Appendix S

Operations Plan

City of Santa Monica

Charnock Wellfield Restoration Project

Operations Plan - Charnock

Prepared by
Black & Veatch Corporation
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1.0 Introduction

The City of Santa Monica (City) is undertaking the Charnock Well Field Restoration Project (Project). The Project will fully restore local groundwater supplies, reduce the use of imported water from Northern California and the Colorado River, and meet sustainability objectives. System operations and the Project's key components include: pre-treatment facilities at the Charnock Well Field and additional water treatment at the Santa Monica Water Treatment Plant (SMWTP), which is also referred to as the Arcadia Water Treatment Plant (Arcadia WTP).

1.1 Report Purpose

This Operations Plan identifies the raw water quality, treatment process, water quality monitoring program, the control systems, the equipment operations, and startup and shutdown procedures for the Charnock Well Field.

1.2 Project Overview

The Charnock Well Field has been used as a source of water for potable service since 1924. In 1996, the Charnock Well Field was found to be contaminated with methyl tertiary-butyl ether (MTBE), a gasoline compound. The source of the gasoline compound was leakage from underground storage tanks at gasoline service stations located south of the well field. The wells were shut down and subsurface investigations and source remediation analyses were undertaken. The well field is considered an extremely impaired water source by the California Department of Public Health (DPH). The loss of the Charnock Well Field supply caused the City to increase the amount of imported water purchased from Metropolitan Water District of Southern California (MWD) to approximately 85 percent of its total consumption.

Because MTBE has been detected at concentrations as high as 610 µg/L (or 0.610 mg/L; Well 19; March 15, 1996), restoration of the well field as a potable water supply will require an amended domestic water supply permit from the DPH.

In 1996, at the time of the well field shutdown, tertiary-butyl alcohol (TBA), another gasoline compound, was not detected in any of the production wells. Since then, TBA has been detected in the regional groundwater monitoring wells surrounding the site, as well as in one unconfirmed sample collected from Well 15 in 2008 (at a concentration of 2.2 µg/L, which is just above the lab's method detection limit of 2 µg/L).

The City also owns and operates the Arcadia WTP, which has an existing treatment capacity of 14 million gallons per day (mgd). The water treatment facilities were originally designed to reduce water hardness and to remove iron, manganese, and trichloroethylene (TCE). The ion exchange (IX) softening beds and associated brine facilities have not been used for a number of years and have now been demolished. The original treatment processes and structures that remain at the existing WTP therefore comprise gas chlorination facilities, a 5 million gallon (MG) potable water reservoir, booster pump station, lab/workshop and main office. The reservoir contains mechanical aerators for Volatile Organic Compound (VOC) removal, with an associated off-gas scrubbing system.

Both the Charnock and Arcadia sites are located in the city of Los Angeles.

The Charnock Well Field sends water approximately 3.4 miles via a pipeline to the Arcadia WTP for treatment and entry into the distribution system. Along that pipeline, there is a single MWD connection and input of additional ground water from the Olympic Well Field (also referred to as Santa Monica Wells). The Arcadia Wells, located on the WTP site, also contribute to the incoming groundwater.

As part of this Project, the Charnock Well Field is to be returned to full production, with the installation of a well head treatment system. The treatment system to be constructed at the well field comprises GAC adsorption to treat water from three (3) contaminated wells. The new treatment facility design and operation will be evaluated against the DPH guidance memorandum, "Policy Guidance for Direct Domestic Use of Extremely Impaired Sources" (97-005 Memo) as summarized in Table 1-1.

The treated water will be combined with water from two (2) non-contaminated wells, and the combined flow will be pumped to the Arcadia WTP. The water treatment facilities at the Arcadia WTP will be upgraded to include a Reverse Osmosis (RO) softening system, with the existing reservoir aeration system continuing to remove TCE before the finished water is put into distribution. Evaluations of the sustainable production capacity of the City's well field have been carried out by WorleyParsons Komex, with the recommendation that the upgraded Arcadia WTP be designed for a maximum flow of 10.0 mgd.

The Charnock Pipeline and booster pumps, the MWD connections, and the facilities at the Olympic Well Field are not a part of this Project.

Table 1-1
Guidance from 97-005 Memo for Restoring an Impaired Water Source for Domestic Water Supply

DPH 97-005 Memo Guidance	Design Feature or Planned Procedure for: MTBE	TBA
"Treatment must be commensurate with the degree of risk associated with the contaminants."	Adsorption of MTBE onto GAC is listed by EPA as an effective treatment method.	TBA removal will be by biodegradation within the GAC beds.
"As a minimum, treatment...shall include use of the best available treatment technology defined for the contaminant(s) by the Environmental Protection Agency."	Adsorption of MTBE onto GAC is listed by USEPA as an effective treatment method for MTBE removal; however GAC is not identified by DPH as a BAT.	A BAT has not been developed by the USEPA or DPH for TBA; however, research citations have shown biological degradation of TBA.
"The treatment processes must have reliability features consistent with the type and degree of contamination."	Two GAC vessels in series improve the reliability of the system to capture MTBE	Two GAC vessels in series improve the reliability of the system to degrade TBA.
"All treatment processes used must be optimized to reliably produce water that contains the lowest concentration of contaminants feasible at all times."	Greensand filters upstream of the GAC minimize the backwashing frequency of the GAC vessels, to help improve treatment efficiency and reliability	An aeration system is included to maintain adequate dissolved oxygen in the feed water to support biomass for TBA removal, and the empty bed contact time through the two GAC vessels will be 22 minutes at design flow.
"The entire flow...must pass through the complete treatment process"	Meets Guidance	Meets Guidance
"Any water from other sources that is available for blending prior to entry into the distribution system should be used to provide an additional safety factor."	Meets Guidance	Meets Guidance
For multi-barrier treatment, "Each barrier should effectively reduce the contaminant by a significant fraction of the total required reduction."	Two GAC vessels in series improve the reliability of the system to capture MTBE	Two GAC vessels in series improve the reliability of the system for degradation of TBA.
"The treatment processes should address all the contaminants of public health concern in an extremely impaired source."	GAC effectively removes most organic contaminants, including those (i.e., TCE, 1,1-DCE) found in the Charnock well field.	GAC effectively removes most organic contaminants, including those (i.e., TCE, 1,1-DCE) found in the Charnock well field.
"Proposed monitoring and treatment should include:		
▾ Performance standards (field measurable indicator of treatment efficiency"	The City has in-house analytical capability to track MTBE through the treatment process regularly; however monitoring will be done by a contract lab to track performance.	There is no field test method for TBA, and water quality monitoring will be required at a frequency to detect breakthrough in a timely manner.

