

conveyance system. These aspects will need to be determined as evaluation process.

Figure 6-7: CIP Project #1 – Site of Potential ISSSP Pump

ENGINEERING REPORT

Manzanita Disinfection System Replacement Feasibility Study

Prepared For:

City of Manzanita
P.O. Box 129
Manzanita, Oregon 97130

December 2020



Manzanita Disinfection System Replacement Feasibility Study

City of Manzanita
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PACE Project No.19891

Preparation of this document was funded by a Sustainable Infrastructure Planning Projects (SIPP) grant from Business Oregon, Infrastructure Finance Authority.

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PROJECT CERTIFICATION

The technical material and data contained in this report was prepared by PACE Engineers, Inc., under the supervision of the below listed individuals. Those responsible staff members who are registered professional engineers are licensed in the State of Oregon.



RENEWS: 12/31/2020

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Preparation of this document was funded by a Sustainable Infrastructure Planning Projects (SIPP) grant from Business Oregon, Infrastructure Finance Authority.

1. INTRODUCTION

The City of Manzanita (the City) is located off U.S. Highway 101 in Tillamook County approximately 27 miles north of the City of Tillamook. Resident population in 2018 was estimated at 635 persons (source: PSU Population Research Center). Manzanita is a popular tourist stop and approximately 75 percent of the housing stock is associated with second homes and vacation use; consequently, water demands are considerably higher at times than the resident population would suggest.

Manzanita owns and operates a water system. It is also part of the Joint Water System with the City of Wheeler. Currently, Manzanita obtains all its water from the Joint Water System wells located near the Nehalem River (see Figure 1.1). The City of Wheeler also obtains its water from the wells; it has a resident population of 400 persons but only 21 of its homes are associated with second homes or vacation use. The Oregon Health Authority (OHA) lists the wells under the City of Wheeler Water System (PWS #OR4100952); however, the City of Manzanita Water System (PWS #OR4100505) owns most of the infrastructure and manages the Joint System for both parties. The relationship is formalized in an Intergovernmental agreement.

Extensive water system improvements were undertaken and completed in 2003. The project included the well field and an associated building that includes facilities for disinfection and corrosion control. A MIOX mixed oxidant generator was installed to provide onsite generation of disinfectant. The City has maintained the generator but is faced with high, and increasing, costs associated with keeping it functional. As a result, the City is interested in replacing it with a sodium hypochlorite system. The purpose of this feasibility study is to address deficiencies with the City's mixed oxidant generation system and consider the conversion to the sodium hypochlorite alternative. For purposes of this study, the term "hypochlorite" is used as short hand for "sodium hypochlorite".

2. SCOPE

The scope of this study was discussed with City staff. The following scope is based on the discussion and our understanding of what is needed.

The study will evaluate:

- The existing equipment.
- Options for restoration or replacement if practicable or desirable to the City.
- Space availability in the existing building for conversion to liquid hypochlorite.
- Sizing of the liquid hypochlorite system.

- Tankage and facilities for storing and handling the hypochlorite.
- Recommendations for storing and handling the hypochlorite.
- A proposed hypochlorite system layout.
- An opinion of probable cost.

3. REFERENCES

The following materials were utilized in the preparation of this document:

- Preliminary Population Estimates, July 2018, Portland State University, 2018.
- City of Manzanita Water Improvements Record Drawings, HGE, Inc., 2003.
- Selected monthly and daily pumped water records, City of Manzanita, July 2016 – July 2018.
- Monthly Disinfection Report for Ground Water Systems, State of Oregon Drinking Water Program, July 2016 – July 2018.
- Onsite Disinfection System Provides DBP Reduction, Residual Maintenance, Gene Schroeder, WaterWorld, October 1, 2005.
- Latest Chemical Results (PWS OR4100952), OHA Drinking Water Data Online, 2018.
- City of Manzanita Water System Master Plan, HGE, Inc., May 2006.

4. WATER SUPPLY (WELL NO. 1 AND WELL NO. 2)

The two water supply wells are located near the Nehalem River but classified by OHA as ground water. Original capacity was approximately 525 gpm each with no duplex capability. Pumps were replaced in 2018 in association with the construction of CO₂ removal facilities at the well building. The new pumps are reported to produce 500 gpm (720,000 gpd) in simplex mode and 750 gpm (1,080,000 gpd) in duplex mode.

Water pumped in 2018 averaged 155,492 gpd in January, and 379,481 gpd in July, with a peak day of 673,974 gallons on July 6th. July water pumpage increased 12 percent from 2016 to 2017 and 4 percent from 2017 to 2018. Water system usage is growing; consequently, an expansion of pumping capacity may be needed within the next 20-year time horizon.

Water rights permit #G12196 for the wells includes a permitted rate of 3.6 cfs (1,616 gpm; 2,326,600 gpd). The permit is currently under review by the Oregon Water Resources Department (OWRD) for a permit extension. The extension may include conditions that effectively limit the ultimate practicable development of the permitted capacity.

Except for high CO₂ levels, the source water is excellent quality: nitrates generally less than 2 mg/l; and disinfection byproducts are minimal or not detected.

5. EXISTING DISINFECTION SYSTEM AND DEFICIENCIES

A MIOX-252 mixed oxidant generation system was installed in 2003 (see Photos P1-1 and P1-2). Record drawings for the facility, which show the general layout and relation to other components in the well building, are included on Figure 8.1.

The system uses salt water brine and electricity to create a solution of chlorine-based chemical species (commonly referred to as “mixed oxidants”). The installation includes two electrolytic cells, each with a rated capacity of 25 pounds Of mixed oxidants per day. Other major components include: a water softener, a 500-gallon (52” diameter by 60” tall) brine generation tank, brine pumps, a 200-gallon (36” diameter by 48” tall) mixed oxidant storage tank, and a MIOX pump (Wallace & Tiernan Encore 700 diaphragm metering pump).

The system has a significant design flaw: the electrical components are located below the water and chemical lines. O-rings associated with the lines must be replaced frequently to control leaks. Staff report that the mixed oxidant concentration is inconsistent and there is a high sodium residual in the water, suggesting poorly functioning equipment. The system is no longer made, and replacement parts are no longer readily available. Needed parts must be custom made; recently, the City was quoted a price of \$30,000 for a replacement electrolytic cell.

The installation can be seen in Photos: P1-1 and P1-2 (the MIOX units), P2-1 and P2-2 (water softener and mixed oxidant tank on the north wall), P3-1 and P3-2 (MIOX unit, brine tank and bags of salt off the east wall), and P4-1 and P4-2 (feed into the pH and CL2 analyzers and turbidimeter, and the MIOX injection point on the 8” discharge line). The photos can be compared to wall elevations shown in the record drawings included in Figure 8.1.

In general, the City tries to maintain a chlorine residual of 0.3 mg/l at the entry point to the distribution system. Review of daily records for the period July 2016 to July 2018 show a range of .26 mg/l to 0.59 mg/l. The range may reflect some of the inconsistencies noted above with the mixed oxidant concentrations.

6. IMPROVEMENT ALTERNATIVES

6.1 Fix or Replace the Existing System

Fixing the existing MIOX system is not recommended. The system is obsolete and has exceeded its design life. Notable deficiencies include:

- ♦ Poor unit design (with reference to the configuration of plumbing and electrical components)
- ♦ Poor condition due to poor design rather than lack of maintenance
- ♦ Lack of readily available parts
- ♦ Cost of custom made parts
- ♦ Inconsistent mixed oxidant concentrations

- ♦ Lack of reliability with regard to functionality and consistent mixed oxidant concentrations

Replacement is also not recommended. Onsite hypochlorite generators have evolved since the MIOX system was developed; however, capital costs are relatively high, and the City has expressed a preference for the simplicity and initial low-cost of installing a liquid hypochlorite system and an understanding, based on conversation with suppliers, of the costs associated with deliveries of hypochlorite.

6.2 New Hypochlorite System

Removal of the MIOX system will leave adequate space in the Well Building for the new hypochlorite system. (68 inches along the south wall and approximately 17 feet along the east wall).

