failure 3		YES		30 sec			
Alarm 53	204-LSH-510	Filtrate Prime Failure 1	YES			30 sec			
Alarm 54		Filtrate Prime Failure 2	YES			30 sec			
Alarm 55		Filtrate Prime Failure 3		YES		30 sec			
Alarm 56	204-LSL-102	MOS Tank Level Low, Low		YES		60sec			Stop filtration
Alarm 57	204-LSL-202	MOS Tank Level Low, Low		YES		60sec			Stop filtration
Alarm 58	204-LSL-302	MOS Tank Level Low, Low		YES		60sec			Stop filtration
Alarm 59	204-LSL-402	MOS Tank Level Low, Low		YES		60sec			Stop filtration
Alarm 60	204-LSL-502	MOS Tank Level Low, Low		YES		60sec			Stop filtration
Alarm 61	204-LT-102	MOS Tank Level High, High		YES			115	inches	
Alarm 62		MOS Tank Level Low		YES		60sec	<104	inches	Stop filtration
Alarm 63	204-LT-202	MOS Tank Level High, High		YES			115	inches	
Alarm 64		MOS Tank Level Low		YES		60sec	<104	inches	Stop filtration
Alarm 65	204-LT-302	MOS Tank Level High, High		YES			115	inches	
Alarm 66		MOS Tank Level Low		YES		60sec	<104	inches	Stop filtration
Alarm 67	204-LT-402	MOS Tank Level High, High		YES			115	inches	
Alarm 68		MOS Tank Level Low		YES		60sec	<104	inches	Stop filtration
Alarm 69	204-LT-502	MOS Tank Level High, High		YES			115	inches	
Alarm 70		MOS Tank Level Low		YES		60sec	<104	inches	Stop filtration

Alarm List

Project: Healdsburg WWTP Upgrade
Client: City of Healdsburg
Location: Healdsburg, CA
Project No.: 42251
Revision: 0
Date: 6-Aug-07