DPH 97-005 Memo Guidance	Design Feature or Planned Procedure for:	
	MTBE	TBA
◆ The treatment objective for all contaminants should be optimized to the lowest extent feasible and must assure compliance with the MCL/AL at all times.	Two GAC vessels in series will produce concentrations less than the current reporting limit (i.e., <3.0 µg/L) at all times.	Two GAC vessels in series will provide 22 minutes of EBCT, which is conducive for biodegradation. Feed water will be dechlorinated and aerated to enhance bioactivity.
◆ Facilities…should be designed and operated to meet the MCLG [MCL goal] where this can be accomplished in a cost effective manner.	The PHG by DPH is 13 µg/L for MTBE. The treatment system will produce water with MTBE concentrations less than the current reporting limit (i.e., <3.0 µg/L) at all times. Other contaminants will be removed by the multiple barriers provided at the Charnock facility and Arcadia WTP.	There is no PHG for TBA, but DPH indicated that the DLR (0.002 mg/L) can be used as a finished water goal. The facilities are designed with aeration, dechlorination and an EBCT to promote bioactivity to achieve this treatment goal.
▾ Operations plan that identifies all operational procedures, failure response triggers, and loading rates, including: process monitoring plan, process optimization procedures, established water quality objectives or goals, and level of operator qualification.	This will be reviewed by DPH for the amended permit application.	This will be reviewed by DPH for the amended permit application.
▾ Reliability features (response plan for failure to meet the treatment objective, alternative disposal methods, and shutdown triggers and restart procedures)	These will be reviewed by DPH for the amended permit application.	These will be reviewed by DPH for the amended permit application.
▾ Compliance monitoring and reporting program	These are included in the Operations plan.	These are included in the Operations plan.
▾ Notification plan	This will be developed for review by DPH for the amended permit application.	This will be developed for review by DPH for the amended permit application.
▾ Extremely impaired source water quality surveillance plan"	This will be developed for review by DPH for the amended permit application.	This will be developed for review by DPH for the amended permit application.

2.0 Source of Supply

2.1 Well Field

The existing Charnock Well Field Facilities include: five (5) water supply wells (Well numbers 13, 15, 16, 18, and 19), contact basin, booster pump station, chlorine building, power substation and control room. In addition, there are fourteen (14) abandoned production wells located at the site (Well numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 17).

Groundwater from the wells is pumped to Arcadia WTP via the Charnock Pipeline. Along the pipeline, there is a single MWD connection (MWD Feeder #2) and connections to the Santa Monica Wells. The Arcadia Wells also discharge into the Charnock Pipeline where it enters the WTP site. The Arcadia treatment facilities were originally designed to reduce water hardness and to remove iron, manganese, and trichloroethylene (TCE). The ion exchange (IX) softening beds and associated brine facilities have now been demolished. The original treatment processes and structures that remain at the existing WTP therefore comprise gas chlorination facilities, a 5 million gallon (MG) potable water reservoir with aerators for VOC removal, and booster station to pump treated water into the distribution system.

In 1996, the Charnock Well Field was found to be contaminated with MTBE and the active production wells were shut down. Since then, TBA has been detected in the regional groundwater monitoring wells surrounding the site, as well as in one un-confirmed sample collected from Well 15 in 2008.

Restoration of the well field as a potable water supply will require an amended domestic water supply permit from the DPH. The Charnock Well Field Restoration Project therefore includes treatment at the well field site for the removal of MTBE and degradation of TBA from three of the five Charnock Wells, with interconnecting pipe to allow for the treatment of the remaining two wells, if deemed necessary in the future. The combined well flow will be pumped to the Arcadia WTP using the existing booster pumps and the Charnock Pipeline. The water treatment facilities at the Arcadia WTP will be upgraded to include a Reverse Osmosis (RO) softening system, with the existing reservoir aeration system continuing to remove TCE before the finished water is put into distribution.

The Charnock Well Field currently consists of five production wells, three of which are expected to contain and capture the contamination; Well 13, the oldest, was installed in 1966; Wells 15 and 19 were installed in 1989. The remaining two, Wells 16 and 18, are not anticipated to contain MTBE and TBA contamination, as long as the pumping regime maintains 60 percent of flow from the contaminated wells. Table 2-1 shows the allowable pumping scenarios with this 60 percent flow limitation.

Table 2-1.
The Percentage of Contaminated Water Being Pumped from the Aquifer at Different Operating Well Combinations

Combo No.	Wells #13*	#15*	#16	#18	#19*	'Contaminated' Flow (%)	Total Flow (mgd)
Acceptable Flow Combinations (Contaminated Flow > 60% of Total Flow)							
1	x	x			x	100	5.6
2	x	x	x			62	5.6
3		x	x		x	64	6.1
4	x		x		x	64	6.1
5	x	x	x		x	72	7.8
6	x	x		x	x	64	8.8
Not Acceptable Flow Combinations (Contaminated Flow <60% of Total Flow)							
7	x			x	x	55	7.1
8		x		x	x	55	7.1
9	x	x	x	x	x	51	11.0

* Considered to be contaminated by MTBE and TBA when water is pumped from aquifer.

2.2 Raw Water Quality

The raw water quality parameters of concern are MTBE and TBA, as well as any parameter that would impact removal of these by adsorption and/or biodegradation on the GAC.

Previous investigations by the City, through groundwater modeling (GeoTrans simulations of 2005 and 2006), the Preliminary Design Report (PDR) by WorleyParsons Komex (2007) and sampling from monitoring wells in the vicinity of the Charnock Well Field indicate that the highest concentration of MTBE in any one of Wells 13, 15, or 19 will be 61 μg/L, and the highest concentration of MTBE in the blend to the Charnock Treatment Facilities will be 35 μg/L (or 0.035 mg/L). The PDR utilized a safety factor of 2, thus the maximum anticipated MTBE concentration would be 70 μg/L (or 0.070 mg/L).