Sodium hypochlorite is a widely used and proven disinfection technology. Operation and maintenance is straightforward and the equipment is considerably less complex and costly compared to onsite generation. There are some potential issues - these are discussed in Section 8.

6.3 Recommendations

A new hypochlorite system is recommended based on an assessment of the existing MIOX system and City preference

7. HYPOCHLORITE SYSTEM DESIGN BASIS

7.1 Dosing (Feed Rate) Requirements

The City tries to maintain a chlorine residual of 0.3 mg/l. Staff believe there is very little chlorine demand associated with the raw well water, so the chlorine added roughly corresponds to the residual in the disinfected water. The City does not have actual data on mixed oxidant concentrations added. The injection of mixed oxidants is adjusted based on the chloride residual achieved. Nevertheless, a higher concentration may be needed at times, so for planning purposes, a dosing concentration of 1.0 mg/l (1.0 ppm) is recommended for calculating the maximum dosing capabilities.

The City has installed a CO₂ removal unit that breaks pumping head from the wells. Capacity of the well pumps are: 500 gpm (simplex mode) and 750 gpm (duplex mode). Because of the break in head at the CO₂ removal unit, booster pumps were installed to provide capacity comparable to that of the well pumps. These pumps were all installed in 2018, so an upgrade in pumping capacity should not be needed in the near future. The new pumps represent a 50 percent increase over the previous pumps since the duplex mode was not available until the new pumps were installed and the system modified to allow duplex operation.

The size of the metering pumps should be such as to accommodate the range of dosing noted below.

- ♦ The lower rate is based on 500 gpm of raw water and a dosing concentration of 0.3 mg/l.
- ♦ The higher rate is based on 750 gpm of raw water and a dosing concentration of 1.0 mg/l.

The City plans to use sodium hypochlorite with a nominal concentration of 12.5 percent. Metering pump feed rates are computed in Appendix A and summarized in Table 7.1.

Table 7.1: Metering Pump Feed Rate Summary		
Water Production Pump Range (gpm)	System Chlorine Dose (ppm)	Feed Rate (gph)
500	0.3	0.072
500	1.0	0.24
750	0.3	0.11
750	1.0	0.36

If the 12.5 percent solution is diluted (or degrades due to prolonged storage), the increase in metering pump flow rate will be inversely proportional to the percent decrease in solution concentration. For example, if the hypochlorite concentration is cut in half, the pumping rate will need to double. Gas generation can be an issue with higher concentrations of hypochlorite – especially under suction lift conditions. This can be addressed with careful selection of metering equipment that have additional provisions, such as degassing heads; and use of appropriate chemical feed piping diameters.

7.2 Volumetric Needs

Standard hypochlorite 12.5 percent solution will degrade relatively quickly and is best used within one month if stored at full strength. The City has expressed an interest in using low-sodium hypochlorite with has a longer shelf-life. Appendix B includes information on low-sodium hypochlorite.

Volumetric requirements are calculated in Appendix A and summarized in Table 7.2.

Table 7.2: Monthly Hypochlorite Volumetric Need

Month	Water Production			12.5 Percent Hypochlorite	
	Total (gal.)	Rate (gpm)	Pump Hours (hrs)	Feed Rate (gph)	Total (gal)
@0.5 ppm					
January 2018	4,820,000	500	160.7	0.12	11.6
July 2018	11,764,000	500	392.1	0.12	28.2
@1.0 ppm					
January 2018	4,820,000	500	160.7	0.24	38.6
July 2018	11,764,000	500	392.1	0.24	94.2

Bulk deliveries of 12.5 percent hypochlorite are typically 350-400 gallons minimum (based on a conversation with the City's chemical supplier). This quantity would result in excessively long storage and is not recommended even with the low-sodium hypochlorite. The City can obtain low-sodium hypochlorite in 50-gallon drums. An order of one to four barrels would provide for approximately two months depending on the season and chlorine dose.

7.3 Other Considerations

The chemical feed pumps will inject into the water system transmission main which has a static pressure of approximately 76 psi based on the difference between the top water elevation of the City's reservoir and the floor elevation of the disinfection building. The booster pumps at the Well Building operate at 89.1 psi total dynamic head at 498 gpm (simplex mode), and approximately 110 psi (reported) at 750 gpm (duplex mode). The chemical feed pumps will need to operate over the noted range of transmission system pressures.

The hypochlorite and chemical feed system will be located inside a heated building; consequently, there are no thermal or UV considerations associated with storage. Safety and storage information on sodium chloride is included in Appendix B.

8. EQUIPMENT AND LAYOUT

8.1 Miox System Removal

Equipment and piping associated with the Miox onsite system occupies a considerable amount of space within the well building. Recommended removals are shown in Figure 8.1. Figure 8.1 also shows a ¾" water line that is noted to remain but part or all of it will likely be removed according to the City's preference after a closer examination of the pipe's condition; see Section 8.4 for additional discussion regarding a full or partial replacement of this line.

8.2 Chemical (Hypochlorite) Feed Pumps

Using 50-gallon drums of hypochlorite will require a pump capable of meeting the suction lift requirements (to avoid having to transfer hypochlorite to another tank that will provide a flooded suction). The suction lift requirement eliminates standard diaphragm pumps from consideration. The high system pressure eliminates peristaltic pumps. Several pumps, including stepper motor pumps, were considered and the City expressed a preference for the Prominent Gamma/ X diaphragm metering pump which is designed to operate under the conditions noted in the subsections above. Two pumps should be available for redundancy. Product literature noting pump characteristics and features is included in Appendix C.

8.3 Chemical Feed Assembly

The City has expressed a preference for a prefabricated duplex chemical feed pumping assembly. The unit is Prominent Dual Gamma X Chemical Feed Panel that includes two Prominent Gamma X Pumps (GMXA1604NPTVOOUDC1300EN). Appendix C includes a drawing of the chemical feed assembly and a list of components and system data.

8.4 New Water Line

A new water line is recommended as part of the overall work in the Well Building. The plan is to remove the existing $\frac{3}{4}$ " line and replace it with the new line ($\frac{3}{4}$ " schedule 80 PVC). The replacement can be whole or part depending on the condition of the pipe and/or the City's preference.

8.5 System Layout

Figure 8.1 shows the building layout and, with the noted equipment removals, ample room for locating the proposed chemicals and equipment. The City will determine the final locations consistent with the following general locations:

- ♦ Chemical feed assembly – locate on the east wall, to the left of the existing analyzers, at the minimum height needed to facilitate connecting and disconnecting to the 50-gallon drum of 12.5 percent hypochlorite located immediately below. Minimizing the height reduces the suction lift requirement. The recommended pumps have a 6.0 foot suction lift capability.
- ♦ Hypochlorite storage – depending on the time of year and actual rates of usage, between one and four 50-gallon drums of 12.5 percent hypochlorite will be delivered at a time and will require storage. These can be stored inside, along the east wall.
- ♦ Piping – Minor piping modifications will be needed to connect the chemical feed assembly to the existing system. There are no changes anticipated for the injection point into the transmission main.

The City intends to evaluate actual hypochlorite usage to better determine if larger capacity tank for hypochlorite would be practicable and to evaluate operation under suction lift conditions. Based on the results, the City may further modify the facility to provide a larger

tank for bulk deliveries of hypochlorite and to reconfigure the chemical feed assembly to allow for a flooded suction.