SIEMENS

Alarm No.	Tag No.	Description	Warning	Cell Shutdown	CIP Hold	Delay	setpoint	Units	Notes
Alarm 71	203-LSH-150	Aeration Basin Level High, High	YES				XX		Plant Alarm
Alarm 72	203-LSH-250	Aeration Basin Level High, High	YES				XX		Plant Alarm
Alarm 73	203-LT-150	Aeration Basin Level Low	YES				XX		Place Cell off line / Stop Filtration
Alarm 74		Aeration Basin Level Low, Low		YES			XX		Shut down entire MOS System
Alarm 75		Aeration Basin Level High	YES				XX		Place another Cell cell online
Alarm 76	203-LT-250	Aeration Basin Level Low	YES				XX		Place Cell off line / Stop Filtration
Alarm 77		Aeration Basin Level Low, Low		YES			XX		Shut down entire MOS System
Alarm 78		Aeration Basin Level High	YES				XX		Place another Cell cell online
Alarm 79	203-MFP-100	Feed Pump Failed To Run		YES		5 sec			Shutdown 1 Cell
Alarm 80		Feed Pump Failed To Stop		YES		5 sec			Shutdown 1 Cell
Alarm 81		Filtrate Pump General Drive Shutdown		YES		5 sec			Shutdown 1 Cell
Alarm 82	203-MFP-200	Feed Pump Failed To Run		YES		5 sec			Shutdown 1 Cell
Alarm 83		Feed Pump Failed To Stop		YES		5 sec			Shutdown 1 Cell
Alarm 84		Filtrate Pump General Drive Shutdown		YES		5 sec			Shutdown 1 Cell
Alarm 85	203-MFP-300	Feed Pump Failed To Run		YES		5 sec			Shutdown 1 Cell
Alarm 86		Feed Pump Failed To Stop		YES		5 sec			Shutdown 1 Cell
Alarm 87		Filtrate Pump General Drive Shutdown		YES		5 sec			Shutdown 1 Cell
Alarm 88	203-MFP-400	Feed Pump Failed To Run		YES		5 sec			Shutdown 1 Cell
Alarm 89		Feed Pump Failed To Stop		YES		5 sec			Shutdown 1 Cell
Alarm 90		Filtrate Pump General Drive Shutdown		YES		5 sec			Shutdown 1 Cell
Alarm 91	203-MFP-500	Feed Pump Failed To Run		YES		5 sec			Shutdown 1 Cell
Alarm 92		Feed Pump Failed To Stop		YES		5 sec			Shutdown 1 Cell
Alarm 93		Filtrate Pump General Drive Shutdown		YES		5 sec			Shutdown 1 Cell
Alarm 94	203-MFP-600	Feed Pump Failed To Run		YES		5 sec			Shutdown 1 Cell
Alarm 95		Feed Pump Failed To Stop		YES		5 sec			Shutdown 1 Cell
Alarm 96		Filtrate Pump General Drive Shutdown		YES		5 sec			Shutdown 1 Cell
Alarm 97	250-BLWR-500	Air Scour Blower Failed To Run		YES		5 sec			Shutdown 2 Cells
Alarm 98		Air Scour Blower Failed To Stop		YES		5 sec			Shutdown 2 Cells
Alarm 99		Air Scour Blower General Drive Shutdown		YES		5 sec			Shutdown 2 Cells
Alarm 100	250-BLWR-600	Air Scour Blower Failed To Run		YES		5 sec			Shutdown 2 Cells
Alarm 101		Air Scour Blower Failed To Stop		YES		5 sec			Shutdown 2 Cells
Alarm 102		Air Scour Blower General Drive Shutdown		YES		5 sec			Shutdown 2 Cells