The same investigations showed that the highest concentration of TBA in the blend to the Charnock treatment facilities will be 5 μg/L (or 0.005 mg/L), but with a safety of factor of 2, the maximum anticipated concentration of TBA is 10 μg/L (or 0.010 mg/L).

As part of the Project, water from all of the Charnock wells was analyzed for inorganic, organic, and general physical/chemical quality in two sampling events: 1) Summer 2008 sampling for parameters which might impact design; and, 2) 97-005 sampling, a regulatory requirement by the DPH.

Although MTBE was not detected in the Summer 2008 or 97-005 monitoring results, it is anticipated that the contaminant plume will travel towards Wells 13, 15 and 19 once the treatment facility is in service and the wells resume active pumping. MTBE concentrations are expected to approach 70 µg/L (or 0.070 mg/L) in the blended water from Wells 13, 15, and 19.

TBA has generally been non-detect in Wells 13, 15, and 19 in 97-005 samples collected in 2008. This compound has been detected in regional monitoring wells, and may be detected in the future as the wells resume pumping. The additional sampling from Summer 2008 showed 2.2 µg/L (or 0.0022 mg/L) in water from Well 15, which is just above the laboratory method detection limit. However, repeat or confirmation sampling could not be performed due to non-functioning pump/well infrastructure at Well 15.

Sampling of the wells during Summer 2008 also revealed elevated concentrations of uranium and gross alpha (Table 2-2). Note that only the concentrations in Well 19 appear to be above the respective Maximum Contaminant Level (MCL). Blending with the other Santa Monica Wells will lower the concentration of the radionuclides to values less than the MCL at the Arcadia WTP. Furthermore, RO is a best available technology for uranium and gross alpha. The new RO System at the Arcadia WTP will therefore remove the radionuclides, which will be concentrated in the waste stream.

Table 2-2
Water Quality of Wells 13, 15 and 19, and the Blend Being Treated by the Charnock Well Field Treatment Facility†

Characteristic	Units	Well 13	Well 15	Well 19	Blend
pH	--	7.3	7.7	7.3	7.4
Total Dissolved Solids (TDS)	mg/L	704	718	848	764
Turbidity	NTU	6.3	31	1.2	<5
Alkalinity	mg/L*	316	283	404	339
Chloride	mg/L	69	51	73	65
Fluoride	mg/L	0.34	0.23	0.34	0.31
Sulfate	mg/L	170	199	230	202
Nitrate, as N	mg/L	3.5	ND	ND	<3.5
Nitrite, as N	mg/L	ND	ND	ND	ND
Dissolved Organic Carbon**	mg/L	<0.5	0.58	0.55	<0.58
Total Organic Carbon **	mg/L	<0.5	0.89	0.56	<0.89
Calcium	mg/L	120	110	140	125
Iron	mg/L	0.84	2.9	0.52	1.4
Magnesium	mg/L	46	45	58	50
Potassium	mg/L	2.7	3.1	2.6	2.8
Silica, total	mg/L	38	30	34	34
Sodium	mg/L	69	65	76	70.7
Aluminum	µg/L	37	ND	ND	<37
Barium	µg/L	46	67	40	50
Manganese	µg/L	37	95	88	75

Characteristic	Units	Well 13	Well 15	Well 19	Blend
Strontium	µg/L	770	990	850	868
Radium – 226	pCi/L	ND	ND	ND	ND
Radium – 228	pCi/L	ND	ND	ND	ND
Radium – 226 + Radium – 228	pCi/L	ND	ND	ND	ND
Strontium – 90	pCi/L	ND	ND	ND	ND
Tritium	pCi/L	ND	ND	ND	ND
Uranium	pCi/L	13	9.4	67	35
Gross Alpha	pCi/L	3.5	10	35	24
1,1 Dichloroethlyene	µg/L	13	0.7	10	8.1
tert-Butyl alcohol (TBA)#	µg/L	ND	ND	ND	ND
Methyl-t-butyl ether (MTBE)	µg/L	ND	ND	ND	ND
Tetrachloroethlyene	µg/L	ND	ND	ND	ND
Trichloroethylene	µg/L	16	1.6	25	15
Dissolved oxygen	µg/L	4.1	3.8	3.2	3.7
Total Hardness	mg/L*	489	460	588	518

* mg/L as $CaCO_3$; † Data are from 97-005 testing by MWH laboratories; ** Data were analyzed by Underwriters Laboratories (UL); # TBA was detected at 2.2 µg/L in Well 15 during Summer 2008 sampling (Underwriters Laboratories); repeat sampling could not be performed due to non-functioning infrastructure at the well.

3.0 Water Treatment Facilities

Improvements to the Charnock Well Field will include greensand filtration and GAC adsorption to treat contaminated groundwater from Wells 13, 15 and 19. The treated water will be combined with water from the non-contaminated wells, Wells 16 and 18, and the combined flow will be pumped to the Arcadia WTP. The proposed Charnock treatment facility will have a design capacity of 3,000 gpm when four of the GAC trains are in operation. With all five treatment trains in operation a peak flow of 3,750 gpm can be treated at the facility.

The Charnock Treatment Facilities will include:

- Down-hole Well chlorination
- Raw Water Equalization Tank and Filter Feed Pumps
- Pressure (Greensand) Filters
- Filtered Water Tank and Backwash Supply Pumps
- Backwash Recovery System
- GAC Contactors
- Sodium Hypochlorite feed system
- Sodium Bisulfite feed system
- Polyaluminum Chloride
- Transfer pumps and piping
- Electrical and Control Systems

The plant will be equipped with six Greensand Filters (housed in three vessels) and five trains of two GAC Vessels in series, plumbed in a lead-lag configuration in each train.

The Pressure Filters and GAC units will be mounted on an outdoor pad that will also support two, one-storey buildings for electrical/control rooms and chemical storage (for sodium hypochlorite, sodium bisulfite and polyaluminum chloride). Below-grade basins under the pad will serve as an equalization tank, filtered water tank, and spent backwash recovery tank, respectively. A package lamella unit located above the spent backwash water tank will allow consolidation of the backwash solids and recovery of settled washwater, which will be returned to the head of the Facility. A 3-D rendering of the layout of the new facilities is shown in Figure 3-1.