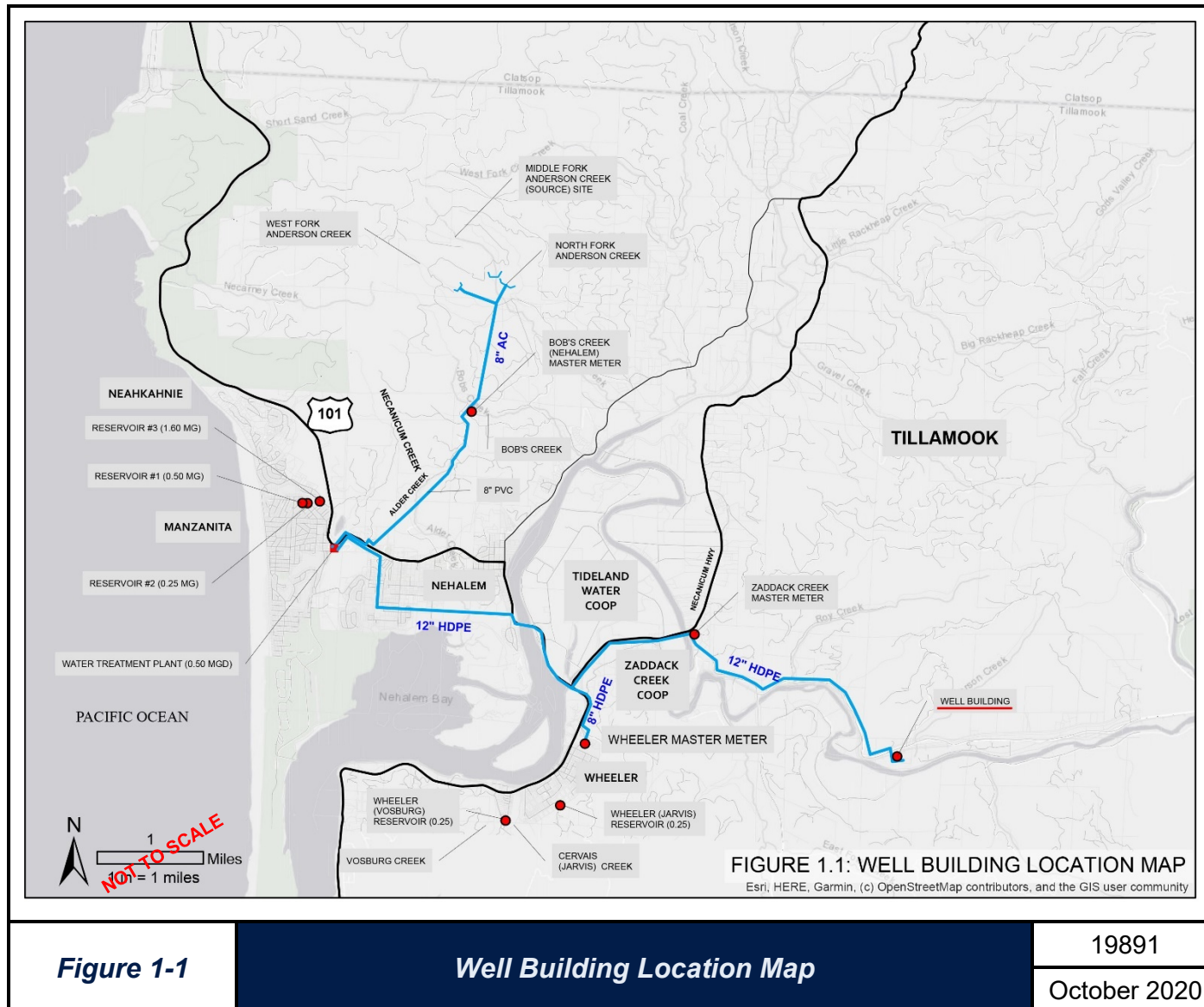
9. OPINION OF PROBABLE COST

The City intends to remove the old equipment and install the new equipment themselves. Aside from chemical costs, the most significant cost is associated with the two metering pumps and chemical feed assembly. Costs are approximately \$11,000 for equipment, but there will likely be additional costs associated with removal and disposal of old equipment and the initial purchase of hypochlorite. Budget \$15,000.

10. IMPLEMENTATION

The City has budgeted for the work and intends to implement the project this fiscal year (2020-2021).

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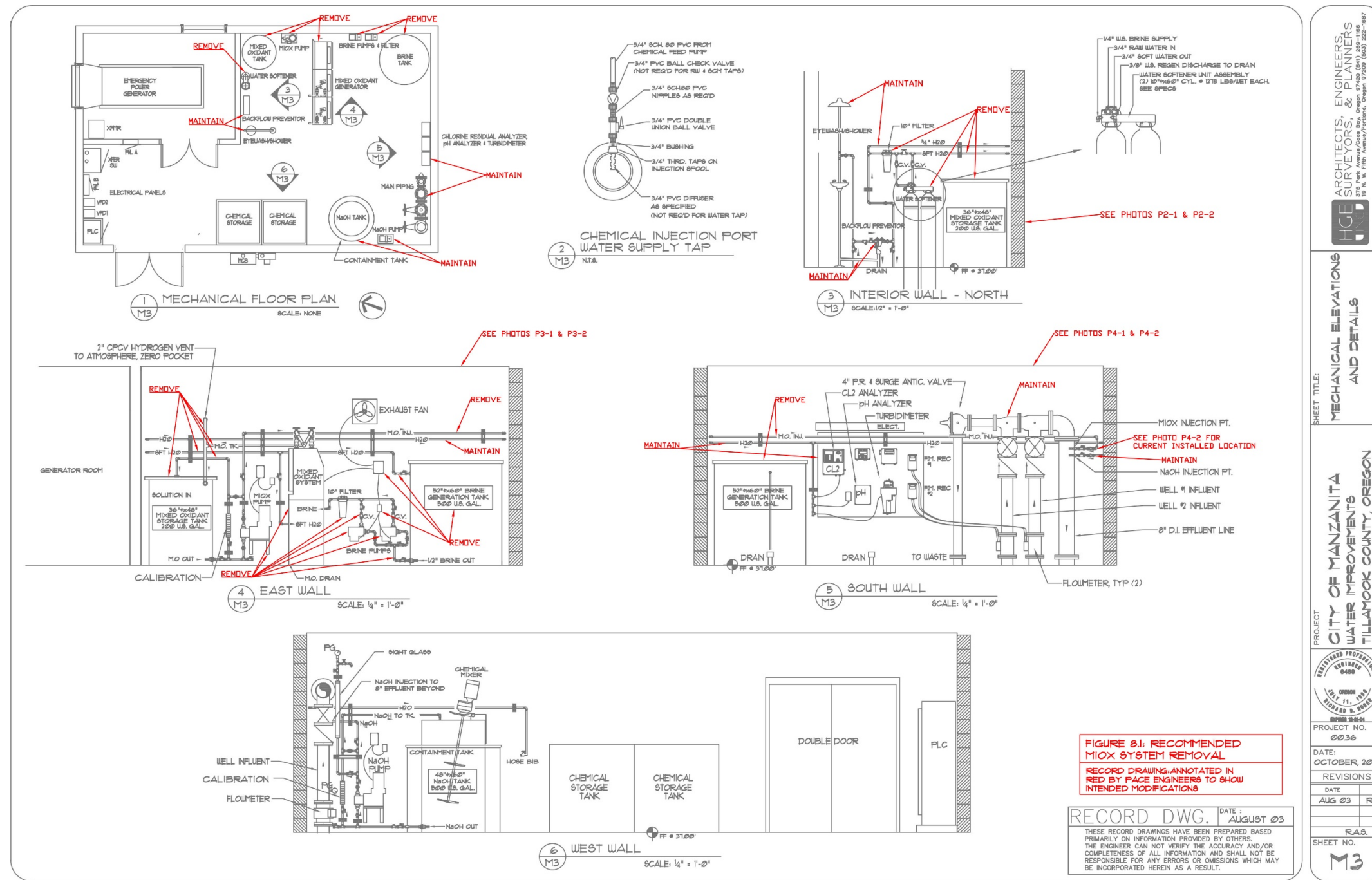


Figure 8-1

Recommended Miox System Removal

19891

October 2020

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Photo P1-1: Miox System (Front)



Photo P1-2: Miox System (Back)



Photo P2-1: North Wall



Photo P2-2: North Wall



Photo P3-1: East Wall (North Side)



Photo P3-2: East Wall (South Side)



Photo P4-1: South Wall (East Side)



Photo P4-2: South Wall (West Side)