Alarm 103	250-BLWR-700	Air Scour Blower Failed To Run		YES		5 sec			Shutdown 2 Cells
Alarm 104		Air Scour Blower Failed To Stop		YES		5 sec			Shutdown 2 Cells
Alarm 105		Air Scour Blower General Drive Shutdown		YES		5 sec			Shutdown 2 Cells
Alarm 106	204-FIT-100	ML Feed Flow, Low	YES				2112	GPM	
Alarm 107		ML Feed Flow, Low, Extended		YES		8 hrs	2112	GPM	
Alarm 108		ML Feed Flow, Low, Low		YES		60 sec	2050	GPM	
Alarm 109	204-FIT-200	ML Feed Flow, Low	YES				2112	GPM	
Alarm 110		ML Feed Flow, Low, Extended		YES		8 hrs	2112	GPM	
Alarm 111		ML Feed Flow, Low, Low		YES		60 sec	2050	GPM	
Alarm 112	204-FIT-300	ML Feed Flow, Low	YES				2112	GPM	
Alarm 113		ML Feed Flow, Low, Extended		YES		8 hrs	2112	GPM	
Alarm 114		ML Feed Flow, Low, Low		YES		60 sec	2050	GPM	
Alarm 115	204-FIT-400	ML Feed Flow, Low	YES				2112	GPM	
Alarm 116		ML Feed Flow, Low, Extended		YES		8 hrs	2112	GPM	
Alarm 117		ML Feed Flow, Low, Low		YES		60 sec	2050	GPM	
Alarm 118	204-FIT-500	ML Feed Flow, Low	YES				2112	GPM	
Alarm 119		ML Feed Flow, Low, Extended		YES		8 hrs	2112	GPM	
Alarm 120		ML Feed Flow, Low, Low		YES		60 sec	2050	GPM	
Alarm 121	204-FIT-106	Filtrate Flow, No Flow		YES			<70	GPM	
Alarm 122		Filtrate Flow, Low	YES				<80	GPM	
Alarm 123		Filtrate Flow, High	YES			8hrs	600	GPM	
Alarm 124		Filtrate Recirculation Flow, Low	YES		YES	60 sec	.9 * 595	GPM	For MC/CIP/SIP only
Alarm 125		Filtrate MC/Backwash Flow, High	YES		YES	60 sec	1.1 * 595	GPM	
Alarm 126	204-FIT-206	Filtrate Flow, No Flow		YES			<70	GPM	
Alarm 127		Filtrate Flow, Low	YES				<80	GPM	
Alarm 128		Filtrate Flow, High	YES			8hrs	600	GPM	
Alarm 129		Filtrate Recirculation Flow, Low	YES		YES	60 sec	.9 * 595	GPM	For MC/CIP/SIP only
Alarm 130		Filtrate MC/Backwash Flow, High	YES		YES	60 sec	1.1 * 595	GPM	
Alarm 131	204-FIT-306	Filtrate Flow, No Flow		YES			<70	GPM	
Alarm 132		Filtrate Flow, Low	YES				<80	GPM	
Alarm 133		Filtrate Flow, High	YES			8hrs	600	GPM	
Alarm 134		Filtrate Recirculation Flow, Low	YES		YES	60 sec	.9 * 595	GPM	For MC/CIP/SIP only
Alarm 135		Filtrate MC/Backwash Flow, High	YES		YES	60 sec	1.1 * 595	GPM	
Alarm 136	204-FIT-406	Filtrate Flow, No Flow		YES			<70	GPM	
Alarm 137		Filtrate Flow, Low	YES				<80	GPM	
Alarm 138		Filtrate Flow, High	YES			8hrs	600	GPM	
Alarm 139		Filtrate Recirculation Flow, Low	YES		YES	60 sec	.9 * 595	GPM	For MC/CIP/SIP only
Alarm 140		Filtrate MC/Backwash Flow, High	YES		YES	60 sec	1.1 * 595	GPM	
Alarm 141	204-FIT-506	Filtrate Flow, No Flow		YES			<70	GPM	