The main purpose of the Pressure Filters will be to remove iron and manganese from the feed water to protect the GAC System. Normally, in a GAC column where MTBE is removed by adsorption, there are: (1) a zone of carbon that is saturated with the MTBE or other contaminants that have adsorbed from the water; and, (2) a zone of carbon that is fresh and able to adsorb compounds. Backwashing disrupts the separation of the zones and thus shortens the useful life of the GAC in the vessel. Removing iron and manganese in the well water prior to the GAC will minimize the backwashing frequency by preventing the GAC from becoming coated with iron and manganese, which would decrease its ability to remove MTBE and TBA.

Iron and manganese will be removed through oxidation (in this case, sodium hypochlorite and aeration) and filtration. Downhole chlorination with sodium hypochlorite will both control microbial activity in the wells and begin the process of iron and manganese oxidation upstream of the process treatment units. Water from the three contaminated wells will be combined in a Raw Water Equalization Tank located under the Pressure Filter and GAC Vessels. An aeration system in the Raw Water Equalization Tank will raise the dissolved oxygen to assist in iron and manganese removal. The Pressure Filters will then remove the particulate oxidized iron and manganese. In addition, the greensand will promote more complete removal of manganese by adsorption onto the greensand media.

The filtered water from the GAC Contactors and the uncontaminated raw water from Wells 16 and 18 will be collected in a Filtered Water Tank located under the Pressure Filters and GAC Contactors. This reinforced concrete structure will be tied into the existing booster pump station which will then lift the water to the Arcadia WTP.

Groundwater modeling (by others) suggests that the contaminant plume will be removed after about 10 years, after which the Charnock Well Field will continue to be pumped, without treatment, to the Arcadia WTP. The Charnock Treatment Facility will then be placed in standby mode, if allowed by the DPH closure approval. Upon closure, approved treatment equipment can be dismantled and removed from the site.

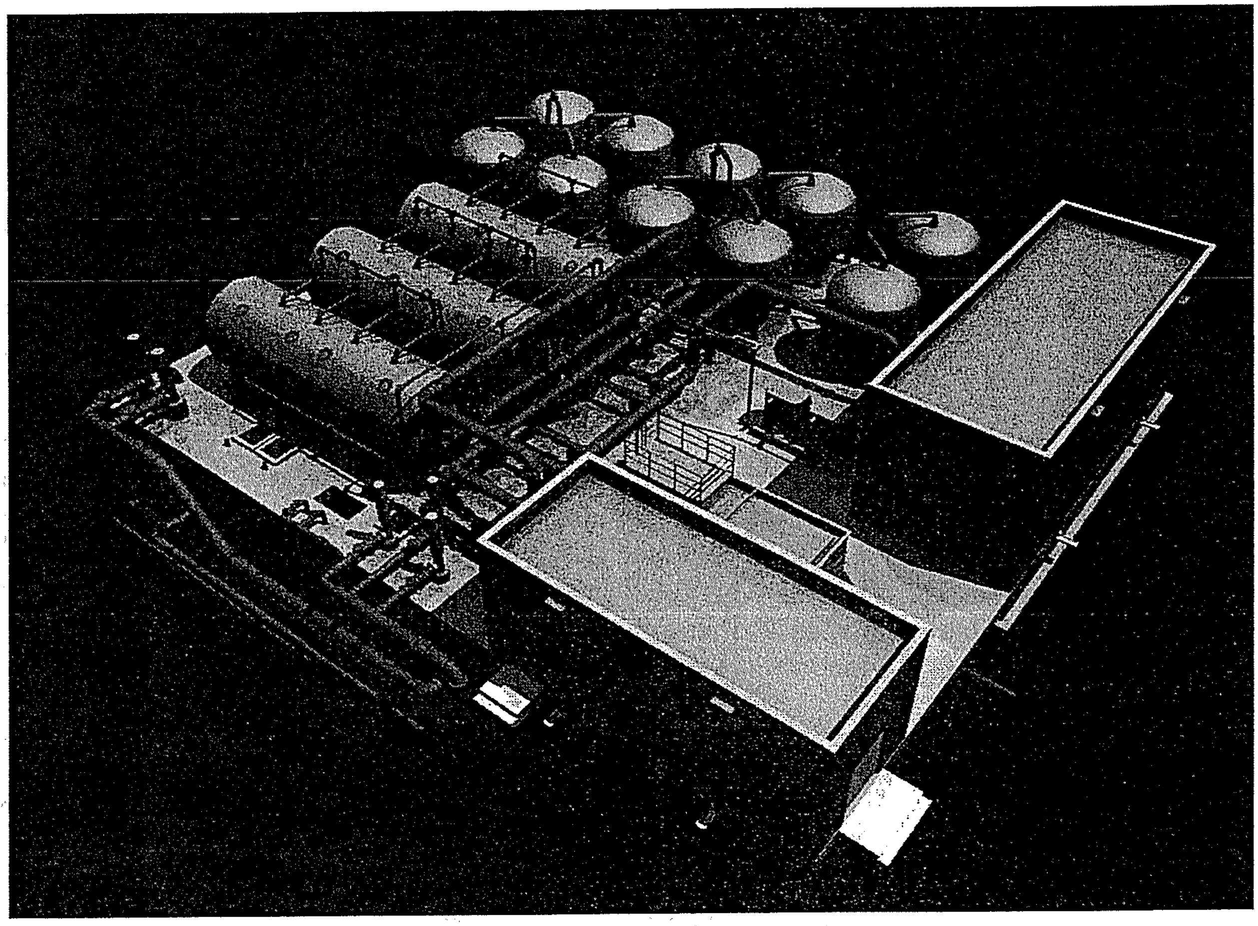

Figure 3.1 Charnock Treatment Facility Site Layout

3.1 Treatment Plant Capacity

The new facilities at the Charnock Well Field will treat water from the three contaminated wells (Wells 13, 15, and 19). The treatment system will consist of greensand filtration for iron and manganese removal and GAC for MTBE and TBA removal and degradation, respectively. Normal operation will have all Pressure Filters and 4 trains of GAC in operation. Water from the two uncontaminated wells (Wells 16 and 18) will be blended with the treated water from the contaminated wells before being pumped to the Arcadia WTP through the Charnock Pipeline.

Based on previous investigations, the sustainable production capacity of the City's well field is 7,000 gpm (10 mgd), which is less than the combined, maximum installed pumping capacity from all of the Charnock, Santa Monica and Arcadia Wells. The Charnock Treatment Facility and downstream wells connecting into the Charnock Pipeline will be appropriately controlled and operated so that only 10 mgd will be passed forward to the Arcadia WTP as a maximum feed flow.