City of Manzanita
Manzanita Disinfection Feasibility Study
Manzanita, Oregon

Appendix A

CL Feed Rate and Volume Calculations

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MANZANITA DISINFECTION SYSTEM REPLACEMENT STUDY

Hypochlorite (12.5%) Feed Rate and Volume Calculations

Chemical Feed:

$$C_F \times Q_F = C_S \times Q_S$$

$$C_F = \text{feed concentration}$$

$$= 12.5\% \left(\frac{10,000 \text{ ppm}}{\%} \right) = 125,000 \text{ ppm}$$

$$Q_F = \text{feed flow}$$

$$Q_F = \frac{C_S \times Q_S}{C_F}$$

$$C_S = \text{system chlorine dose}$$

$$= 0.3 \text{ ppm}$$

$$Q_S = \text{flow} \quad (500 \text{ gpm simplex; } 750 \text{ gpm duplex})$$

$$= 500 \text{ gpm} \left(\frac{60 \text{ min.}}{1 \text{ hr.}} \right) = 30,000 \text{ gph}$$

$$Q_F = \frac{(0.3)(30,000)}{125,000} = 0.072 \text{ gph}$$

$$\text{If } C_S = 1.0 \text{ ppm, then } Q_F = 0.24 \text{ gph}$$

$$\text{If } Q_S = 750 \text{ gpm and } C_S = 0.3 \text{ ppm, then } Q_F = 0.11 \text{ gph}$$

$$\text{If } Q_S = 750 \text{ gpm and } C_S = 1.0 \text{ ppm, then } Q_F = 0.36 \text{ gph}$$

Volume:

Winter (based on January 2018 production; 4,820,000 gal.)

$$4,820,000 \text{ gal} \left(\frac{1}{500 \text{ gpm}} \right) \left(\frac{\text{hr}}{60 \text{ min}} \right) (0.072 \text{ gph}) = 11.6 \frac{\text{gal}}{\text{mo}} @ 0.3 \text{ ppm}$$

$$= 38.6 \frac{\text{gal}}{\text{mo}} @ 1.0 \text{ ppm}$$

Winter (based on January 2018 production; 4,820,000 gal.)

$$11,764,000 \text{ gal} \left(\frac{1}{500 \text{ gpm}} \right) \left(\frac{\text{hr}}{60 \text{ min}} \right) (0.072 \text{ gph}) = 28.2 \frac{\text{gal}}{\text{mo}} @ 0.3 \text{ ppm}$$

$$= 38.6 \frac{\text{gal}}{\text{mo}} @ 1.0 \text{ ppm}$$

City of Manzanita
Manzanita Disinfection Feasibility Study
Manzanita, Oregon

Appendix B
Low-Salt Hypochlorite Information
Sodium Hypochlorite Material Safety and Data Sheets

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Low Salt Sodium Hypochlorite



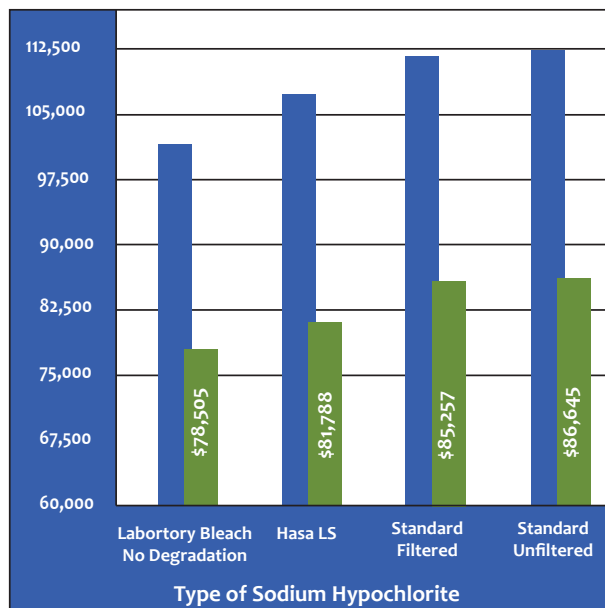
Low Salt (LS) Sodium Hypochlorite is the product of a new, innovative technology that produces bleach that is more environmentally friendly and more cost effective.

By removing 64% of the salt, the quality of LS bleach is chemically improved in both quality and stability which results in significant advantages over traditional bleach.

In addition to removing salts, Hasa filters all bleach to a submicron level. Removing organic contaminants & trace metals further extends the sodium hypochlorite's stability & minimizes decomposition.

- ◆ 64% Less Salt
- ◆ 70% Longer Shelf Life
- ◆ 39% Less Chlorate Formation*
- ◆ 64% Less Perchlorate Formation*
- ◆ 40% Less Oxygen Formation

Annual Fiscal Impact of Decomposition by Various Bleach Types



— Gallons of Sodium Hypochlorite
— Costs of Sodium Hypochlorite

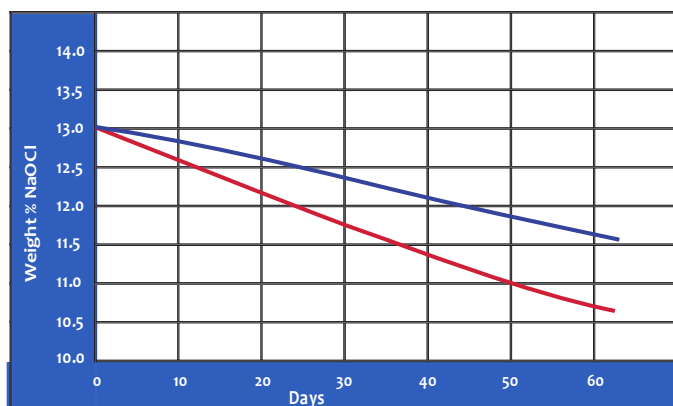
Cost and use data provided by municipal waste water treatment facility

13% LS vs Traditional Bleach Half Life Comparison

	68°F	90°F
LS Bleach	440 Days	79 Days
Traditional Bleach	252 Days	46 Days

* Sodium hypochlorite temperature at 90°F as per AWWA testing standards.

13% Low Salt vs. Traditional Filtered Bleach Decomposition Comparison at 68°F



— 13% Low Salt Bleach
— 13% Traditional Bleach

HASA, Inc.
3401 Industrial Way
PO Box 1173
Longview, WA 98632

(360) 578-9300
www.hasapool.com

LOW SALT





Hasa Low Salt Sodium Hypochlorite



Low Salt Bleach Benefits

70% Longer Shelf Life

- Less degradation means disinfection is more cost effective (see chart other side)
- Decomposes slower so temperature becomes less critical for storage
- 15% higher NaOCl strength 30 days from manufacture using LS bleach.

64% Less Salt Means:

- 3,000 lbs less salt in a truck load
- 33.3 tons less salt – per 100,000 gallons bleach
- Reduced salt violations
- Less clogging of drip systems
- Less salt added to soil through irrigation water
- Better formulations when compounding with other chemicals

Lower Concentrations of Chlorates & Perchlorates

- 39% reduction of Chlorate formation at 30 days*
- 64% reduction of Perchlorate formation at 30 days*

(Prepares utilities for pending Federal (USEPA) Chlorate & Perchlorate regulations)

Less Oxygen Produced Through Gas Off

- Reduces oxygen formation by 40%*
- Reduces equipment problems:
 - Pumps
 - Vapor Traps in Piping
 - Valves & Pressure Reliefs



Low Salt Specifications

Chemical Composition	(% by weight)	
	Min	Max
Sodium Hypochlorite	12.50	15.60
Sodium Chloride	2.50	6.00
Sodium Hydroxide	0.10	2.00
Sodium Carbonate	0.00	0.50
Inorganic Salts of Iron	0.00	0.5 mg/L
Inorganic Salts of Copper	0.00	0.05 mg/L
Inorganic Salts of Nickel	0.00	0.05 mg/L

Traditional Sodium Hypo

Wt % NaOCl	Wt % NaCl	SG
16.5%	13.0%	1.2622
15.0%	11.9%	1.2382
13.0%	10.4%	1.2052
10.5%	8.30%	1.1610
8.0%	6.30%	1.1210
6.0%	4.70%	1.0920
3.0%	2.40%	1.0490

Low Salt Sodium Hypo

Wt % NaOCl	Wt % NaCl	SG
16.5%	4.7%	1.1997
15.0%	4.3%	1.1824
13.0%	3.7%	1.1592
10.5%	3.0%	1.1296
8.0%	2.3%	1.0994
6.0%	1.7%	1.0750
3.0%	0.9%	1.0376



With LS, over 3,000lbs of salt is removed from a 4,500 gallon tanker

Distributed By:

ALLIED UNIVERSAL CORPORATION

Headquarters: 3901 NW 115th Avenue, Miami, Florida 33178 Phone: (305) 888 - 2623

MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR § 1910.1200.