Project: Healdsburg WWTP Upgrade
Client: City of Healdsburg
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Alarm No.	Tag No.	Description	Warning	Cell Shutdown	CIP Hold	Delay	setpoint	Units	Notes
Alarm 142		Filtrate Flow, Low	YES				<80	GPM	
Alarm 143		Filtrate Flow, High	YES			8hrs	600	GPM	
Alarm 144		Filtrate Recirculation Flow, Low	YES		YES	60 sec	.9 * 595	GPM	For MC/CIP/SIP only
Alarm 145		Filtrate MC/Backwash Flow, High	YES		YES	60 sec	1.1 * 595	GPM	
Alarm 146	204-FIT-015	Filtrate Effluent Flow, Low	YES				<300	GPM	
Alarm 147	204-FIT-101	Air Scour Flow, Low	YES			30 sec	.9*813	SCFM	
Alarm 148		Air Scour Flow, Low Continued		YES		60 sec	.9*813	SCFM	
Alarm 149		Air Scour Flow, High	YES			30 sec	1.1*813	SCFM	
Alarm 150		Air Scour Flow, High Continued		YES		60 sec	1.1*813	SCFM	
Alarm 151	204-FIT-201	Air Scour Flow, Low	YES			30 sec	.9*813	SCFM	
Alarm 152		Air Scour Flow, Low Continued		YES		60 sec	.9*813	SCFM	
Alarm 153		Air Scour Flow, High	YES			30 sec	1.1*813	SCFM	
Alarm 154		Air Scour Flow, High Continued		YES		60 sec	1.1*813	SCFM	
Alarm 155	204-FIT-301	Air Scour Flow, Low	YES			30 sec	.9*813	SCFM	
Alarm 156		Air Scour Flow, Low Continued		YES		60 sec	.9*813	SCFM	
Alarm 157		Air Scour Flow, High	YES			30 sec	1.1*813	SCFM	
Alarm 158		Air Scour Flow, High Continued		YES		60 sec	1.1*813	SCFM	
Alarm 159	204-FIT-401	Air Scour Flow, Low	YES			30 sec	.9*813	SCFM	
Alarm 160		Air Scour Flow, Low Continued		YES		60 sec	.9*813	SCFM	
Alarm 161		Air Scour Flow, High	YES			30 sec	1.1*813	SCFM	
Alarm 162		Air Scour Flow, High Continued		YES		60 sec	1.1*813	SCFM	
Alarm 163	204-FIT-501	Air Scour Flow, Low	YES			30 sec	.9*813	SCFM	
Alarm 164		Air Scour Flow, Low Continued		YES		60 sec	.9*813	SCFM	
Alarm 165		Air Scour Flow, High	YES			30 sec	1.1*813	SCFM	
Alarm 166		Air Scour Flow, High Continued		YES		60 sec	1.1*813	SCFM	
Alarm 167	204-PIT-103	TMP High	YES			30 sec	6.5 @ ADF	psi	
Alarm 168		TMP High Continued	YES			3 hrs	6.5 @ ADF	psi	Cell goes into standby
Alarm 169		TMP High, High		YES		15 sec	7.5 @ADF	psi	CIP Required
Alarm 170		TMP High, High, High		YES		15 sec	9	psi	CIP Required
Alarm 171		TMP High Rate of TMP Rise		YES			0.15 / day	psi	Call Factory
Alarm 172	204-PIT-203	TMP High	YES			30 sec	6.5 @ ADF	psi	
Alarm 173		TMP High Continued	YES			3 hrs	6.5 @ ADF	psi	Cell goes into standby
Alarm 174		TMP High, High		YES		15 sec	7.5 @ADF	psi	CIP Required
Alarm 175		TMP High, High, High		YES		15 sec	9	psi	CIP Required
Alarm 176		TMP High Rate of TMP Rise		YES			0.15 / day	psi	Call Factory
Alarm 177	204-PIT-303	TMP High	YES			30 sec	6.5 @ ADF	psi	
Alarm 178		TMP High Continued	YES			3 hrs	6.5 @ ADF	psi	Cell goes into standby
Alarm 179		TMP High, High		YES		15 sec	7.5 @ADF	psi	CIP Required
Alarm 180		TMP High, High, High		YES		15 sec	9	psi	CIP Required
Alarm 181		TMP High Rate of TMP Rise		YES			0.15 / day	psi	Call Factory
Alarm 182	204-PIT-403	TMP High	YES			30 sec	6.5 @ ADF	psi	
Alarm 183		TMP High Continued	YES			3 hrs	6.5 @ ADF	psi	Cell goes into standby
Alarm 184		TMP High, High		YES		15 sec	7.5 @ADF	psi	CIP Required
Alarm 185		TMP High, High, High		YES		15 sec	9	psi	CIP Required
Alarm 186		TMP High Rate of TMP Rise		YES			0.15 / day	psi	Call Factory
Alarm 187	204-PIT-503	TMP High	YES			30 sec	6.5 @ ADF	psi	
Alarm 188		TMP High Continued	YES			3 hrs	6.5 @ ADF	psi	Cell goes into standby
Alarm 189		TMP High, High		YES		15 sec	7.5 @ADF	psi	CIP Required
Alarm 190		TMP High, High, High		YES		15 sec	9	psi	CIP Required
Alarm 191		TMP High Rate of TMP Rise		YES			0.15 / day	psi	Call Factory
Alarm 192	205-PIT-050	Air Scour Blower Pressure, High		YES			5.7	psi	Shut down entire MOS System
Alarm 193		Air Scour Blower Pressure, Low		YES			4	psi	Shut down entire MOS System
Alarm 194	205-PIT-060	Compressed Air Pressure, Low	YES			10 sec	60	psi	
Alarm 195		Compressed Air Pressure, Low, Low		YES		10 sec	50	psi	Shut down entire MOS System
Alarm 196	204-TIT-014	Filtrate Temperature, High	YES			10 sec	> 95	deg F	
Alarm 197	205-TIT-050	Air Scour Blower Temperature, High		YES			XX	deg F	Shut down entire MOS System
Alarm 198	204-AE-107	Turbidity, High	YES			5 sec	0.2	NTU	
Alarm 199		Turbidity, High 4 hrs	YES			4 hrs	0.2	NTU	Recirculation
Alarm 200		Turbidity, High 12 hrs		YES		12 hrs	0.2	NTU	
Alarm 201		Turbidity, High, High	YES			5 sec	0.5	NTU	Recirculation
Alarm 202		Turbidity, High, High, 1 hr		YES		1 hrs	0.5	NTU	
Alarm 203	204-AE-207	Turbidity, High	YES			5 sec	0.2	NTU	
Alarm 204		Turbidity, High 4 hrs	YES			4 hrs	0.2	NTU	Recirculation
Alarm 205		Turbidity, High 12 hrs		YES		12 hrs	0.2	NTU	
Alarm 206		Turbidity, High, High	YES			5 sec	0.5	NTU	Recirculation
Alarm 207		Turbidity, High, High, 1 hr		YES		1 hrs	0.5	NTU	
Alarm 208	204-AE-307	Turbidity, High	YES			5 sec	0.2	NTU	
Alarm 209		Turbidity, High 4 hrs	YES			4 hrs	0.2	NTU	Recirculation
Alarm 210		Turbidity, High 12 hrs		YES		12 hrs	0.2	NTU	
Alarm 211		Turbidity, High, High	YES			5 sec	0.5	NTU	Recirculation
Alarm 212		Turbidity, High, High, 1 hr		YES		1 hrs	0.5	NTU	