The well capacities are summarized in Table 3-1.

Table 3-1
Well Capacities

	Rated Capacity ** (gpm)	Expected Wellfield Sustainable Output (gpm)
Charnock Well 13 (To be treated)	1,200	5,000 – 6,600
Charnock Well 15 (To be treated)	1,200	
Charnock Well 19* (To be treated)	1,000 – 1,500	
Charnock Well 16	2,200	
Charnock Well 18	1,500	
Santa Monica Well 3	780	1,000
Santa Monica Well 4	810	
Arcadia Well 4	240	300
Arcadia Well 5	260	

* Well 19 is equipped with a variable frequency drive to adjust the flow from the well.
** This is the rated capacity of each well, and the actual capacity will be evaluated after refurbishment of the well infrastructure. Note that the well flow values shown in the table below the General Charnock Process Flow Diagram (GC00002) are lower because they were adjusted for the mass balance to achieve the peak plant capacity flow of 3,750 gpm.

The Charnock and Arcadia Treatment Plant capacities are summarized in Table 3-2.

Table 3-2
Treatment Plant Capacities

	Design Capacity	
	gpm	mgd
Charnock GAC Treatment Facility	3,000*	4.32
Charnock Filtered Water Pumps (to Arcadia)	5,000	7.2
Arcadia WTP Combined Well Feed Flow	7,000	10.0

* Flow is based on equalized well flows into the raw water equalization tank. Note that with all five GAC treatment trains in operation, a peak equalized flow of 3,750 gpm (5.4 mgd) can be treated at Charnock.

3.2 Treatment Process

3.2.1 Well Field

Downhole chlorination with sodium hypochlorite will control microbial activity in the wells and begin the process of iron and manganese oxidation. The three contaminated wells (Wells 13, 15, and 19) will be pumped to the Raw Water Equalization Tank for further treatment and water from the two remaining uncontaminated wells (Wells 16 and 18) will be pumped to the Filtered Water Tank to be blended with the treated water. Each well pump will have an associated flowmeter to monitor the flow for the respective well.

3.2.2 Raw Water Equalization Tank and Pressure Filter Feed Pumps

Water from the three contaminated wells will be combined in a Raw Water Equalization Tank located under the Pressure Filters and GAC Vessels. This reinforced concrete structure will also serve as the wet well for the Pressure Filter Feed Pumps. An aeration system will be included in the Raw Water Equalization Tank to raise the dissolved oxygen concentration to optimal levels for further iron and manganese oxidation.

The design criteria for the Raw Water Equalization Tank are summarized in Table 3-3.

Table 3-3
Raw Water Equalization Tank and Filter Feed Pumps

Design Flow, gpm	3,900
Detention Time, minute	10
Hydraulic Efficiency, percent	70
Minimum Capacity, gallons	55,700
Plan Dimensions	
Length, feet	86
Width, feet	14
Side Water Depth	
Minimum, feet	0
Maximum, feet	7
Floor Elevation, feet	~93.00
Overflow Elevation, feet	105.00
Aeration Eductor	
EQ Tank Dissolved Oxygen Target, mg/L	5.0

3.2.3 Pressure Filters

Three Greensand Pressure Filters will be provided for the removal of iron and manganese. Each filter vessel will be split into two, independently-operating cells, giving a total of 6 filter cells. The pressure filters will utilize a combined air-water backwash to remove built-up solids.

The design criteria for the Pressure Filters are summarized in Table 3-4.

Table 3-4
Pressure Filters Design Criteria

Filters	
Number	*3*
Cells Per Filter	*2*

Design Loading Rate, gpm/sf	*3.3*
Type of Filter Control	*Discharge Flow Control Valve*
Backwash Rate, gpm/sf	*13*
Approx Backwash Duration, minutes	*15*
Filter Size	
Length (overall), feet	*40*
Diameter, feet	*12*
Design Pressure Rating, psi	*75*
Filter Media	
Media Surface Area per cell, sf	*227*
Media Type	*Dual*
Media Depth, inches	*36*
Media Material	
Anthracite	
Depth, inches	*18*
Effective Size, mm	*0.6 – 0.8*
Uniformity Coefficient	*<1.6*
Greensand	
Depth, inches	*18*
Effective Size, mm	*0.3 – 0.35*
Uniformity Coefficient	*<1.6*

The backwashing sequence for the Pressure Filters includes:

- Initial drain down (flows into Backwash Recovery Tank)
- Air scour for 1 minute
- Combined air and water backwash (6 gpm/sf) for 1 minute
- Low rate water backwash (6 gpm/sf) for 4 minutes
- High backwash rate (13 gpm/sf) for 6 minutes
- Two-minute ramp down from high to low backwash rate
- Low backwash rate for media re-grading (6 gpm/sf) for 2 minutes

This sequence generates about 41,000 gallons per backwash of a Pressure Filter cell.

Filter-to-waste is not deemed necessary for the Charnock facility, but the ability exists in the event that it becomes necessary.

3.2.4 GAC Contactors

Following the Pressure Filters, ten (10) GAC Contactors, consisting of five trains of two vessels in series, will be provided for the removal and degradation of MTBE and TBA, respectively.

The design criteria for the GAC contactors are summarized in Table 3-5.

Table 3-5
Granular Activated Carbon Contactor Design Criteria

Vessels	
Number	*10 (5 trains of 2 vessels)*
Empty Bed Contact Time, minutes	*7.0 (per vessel)*
Train Design Flow Rate, gpm	*750*
Configuration	*Series Arrangement*
Type of Flow Control	*Discharge Flow Control Valve*
Size	
Diameter, feet	*12*
Height (straight side shell), feet	*5*
Design Pressure, psi	*75*
Media	
Media Surface Area per vessel, sf	*113.1*
Media Type	*GAC*
Media Material	
GAC	
Effective Size, mm	*0.60 – 0.85*
Uniformity Coefficient	*<2.0*

The initial load of GAC will be coconut-based GAC; however, other types of GAC could be installed in the future if they are found to be more cost-effective for MTBE adsorption.