TODAY'S DATE: 09/06/07

MSDS NUMBER: 0001

24 HOUR EMERGENCY CHEMICAL SPILL OR RELEASE PHONE NUMBERS:

Allied Universal Corp. at 1-305-483-7732 (Digital Beeper) and/or CHEMTREC at 1-800-424-9300

SECTION 1 CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Sodium Hypochlorite

Product Names: Aqua Guard Chlorinating Sanitizer, Aqua Guard Bleach, Liquid Chlorine Solution, Liquid Bleach, Hypochlorite, Hypo and Chlorine Bleach.

Listed Strengths: 10.5%, 12.5% and 15%

CAS Number: 7681-52-9

Date MSDS Revised: August 2007 (previous revision 11/04)

Product Use: Disinfectant and sanitizer, see product label for all approved uses & instructions.

NSF Approval: Yes. Certified to NSF/ANSI Standard 60. Maximum use in Potable Water is 84 mg/L for 12.5% bleach and 100 mg/L for 10.5% bleach.

NSF Non-Food Compounds Approval: Yes

SECTION 2 HAZARD INGREDIENTS/IDENTITY INFORMATION

Hazardous Ingredient(s): % (w/w) as Sodium Hypochlorite : 10.5-16%

Exposure Standards: None established for Sodium Hypochlorite, as Chlorine exposure standards are:

PEL (OSHA): 1 ppm as Cl₂

STEL (OSHA): 3 ppm as Cl₂

TLV (ACGIH): 0.5 ppm as Cl₂

TWA (ACGIH): 0.5 ppm as Cl₂

WEEL (AIHA): 2 mg/m³, 15 minute TWA as Cl₂

STEL (ACGIH): 1 ppm as Cl₂

Emergency Overview: May cause burns to the eyes, skin and mucous membranes.

SECTION 3 PHYSICAL/CHEMICAL CHARACTERISTICS

Alternate Name(s):	Bleach
Chemical Name:	Sodium Hypochlorite
Chemical Family:	Oxidizing Agent
Molecular Formula:	Na-O-Cl
Form:	Liquid
Appearance:	Water clear to a slight greenish-yellow, or light yellow aqueous solution
Odor:	Chlorine odor
pH:	11-14, dependent upon % weight as Sodium Hypochlorite
Vapor Pressure:	Not available
Vapor Density (Air=1):	Not available
Boiling Point:	Approximately 230° F (110° C)
Freezing Point:	14 F (8% w/w Cl ₂ solution), 7 F (10% w/w Cl ₂ solution), -3 F (12% w/w Cl ₂ solution)
Solubility (Water):	Completely Soluble
Solubility (Other):	Reacts with Many Organic Solvents
Density:	Appx. 10 lbs. per gallon
Evaporation Rate:	Not Available
Specific Gravity:	1.126 (8% w/w Cl ₂ solution), 1.163 (10% w/w Cl ₂ solution), 1.202 (12% w/w Cl ₂ solution), 1.25 (15% w/w Cl ₂ solution)
Molecular Weight:	74.5

SECTION 4 STABILITY & REACTIVITY DATA

Chemical Stability	Stable <u> X </u>	Unstable _____
Incompatibility (Conditions to Avoid): Stability decreases with heat and light exposure.		
Incompatibility (Materials to Avoid): May react violently with strong acids. Other incompatibles include strong caustics, ammonia, urea, reducing agents, organics, ether and oxidizable materials. Reaction with metals (nickel, iron, cobalt and copper) may produce oxygen gas, which supports combustion. May react with organohalogen compounds to		

form spontaneously combustible compounds. May react explosively with nitro- and chloro-organic compounds as well as acids and reducing agents. Acidification liberates chlorine gas.

Hazardous Decomposition or Byproducts: Chlorine gas. Decomposes with heat and reacts with acids. Hazardous gases/vapors produced are hypochlorous acid, chlorine and hydrochloric acid. Composition depends upon temperature and decrease in pH. Additional decomposition products, which depend on pH, temperature and time, are sodium chloride and chlorate, and oxygen.

No Mechanical Shock or Impact

No Static Discharge

**Oxidizer: No if <12% by weight,
Yes if > than 12% by weight**

Hazardous Polymerization

May Occur _____

Will Not Occur X

Note: Sodium Hypochlorite reacts violently with amines and ammonium salts. Solutions are reactive with common cleaning products such as toilet bowl cleaners, rust removers, vinegar, acids, organics and ammonia products to produce hazardous gases such as chlorine and other chlorinated species.

SECTION 5 POTENTIAL HEALTH EFFECTS AND FIRST AID INFORMATION

GENERAL: May cause immediate pain. Exposure to the skin may cause sensitization or other allergic responses. If the eye is not irrigated immediately after it has been exposed permanent eye damage may occur. Strict adherence to first aid measures following any exposure is essential. **SPEED IS ESSENTIAL!**

ROUTE(S) OF ENTRY AND POTENTIAL HEALTH EFFECTS	EMERGENCY & FIRST AIDE PROCEDURES
INHALATION: Strong irritating to mucous membranes in the nose, throat and respiratory tract. Prolonged contact can cause chronic irritation, pulmonary edema and central nervous system depression. Repeated inhalation exposure may cause impairment of lung function and permanent lung damage.	If inhaled, move expose person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. If breathing is difficult, have trained person administer oxygen. Call a poison control center or medical physician for further treatment advice. Have the product label or MSDS with you when calling or going for medical treatment.
SKIN CONTACT: Prolonged and repeated exposure to dilute solutions often causes irritation, redness, pain and drying and cracking of the skin. Human evidence has indicated that an ingredient in this product can cause skin sensitization. Depending upon the concentration and how soon after exposure the skin is washed with water, skin contact may cause burns and tissue destruction.	If on skin or clothing, take off all contaminated clothing and rinse skin immediately with plenty of water for 15-20 minutes. If irritation persists, repeat flushing. Do not transport victim unless the recommended irrigation period is completed unless flushing can be continued during transport. Call a poison control center or medical physician for treatment advice. Have the product label or MSDS with you when calling or going for medical treatment.
EYE CONTACT: Strongly irritating to eyes. Exposure to vapor can cause tearing, conjunctivitis and burning of the eyes. Eye contact may cause a corneal injury. The severity of the effects depend on the concentration and how soon after exposure the eyes are washed with water. In severe exposure cases, glaucoma, cataracts and permanent blindness may occur.	If in eyes, hold eye open and rinse slowly and gently with plenty of water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye for 10-15 minutes. Do not transport victim until the recommended flushing period is completed unless irrigation can be continued during transport. Call a poison control center or medical physician for further treatment advice. Have the product label and/or MSDS with you when calling or going to medical treatment.
INGESTION: Corrosive. Can cause severe corrosion of and damage to the gastrointestinal tract (including mouth, throat, and esophagus). Exposure is characterized by nausea, vomiting, abdominal pain, diarrhea, bleeding, and/or tissue ulceration.	If swallowed, call poison control center or medical physician immediately for treatment advice. Have the product label or MSDS with you when calling or going for medical treatment. Have exposed person sip a glass of water if able to swallow, and dilute immediately by giving milk, melted ice cream, starch paste or antacids such as milk of magnesia. Avoid sodium bicarbonate because of carbon dioxide release. DO NOT INDUCE VOMITING, LAVAGE OR ACIDIC ANTIDOTES unless told to do so by poison control center or medical physician. DO NOT give anything by mouth to an unconscious person. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water.

NOTE TO PHYSICIAN(S): Pre-existing medical conditions may be aggravated by exposures affecting target organs. There are no known chronic effects. Probable mucosal damage may contraindicate the use of gastric lavage. In addition to the alkalinity of this product, the continued generation of chlorine gas after ingestion can damage further the stomach mucous, depending on the amount ingested. Consideration may be given to removal of the product from the stomach, taking care to avoid perforation of esophagus or stomach. An ounce of 1% sodium thiosulfate or milk of magnesia is helpful.