Alarm List

Project: Healdsburg WWTP Upgrade
Client: City of Healdsburg
Location: Healdsburg, CA
Project No.: 42251
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Alarm No.	Tag No.	Description	Warning	Cell Shutdown	CIP Hold	Delay	setpoint	Units	Notes
Alarm 213	204-AE-407	Turbidity, High	YES			5 sec	0.2	NTU	
Alarm 214		Turbidity, High 4 hrs	YES			4 hrs	0.2	NTU	Recirculation
Alarm 215		Turbidity, High 12 hrs		YES		12 hrs	0.2	NTU	
Alarm 216		Turbidity, High, High	YES			5 sec	0.5	NTU	Recirculation
Alarm 217		Turbidity, High, High, 1 hr		YES		1 hrs	0.5	NTU	
Alarm 218	204-AE-507	Turbidity, High	YES			5 sec	0.2	NTU	
Alarm 219		Turbidity, High 4 hrs	YES			4 hrs	0.2	NTU	Recirculation
Alarm 220		Turbidity, High 12 hrs		YES		12 hrs	0.2	NTU	
Alarm 221		Turbidity, High, High	YES			5 sec	0.5	NTU	Recirculation
Alarm 222		Turbidity, High, High, 1 hr		YES		1 hrs	0.5	NTU	

Appendix ER-D. Equipment Installation Certificates

SIEMENS

October 30, 2009

Mr Jim Flugum
Senior Civil Engineer
City of Healdsburg, CA
340 Foreman Ln
Healdsburg, CA95448

Re: City of Healdsburg, CA WWTP
MBR Modules Installation Certification

Dear Jim,

This letter is to confirm that the MBR system installed at the City of Healdsburg WWTP was installed using the B30R modules and the B40N modules which have been certified by the State of CA Department of Health Services as compliant with the California Water Recycling Criteria (Title 22). The B30R modules were certified via letter of 11/18/05 and the B40N modules were certified via letter of 10/29/08 from Jeffrey Stone of the Department of Health Services

Sincerely,

Robert G. Spuhler
Project Manager
Siemens Water Technologies

cc: Jeff Picirillo – Siemens Water Technologies Corp.
Brian Diamantini – City of Healdsburg
Gerin James – Siemens Water Technologies Corp.

Siemens Water Technologies Corp.
1901 S. Prairie Ave
P.O. Box 1604
Waukesha, WI 53187-1604
Tel: 262.547.0141
Fax: 262.547.4120

TROJAN UV
WATER CONFIDENCE™

October 30, 2009

June Leng
HDR
2365 Iron Point Road
Folsom, CA 95630

Re: Trojan UV3000Plus UV Disinfection System at Healdsburg WWTP CA

Dear Ms. Leng:

Trojan Technologies certifies that the UV equipment installed in the City of Healdsburg WWTP is identical to the technology used in the validation testing (with respect to lamp spacing, type of lamp, quartz sleeve characteristics, and ballasts) as referenced in the California Department Of Public Health letter dated July 23, 2009 regarding the revised conditional acceptance of Trojans UV3000+ UV System.

Should you require any additional information or have any questions then please contact me.

Best regards,

Mark Eyre
Market Regulatory Manager
TROJAN TECHNOLOGIES

Cc C McDonald, Project Manager, Trojan Technologies