The backwash sequence for a GAC vessel comprises a single, high water flow rate at 10 to 12 gpm/sf for 10 to 15 minutes, which generates less than 20,500 gallons of spent washwater per backwash. When fresh GAC is loaded into a vessel, it contains very small GAC particles (referred to as fines) which must be removed by an extended backwash (which generates up to 34,000 gallons). These spent backwash flows will discharge to the Backwash Recovery Tank for treatment through the package plate settler. Air scour is not used during a GAC backwash.

3.2.5 Filtered Water Tank and Backwash Supply Pumps

The filtered water from the GAC Contactors will be collected in a Filtered Water Tank located under the Pressure Filters and GAC Vessels. This reinforced concrete structure will be tied into the existing Booster Pump Station which will then lift the water to the Arcadia WTP. The filtered water tank will also serve as the backwash supply and the wet well for the backwash supply pumps.

The design criteria for the Filtered Water Tank are summarized in Table 3-6.

Table 3-6
Filtered Water Equalization Tank

Design Criteria	Two filter back washes plus flow of one train during the backwash
Minimum Capacity, gallons	93,300
Plan Dimensions	
Length, feet	86
Width, feet	22
Side Water Depth	
Minimum, feet	0
Maximum, feet	7
Floor Elevation, feet	93.00
Overflow Elevation, feet	105.00

3.2.6 Backwash Recovery Tank and Pumps

A Backwash Water Treatment System for the Pressure Filters and GAC Contactors will be provided to receive and treat the iron and manganese solids, and reduce the volume of the process waste stream. The Backwash Recovery Tank is a below grade wet well located under the Pressure Filters. Backwash from the Pressure Filters and GAC Contactors will be directed into this tank. It will be equipped with mixers to keep solids in suspension. This reinforced concrete structure will also serve as the wet well for the Backwash Recovery Pumps. The backwash water will be pumped to the Package Treatment Unit via the Backwash Recovery Pump.

The design criteria for the Backwash Recovery Tank are summarized in Table 3-7.

Table 3-7
Backwash Recovery Tank

Design Criteria	2 Pressure Filter backwashes
Minimum Capacity, gallons	72,290
Plan Dimensions	
Length, feet	86
Width, feet	20
Side Water Depth	
Minimum, feet	0.0
Maximum, feet	6.5
Floor Elevation, feet	93.00
Overflow Elevation, feet	101.00

3.2.7 Packaged Treatment Unit

The Package Treatment Unit for backwash treatment is a plate settler that is equipped with a flocculation zone. The settling zone will have inclined plates to assist in settling solids into the sludge collection zone for disposal. The clarified effluent from the Package Treatment Unit will flow by gravity to the Raw Water Equalization Tank and will be recovered. Sludge collected from the inclined plate settlers will be collected with a sludge scraper and conveyed to an existing sewer line.

The design criteria for the Package Treatment Unit are summarized in Table 3-8.

Table 3-8
Package Treatment Unit Design Criteria

Number	1
Design Capacity, gpm	250
Flocculation	
Type	Slow speed Mechanical Mixing
Sedimentation	
Type	Inclined Plate Settler
Effective Surface Loading Rate, gpm/sf	0.3
Total Horizontal Projected Plate Area, sf	926
Piping	
Influent, inches	6
Effluent, inches	6
Residuals Drawoff, inches	4

3.2.8 Chemical Feed Systems

Chemical feed systems will be provided. Sodium hypochlorite will be used for chlorination and sodium bisulfite will be fed for dechlorination after the Pressure Filters and prior to the GAC vessels. Polyaluminum chloride will be fed upstream of the plate settler to help coagulate the solids for better settling. All systems will be located in the chemical building, south of the GAC.

3.2.8.1 Sodium Bisulfite Feed System

One sodium bisulfite feed system will be supplied to feed 25 percent sodium bisulfite upstream of the GAC contactors. Sodium bisulfite will be delivered to the site by tanker truck and will be stored in bulk storage tanks sized to accept a full truck load. One bulk storage tank will be installed. The sodium bisulfite will be delivered to the feed point by metering pumps designed to feed sodium bisulfite over the full range of flows and dosages. Two metering pumps will be provided to feed the sodium bisulfite to the feed point.

Design criteria for the sodium bisulfite feed system are provided in Table 3-9.

Table 3-9
Sodium Bisulfite Feed System Design Criteria

Sodium Bisulfite Feed System	
Chemical Information	
Delivered Chemical	25% sodium bisulfite, SG = 1.19
Fed Chemical	25% sodium bisulfite, SG = 1.19
Feed Point	Upstream of GAC Vessels
Chemical Dosage as 100% $NaHSO_3$	
Maximum, mg/L	3.0
Average, mg/L	1.5
Minimum, mg/L	0.3
Plant Flow	
Maximum, mgd	5.4
Average, mgd	4.3
Minimum, mgd	1.1
Chemical Feed Flow	
Maximum, gph	2.27
Average, gph	0.91
Minimum, gph	0.05
Turndown Ratio	52.5 : 1
Chemical Storage	Vertical tanks
Tank Material	FRP (Fiberglass Reinforced Plastic)
Tank Number	One (1)
Tank Volume	5,450 gallons
Tank Dimensions	10' diameter x 11' straight side (13'-6" to apex)
Days of storage, avg / max	270 / 108
Feed Equipment	Peristaltic metering pumps
Pump Number	Two (1 – duty, 1 standby)
Pump Flow	0.05 – 2.27 gph
Pump Control	Automatic speed control with local override

3.2.8.2 Sodium Hypochlorite Feed System

One sodium hypochlorite feed system will be supplied to feed 12.5 percent (trade) sodium hypochlorite to the wells, Pressure Filters, and to post-treatment discharge. Sodium hypochlorite will be delivered to the site by tanker truck and will be stored in bulk storage tanks sized to accept a full truck load. Two bulk storage tanks will be installed. The sodium hypochlorite will be delivered to the feed points by metering pumps designed to feed sodium hypochlorite over the full range plant flows and doses. New metering pumps will be installed to feed sodium hypochlorite to the five existing wells, to the greensand filter influent, and to the post-treatment discharge pipeline.

The design criteria for the sodium hypochlorite feed system are summarized in Table 3-10.