SECTION 6 TOXICOLOGICAL DATA

ANIMAL DATA: Inhalation 0.25-hour LC50 - 10.5 mg/L in rats; Acute Dermal LD50 - 10,000 mg/kg in rabbits; Acute Oral LD50 - 8910 mg/kg in rats

SUMMARY: The concentrated solution is corrosive to skin, and a 5% solution is a severe eye irritant. Solutions containing more than 5% available chlorine are classified by DOT corrosive (please see section 10 of this MSDS). Toxicity described in animals from single exposures by ingestion include muscular weakness, and hypoactivity. Repeated ingestion exposure in animals caused an increase in the relative weight of adrenal glands in one study, but no pathological changes were observed in two other studies. Long-term administration of compound in drinking water of rats caused depression of the immune system. No adverse changes were observed in an eight week dermal study of a 1% solution in guinea pigs. Tests in animals demonstrate no carcinogenic activity by either the oral or dermal routes. Tests in bacterial and mammalian cell cultures demonstrate mutagenic activity.

CARCINOGENICITY: None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as carcinogen.

MUTAGENICITY: Sodium Hypochlorite has been shown to produce damage to genetic material when tested in vitro. Studies in vivo have shown no evidence of mutagenic potential for this material. It is judged that the risk of genetic damage is insignificant for sodium hypochlorite because of its biological activity, lack of mutagenicity in vivo, and failure to produce carcinogenic response.

SECTION 7 FIRE AND EXPLOSION HAZARD DATA

Flash Point: This product does not flash		Flammable Limits (Lower): Not Applicable	
Flammable Limits (Upper): Not Applicable		Auto Ignition Temperature: Not Applicable	
Decomposition Temperature: Not Applicable		Rate of Burning: Not Available	
Explosive Power: Not Available	Sensitivity to Mechanical Impact: Not expected to be sensitive to mechanical impact	Sensitivity to Static Discharge: Not expected to be sensitive to static discharge	
Fire and Explosion Hazards: This material is non-flammable but is decomposed by heat and light, causing a pressure build-up which could result in an explosion. When heated, it may release chlorine gas or hydrochloric acid. Vigorous reaction with oxidizable or organic materials may result in fire.		Extinguishing Media: Use agents appropriate for surrounding fire. Foam, dry chemical, carbon dioxide, water fog or spray. If leak or spill has not ignited, use water spray to disperse the vapors and to protect persons attempting to stop the leak.	
Fire Fighting Procedures: Water spray should be used to cool containers and may be used to knock down escaping vapor. Remove storage vessels from the fire zone.		Fire Fighting Protective Equipment: Full protective clothing, including a NIOSH approved self-contained breathing apparatus, must be worn in a fire involving this material. Toxic gas vapors are produced upon decomposition.	

SECTION 8 ECOLOGICAL INFORMATION

The toxicity and corrosivity of this product is a function of concentration and the concentration's pH.

ECOTOXICOLOGICAL INFORMATION: Toxic to aquatic life. 96-hour LC50: fathead minnows: 0.090-5.9 mg/L, bluegill sunfish: 0.10-2.48 mg/L, shore crab: 1.418 mg/L, grass shrimp: 52.0 mg/L, scud: 0.145-4.0 mg/L, water flea: 2.1 mg/L.

ENVIRONMENTAL EFFECTS: Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers. May be an aesthetic nuisance due to color. Mammals and birds, exposed wildlife would be subject to skin irritation and burns due to the corrosive nature of this material.

SECTION 9 DISPOSAL CONSIDERATIONS

Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State, and Local regulations. Do not burn. Do not flush to surface water or sanitary sewer system. If pH of material is equal to or greater than a 12.5, the material is a RCRA Hazardous Waste D002, corrosive.

SECTION 10 TRANSPORT INFORMATION

U.S. DOT Basic Shipping Description: Hypochlorite Solutions, 8, UN1791, III

U.S. DOT Hazardous Substance: Yes, RQ 100 pounds (Sodium Hypochlorite)

U.S. DOT Marine Pollutant: No

U.S. DOT Required Label: Corrosive (see column 6, 49 CFR §172.101)

U.S. DOT Packaging Exception: Yes, if package meets the criteria of a limited quantity or consumer commodity as defined by 49 CFR §171.8, §173.144 and .154, and §172.312 and .316

N. AMERICAN EMERGENCY GUIDE PAGE NUMBER: 154

Transportation Emergency Phone Numbers: CHEMTREC 1-800-424-9300

SECTION 11 PRECAUTIONS FOR SAFE HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Take all precautions to avoid personal contact. Keep container closed except when transferring material. Locate safety shower and eyewash station close to chemical handling area. Use normal good industrial hygiene and housekeeping practices, wash thoroughly after handling. Store in a cool, dry, well-ventilated area, away from incompatibles (minimum distance of 20-25 feet per NFPA Code 1) and direct sunlight. Keep container properly labeled at all times. Vented containers must be used and must be kept closed when not

being used. Long-term storage is impossible without decomposition. Only use containers made from tinted glass, polyethylene & FRP. Keep out of reach of children.

PROCESS HAZARDS: Not Available

STORAGE TEMPERATURE: Store containers below 29°C and above freezing point. Do not expose sealed containers above 40°C. Try to store in the dark at the lowest possible temperature, but keep from freezing, to slow-down decomposition.

SECTION 12 EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Full handling precautions should be taken at all times. Provide good room ventilation plus local exhaust at points of emission and low level floor exhaust in immediate handling area. Where engineering controls are not feasible, use adequate local exhaust ventilation wherever mist, spray or vapor may be generated.

PERSONAL PROTECTIVE EQUIPMENT:

Eye: Use chemical safety goggles when there is potential for contact (splashing), faceshield recommended – ANSI Z87.1

Skin: Gloves and protective clothing (apron, boots, and bodysuits) made from rubber, vinyl, neoprene or PVC. Standard work clothing closed at the neck and wrist while wearing impervious equipment.

Respiratory (Specify Type): A NIOSH/MSHA approved air purifying respirator with an acid gas cartridge or canister may be permissible under circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is potential for uncontrolled releases, exposure levels are not known, or other circumstances where air purifying respirators may not provide adequate protection.

Other: Eyewash, shower station (ANSI Z358.1) must be provided within the immediate work area.

SECTION 13 ACCIDENTAL RELEASE MEASURES

Ventilate enclosed area. Collect product for recovery or disposal. For release to land, contain discharge by constructing dikes or applying inert absorbent; for release to water, utilize damming and/or water diversion to reduce the spread of contamination; and, for release to air, vapors may be suppressed by the use of a water fog. All run-off water must be captured for treatment and disposal. Collect contaminated soil and water, and absorbent for disposal. Notify applicable government authority if release is reportable or could adversely affect the environment. Please follow all Local, State and Federal Laws for clean-up and disposal of all contaminated material. **Deactivating Chemicals:** Sodium Sulfite, Sodium Thiosulfate and Sodium Bisulfite.

SECTION 14 REGULATORY INFORMATION

OSHA CLASSIFICATION, 29 CFR §1900-1910:

Physical Hazards: Reactivity **Health Hazards:** Acute - Skin Sensitizer, Corrosive

CERCLA AND SARA REGULATIONS, 40 CFR §300-373:

Reportable Quantity = 100 lb.

CERCLA Hazardous Material: Yes

Title III Hazard Classifications: Acute - yes, Chronic - no, Fire - yes, Reactivity - yes & Sudden Release of Pressure - No. This product may be reportable under the requirements of 40 CFR §370.

SARA Extremely Hazardous Substance: No **SARA Toxic Chemical:** No

CA Prop 65: No

FDA 21 CFR 178.1010: Yes, Approved as Sanitizer

NSF Whitebook (former USDA Approval) Listing: Aqua Guard Chlorinating Sanitizer 10.5% - 3D, B1, B2, D1, D2, G4, G7, GX, Q4, Aqua Guard Bleach 12.5% - 3D, B1, B2, D1, D2, G4, GX, Q4

EPA "CLEAN AIR ACT": This product does not contain nor is it manufactured with ozone depleting substances. It is not defined as a Hazardous Air Pollutant per 40 CFR 112.