Table 3-10
Sodium Hypochlorite Feed System Design Criteria

Chemical Information			
Delivered Chemical	12.5% (trade) sodium hypochlorite, 10.6% as chlorine, SG = 1.175		
Fed Chemical	12.5% (trade) sodium hypochlorite, 10.6% as chlorine, SG = 1.175		
Feed Point	Well #13	Well #15	Well #19
Chemical Dosage as 100% Cl_2 (chlorine)			
Maximum, mg/L	80	8.0	8.0
Average, mg/L	2.5	2.5	2.5
Minimum, mg/L	1.0	1.0	1.0
Well Pump Flow, gpm	1,090	1,090	1,367
Chemical Feed Flow			
Maximum, gph	4.19	4.19	5.26
Average, gph	1.31	1.31	1.64
Minimum, gph	0.52	0.52	0.66
Turndown Ratio	8:1	8:1	8:1
Feed Point	Well #16	Well #18	
Chemical Dosage as 100% Cl_2 (chlorine)			
Maximum, mg/L	8.0	8.0	
Average, mg/L	2.5	2.5	
Minimum, mg/L	1.0	1.0	
Pump Flow, gpm	2,200	1,500	
Chemical Feed Flow			
Maximum, gph	8.45	5.76	
Average, gph	2.64	1.8	
Minimum, gph	1.06	0.72	
Turndown Ratio	8:1	8:1	
Feed Point	Pressure Filters		
Chemical Dosage as 100% Cl_2 (chlorine)			
Maximum, mg/L	2.0		
Average, mg/L	0.5		
Minimum, mg/L	0.2		
Plant Flow			
Maximum, mgd	5.4		
Average, mgd	5.4		
Minimum, mgd	5.4		
Chemical Feed Flow			
Maximum, gph	3.6		
Average, gph	0.9		
Minimum, gph	0.36		
Turndown Ratio	10:1		
Feed Point	Post Treatment		
Chemical Dosage as 100% Cl_2			

Chemical Information	
Maximum, mg/L	4.0
Average, mg/L	1.5
Minimum, mg/L	0.5
Plant Flow	
Maximum, mgd	10.44
Average, mgd	10.44
Minimum, mgd	10.44
Chemical Feed Flow	
Maximum, gph	13.93
Average, gph	5.22
Minimum, gph	1.74
Turndown Ratio	
Chemical Storage	Vertical tank
Tank Material	FRP
Tank Number	Two (2) – one duty, one standby
Tank Volume	5,875 gallons
Tank Dimensions	10' diameter x 14' straight side
Days of storage (single tank), avg / max	31.4 / 9.6
Feed Equipment	Peristaltic metering pumps
Feed Point	Well Pumps, Filter, Post-Treatment
Pump Number	Nine (7 duty, 2 standby)
Pump Flow	0.36 – 13.93 gph
Pump Control	Automatic speed control with local override

3.2.8.3 Polyaluminum Chloride Feed System

One polyaluminum chloride feed system will be supplied to feed chemical upstream of the plate settler packaged treatment unit. Polyaluminum chloride will be delivered to the site in storage totes. The polyaluminum chloride will be delivered to the feed point by metering pumps designed to feed chemical over the full range of flows and dosages. Two metering pumps will be provided to feed the polyaluminum chloride to the feed point.

Design criteria for the polyaluminum chloride feed system are provided in Table 3-11.

Table 3-11
Polyaluminum Chloride Feed System Design Criteria

Polyaluminum Chloride Feed System	
Chemical Information	
Delivered Chemical	51% sodium bisulfite, SG = 1.40
Fed Chemical	51% sodium bisulfite, SG = 1.40
Feed Point	Upstream of Package Plate Settler
Chemical Dosage as 100% $NaHSO_3$	
Maximum, mg/L	20
Average, mg/L	10

Polyaluminum Chloride Feed System	
Minimum, mg/L	5
Plant Flow	
Maximum, gpm	225
Average, gpm	225
Minimum, gpm	225
Chemical Feed Flow	
Maximum, gph	0.38
Average, gph	0.19
Minimum, gph	0.10
Turndown Ratio	4:1
Chemical Storage	Storage Totes (One)
Feed Equipment	Diaphragm metering pumps
Pump Number	Two (1 – duty, 1 standby)
Pump Flow	0.10 – 0.38 gph
Pump Control	Manual stroke length and automatic stroke speed control with local override

3.3 Solids Disposal

Solids from the plate settler will be disposed of to the sanitary sewer.

3.4 Storm Water Catch Basin

Surface drainage from the Filter Complex and paved areas of the Charnock Treatment Plant will flow overland to a catch basin. A storm drain system will collect all water from the catch basin, and pass all storm water through an oil grit separator. The system is designed to handle a storm event with a 25 year return period, and a duration equal to the time of concentration for the storm drain system.

Design criteria for the Storm Water Catch Basin and storm drain system are provided in Table 3-12.

Table 3-12
Storm Water Catch Basin Design Criteria

Storm Water Catch Basin	
Design Storm	
Return Period	25 years
Storm Duration	5 minutes
Storm drain pipe	Upstream of Package Plate Settler
Minimum diameter	12 inches
Minimum slope	0.005 ft/ft
Oil Grit Separator	
Design Flowrate	1.6 cfs
Particle size (80% removal)	125 μm
Sump volume	1.3 cubic yards

3.5 Electrical

Electrical systems for the Pressure Filters, GAC Contactors, and chemical feed systems will be located in a building separate from the chemical building.

4.0 Normal Operation and Controls

This section covers operation and controls for normal operating procedures. Any troubleshooting or infrequent maintenance procedures are discussed in Chapter 6.

For the purpose of this operations plan when a signal = 1 it is considered to be active of being maintained; when a signal = 0 it is considered to be inactive or stopped.

4.1 Well Field

At Charnock, there are some pump operation combinations that are not allowed due to the need to keep the contaminated wells (i.e., 13, 15, and 19) at levels of > 60 percent of the total flow pumped from the Charnock wellfield (including wells 16 and 18). During rehabilitation and redevelopment of the wells, well 19 will be fitted with an adjustable speed motor, so the flow can be less than the maximum pump capacity. The various well operation combinations and the resulting percentage of contaminated well flow relative to total flow is shown in Table 4-1.