EPA Pesticide: The 10.5% and 12.5% sodium hypochlorite products are registered with the U.S. EPA as a pesticide, as required under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of Federal law to use this product for pesticidal applications in a manner inconsistent with the FIFRA labeling.

NPCA-HMIS RATING: HEALTH: 3

FLAMMABILITY: 0

REACTIVITY: 2

NFPA RATING: NONE AT THIS TIME

SECTION 15 REFERENCES

Suppliers' Material Safety Data Sheets and EPA Labeling Requirements

Olin and OxyChem Sodium Hypochlorite Handbook

Chlorine Institute Sodium Hypochlorite Pamphlet #96

Chlorine Institute Product Stewardship Bulletins for Sodium Hypochlorite

This information contained herein, while not guaranteed, is offered only as a guide to the handling of this specific material and has been prepared in good faith by product knowledgeable personnel. This information is not intended to be all-inclusive as to the manner and conditions of use, handling and storage. Other factors may involve other or additional safety or performance considerations. Though Allied Universal Corporation is happy to respond to questions regarding safe handling of Allied's products, safe handling and use remains the responsibility of the product's consumers and/or customers. No warranty of merchantability or fitness for purpose, or any other kind, express or implied, is made regarding performance, stability or otherwise. Allied Universal Corp. will not be liable for any damages, losses, injuries or consequential damages that may result from the use of or reliance on any information contained herein. No suggestions for use are intended as, and nothing herein shall be construed as a recommendation to infringe any existing patents or violate any federal, state or local laws, rules, regulations or ordinances.

**City of Manzanita
Manzanita Disinfection Feasibility Study
Manzanita, Oregon**

**Appendix C
Dual Gamma X Quote
Prominent Feed Assembly**

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3216 E. Portland Avenue
Tacoma, WA 98404
253-779-4160
tmginc@tmgservices.net

August 4, 2020
QUOTATION

PACE Engineers
Attn: Bill Pavlich
4500 Kruse Way, Suite 250
Lake Oswego, OR 97035

Dear Bill,

TMG Services is pleased to offer you a QUOTATION on a Prominent Dual Gamma X Chemical Feed Panel for your Manzanita, OR application. Please do not hesitate to contact me if you have any questions.

(1) Prominent Dual Pump Panel Consists of the Following:

- Skid Type: Black polypropylene wall panel
- Chemical Inlet: (1) 0.5" and Solution Outlets: (1) 0.5"
- Isolation ball valves as required (vented)
- One wye strainer
- 100ml PVC calibration cylinder
- Two pressure relief valves
- Two 12 cubic inch CPVC/Viton pulsation dampeners
- One discharge pressure gauge with isolator
- One back pressure valve
- Electrical terminal box for all pump electrical connections
- 120vac power

(2) Prominent Gamma X Pumps; GMXA1604NPT7V000UDC1300EN

- 0.41 GPH @ 145 PSI
- Liquid End Materials: Acrylic/PVC (PVDF Degassing)
- Diaphragm/Seals: PTFE/PFTE Coated
- Liquid End Version: Degassing Version w/o Bypass
- Hydraulic Connections: Special Connect. 1/2" USA
- 100-230V, 50/60 Hz; North American Plug, 115V
- Relay, Pre-Set: Fault Relay+4-20 mA Output
- Control Variant: Option 0+Analog Control
- Metering Monitor: Pulse Signal Input
- (2) Universal Control Cables, 15 ft.

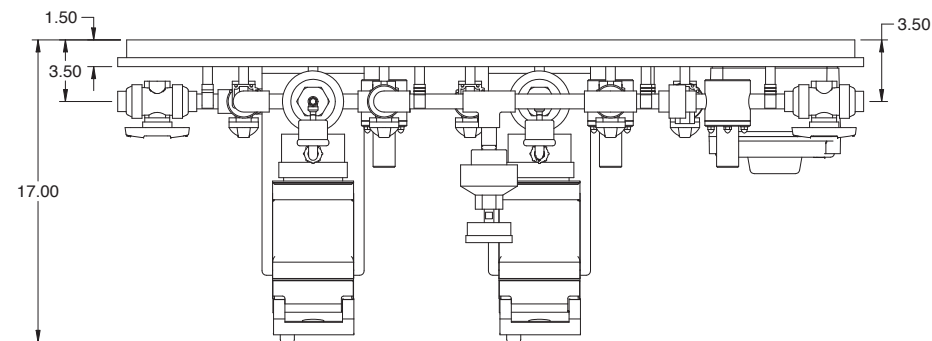
(1) 2 Pump Terminal Box Kit

PRICE: \$ 10,584 (Including Freight)

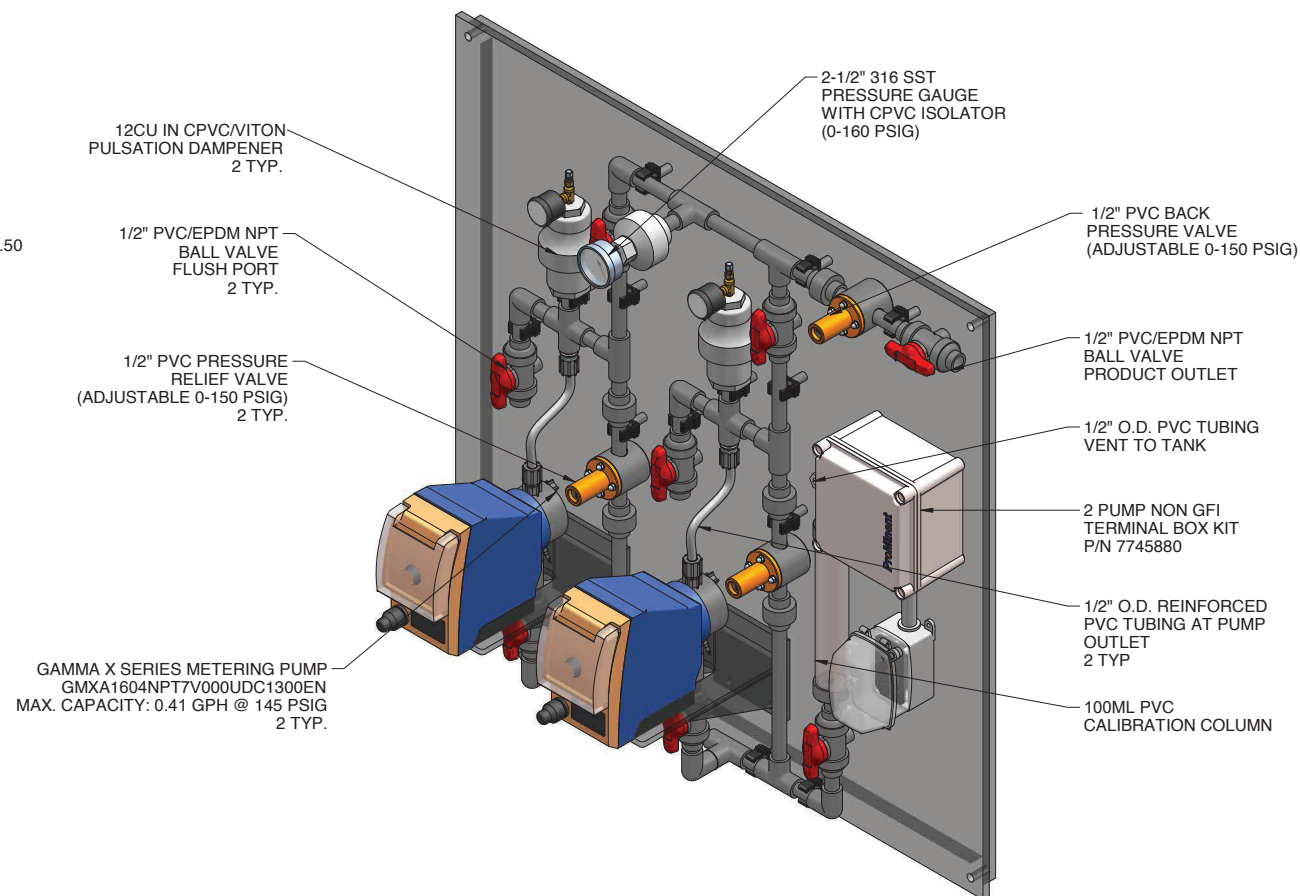
Terms & Conditions of Sale:

- F.O.B.: Prepaid and Add
- Payment Terms: Net 30 Days – Our terms of payment are 100% payable 30 days after shipment. Since this is an agreement between Buyer and Seller, and Seller has no relationship with the third party owner, this agreement must be independent of any third party action or inaction. Payment will be due as indicated above without a dependency on the buyer being paid by the owner, with no further restriction or impediments, and regardless of any payment arrangement that may exist between contractor and owner.
- This price is in effect for 60 days.
- Submittals, if required, will be provided 2 - 4 weeks after receipt of all technical data at T M G Services.
- Delivery will be made in approximately 6 - 8 weeks after receipt of order and/or approvals and resolution of all necessary technical data at T M G Services.
- Quotation prices do not include any sales taxes or any other taxes that may apply.
- This quotation is limited to the products and/or services as listed and excludes any item or service not specifically listed.

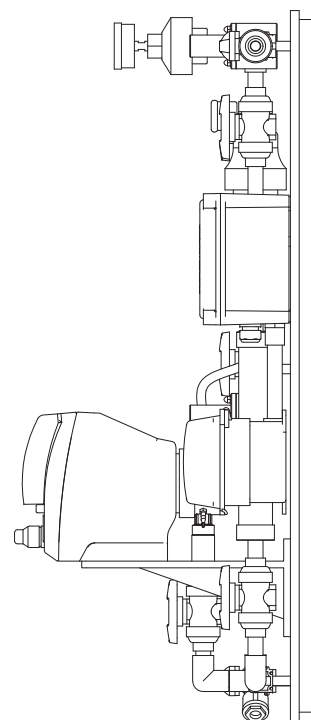
Regards,
Becky Doolin
TMG Services, Inc.



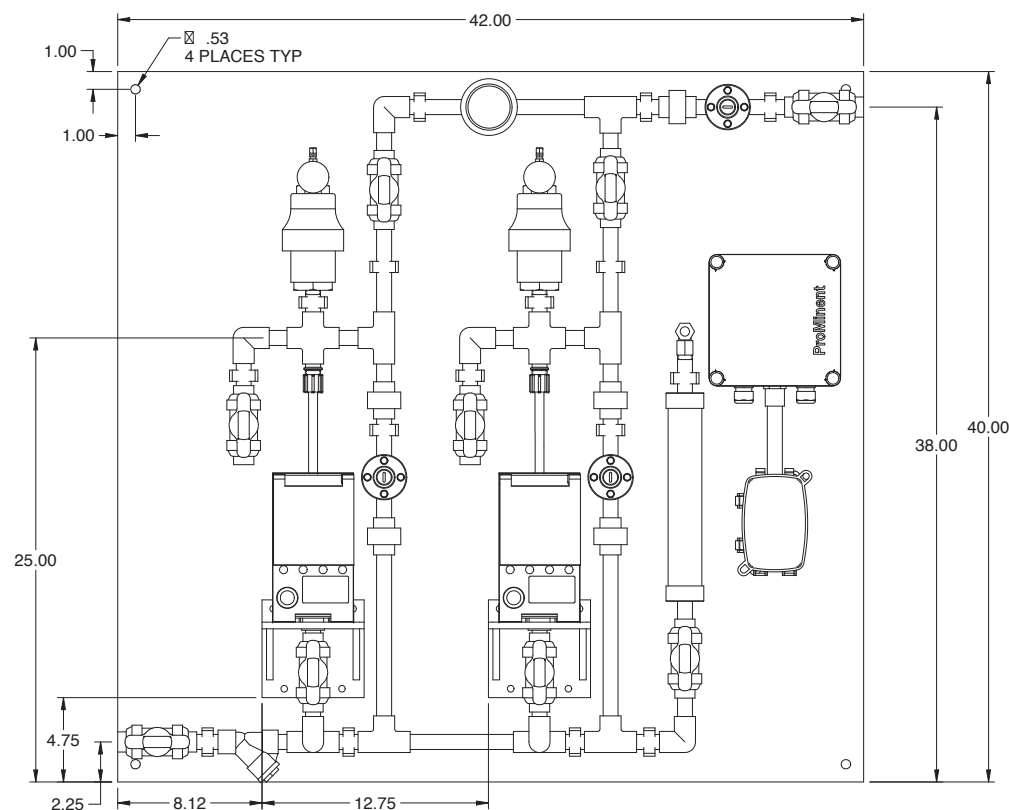
PLAN VIEW



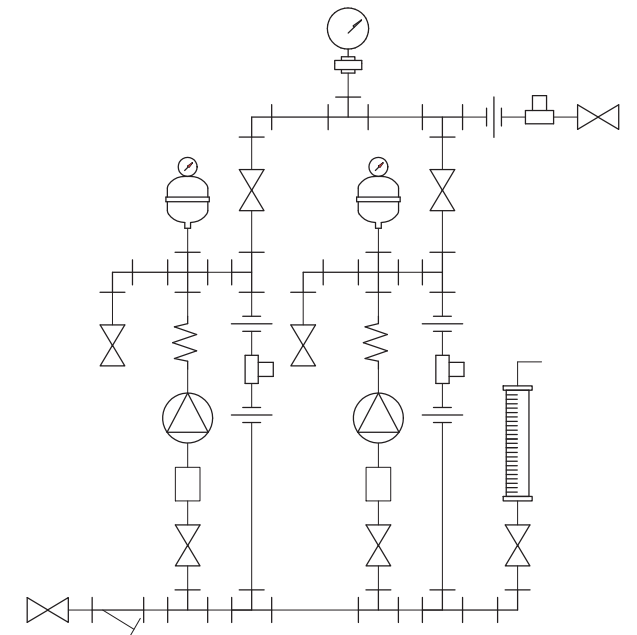
ISOMETRIC VIEW



SIDE VIEW



FRONT VIEW



PIPING SCHEMATIC

NOTES:

1. ALL PIPING AND FITTINGS SHALL BE 1/2" SCH. 80 PVC SOCKET WELD WITH EPDM SEALS UNLESS OTHERWISE REQUIRED BY COMPONENTS.
2. ALL DIMENSIONS ARE IN INCHES AND ARE SHOWN FOR REFERENCE ONLY.

A	12/12/18	RELEASED FOR PRODUCTION	ALS		
0	09/05/18	FIRST ISSUE	ALS		
REV	DATE	DESCRIPTION	BY	APPD	REVD



	REVISIONS
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CUSTOMER MANZANITA, OR - SODIUM HYPOCHLORITE SYSTEM GENERAL ARRANGEMENT

JOB No	3020102848	PURCHASE ORDER No	C201806MC29
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TITLE	ALUM FEED SYSTEM GENERAL ARRANGEMENT
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ENGINEERS SEAL	  <p>THE PROMINENT GROUP OF COMPANIES</p>	
	PITTSBURGH, PA USA	WWW.PROMINENT.US
	PROMINENT FLUID CONTROLS LTD. 490 SOUTHGATE DRIVE. GUELPH, ONTARIO, CANADA N1H 6J3 TEL. 519 836 5692 FAX. 519 836 5226	PROMINENT FLUID CONTROLS INC. RIDC PARK WEST 136 INDUSTRY DRIVE, PITTSBURGH P.A., U.S.A. 15275 TEL. 412 787 2484 FAX. 412 787 0704
	DESIGNED ALS	APPROVED CM
	DRAWN ALS	SCALE N.T.S.
	CHECKED SK	DATE 09/05/18

MAXIMUM TESTING PRESSURE =	145 PSI
MAXIMUM OPERATING PRESSURE =	145 PSI
CHEMICAL SERVICE =	ALUM

DWG No	3018800395-200	REV A	PAGE 1/1
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