Table 4-1.
The Percentage of Contaminated Water Being Pumped from the Aquifer at Different Operating Well Combinations

Combo No.	Wells					'Contaminated' Flow (%)	Total Flow (mgd)
	#13*	#15*	#16	#18	#19*		
Acceptable Flow Combinations (Contaminated Flow > 60% of Total Flow)							
1	x	x			x	100	5.6
2	x	x	x			62	5.6
3		x	x		x	64	6.1
4	x		x		x	64	6.1
5	x	x	x		x	72	7.8
6	x	x		x	x	64	8.8
Not Acceptable Flow Combinations (Contaminated Flow <60% of Total Flow)							
7	x			x	x	55	7.1
8		x		x	x	55	7.1
9	x	x	x	x	x	51	11.0
* Considered to be contaminated by MTBE and TBA when water is pumped from aquifer.							

4.1.1 Well Discharge Flowmeter

There are five flowmeters that monitor the flow from the associated well. The outputs are displayed on the Charnock well pump display.

The well discharge flowmeters have the following interlocks.

ALARMS (All alarm setpoint are operator adjustable)

- Well 13 Running and flow is less than 10 gpm (C-RW-FIT-1001 <10 gpm)
- Well 15 Running and flow is less than 10 gpm (C-RW-FIT-1002 <10 gpm)
- Well 19 Running and flow is less than 10 gpm (C-RW-FIT-1003 <10 gpm)
- Well 16 Running and flow is less than 10 gpm (C-RW-FIT-1004 <10 gpm)
- Well 18 Running and flow is less than 10 gpm (C-RW-FIT-1005 <10 gpm)

STATUS INDICATIONS

- C-RW-FIT-1001 – Well Pump 13 Discharge Flow
- C-RW-FIT-1002 – Well Pump 15 Discharge Flow
- C-RW-FIT-1003 – Well Pump 19 Discharge Flow
- C-RW-FIT-1004 – Well Pump 16 Discharge Flow
- C-RW-FIT-1005 – Well Pump 18 Discharge Flow

4.1.2 Booster Pumps

The plant PLC will generate an alarm to alert the operator if the difference between the Total Available Flow from Charnock Booster Pumps and the Total Available Charnock Plant Flow is greater than 500 gpm (operator adjustable).

4.2 Raw Water Equalization Tank and Pressure Filter Feed Pumps

4.2.1 Raw Water Equalization Tank

A level indicator (C-RW-LIT-1001) is provided to monitor the level in the raw water equalization tank. High-high and low-low level switch are also provided (C-RW-LSHH-1001 and C-RW-LSLL-1001, respectively).

The raw water equalization tank level instruments have the following interlocks:

- Raw water equalization tank level has reached low (C-RW-LIT-1001 < 2')

- Raw water equalization tank level has reached high (C-RW-LIT-1001 > 6')
- Raw water equalization tank level has reached high-high (C-RW-LSHH-1001 = XX')
- Raw water equalization tank level has reached low-low (C-RW-LSLL-1001 = XX')

4.2.2 Pressure Filter Feed Pumps

There are three pressure filter feed pumps; pressure filter feed pump 1 (C-RW-PVE-1101), pressure filter feed pump 2 (C-RW-PVE-1201), and pressure filter feed pump 3 (C-RW-PVE-1301). The pressure filter feed pumps operate in local manual, remote manual, or automatic mode. When ON is selected the pump runs in local manual mode and pump speed can be adjusted at the AFD.

Remote manual control is provided through the PLC. When remote is selected at the local drive and manual is selected at the HMI, the pump on/off and speed is controlled from the HMI using operator manual commands.

Remote automatic control is provided through the PLC. When the pump switch is in the remote position and auto is selected at the HMI, the pumps are controlled by a Proportional Integral controller. The setpoint for the controller is the Total Available Charnock Treatment Flow and trimmed by the level (C-BW-LIT-1001) in the filtered water tank. The controller feedback is from the filter feed pump discharge flowmeter (C-RW-FIT-1001). The output of the PI controller is the pump speed.

The pumps are designed for lead, lag, and standby controls. The lead pump is started first and changed speed to meet the Charnock Plant Flow Demand.

If the pressure filter feed pump flow is 5% (operator adjustable) less than the Total Available Charnock Treatment Flow with the lead pump is running at 100% for 5 minutes (operator adjustable), then the lag pump will be started and the speed of both pump will be reduced to minimum speed (60% - operator adjustable). Both lead and lag pump will be adjusted up and down at the same speed to meet the Charnock Plant Flow Demand.

If the pressure filter pump flow is more than 5% (operator adjustable) over the Total Available Charnock Treatment Flow with both the lead and lag pumps running at the minimum speed (60%) for 5 minutes (operator adjustable), the lag pump is stopped.

The standby pump will be started to replace any tripped pump. The lead, lag, and standby pumps automatically rotate every time all pumps are stopped.

The PI controller setpoint will be trimmed by the filtered water tank level (C-FLT-LIT-1001). If the tank level is above the operating band of 7' to 8' (operator adjustable), the PI controller setpoint is reduced by 5% (operator adjustable) for every 5 minutes (operator adjustable) as long as the tank level stays above the filtered water tank operating band. The PI controller setpoint stays the same as long as the tank level stays within the filtered water tank operating band. If the tank level is below the operating band, the PI controller setpoint increases by 5% (operator adjustable) for every 5 minutes (operator adjustable) as long as the filtered water tank level stays below its operating band.

The pressure filter feed pumps have the following interlocks:

PERMISSIVE

- Ready-To-Receive Feed Water signal is active.
- Raw water equalization tank low-low level is not reached (C-RW-LSLL-1001 = XX').
- Raw water equalization tank is above 5', operator adjustable (C-RW-LIT-1001 > 5').

STOP OVERRIDE

- Raw water equalization tank low-low level is reached (C-RW-LSLL-1001 = XX').
- Raw water equalization tank low level is reached, operator adjustable (C-RW-LIT-1001 < 3').
- Pressure filter pumps discharge pressure is above 60 psi, operator adjustable (C-RW-PIT-1001 > 60 psi).

AUTO START FOR THE LEAD PUMP

- Charnock filtered water tank level is below the start level, operator adjustable (C-FLT-LIT-1001 < 8').
- Feed water request from the RO is active.
- At lease one of the Charnock booster pumps is running.

AUTO STOP FOR THE PUMPS

- Charnock filtered water tank level is at or above 9', operator adjustable (C-BW-LIT-1001 ≥ 9').
- Feed water request from the RO stops.

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail signal from the pump AFD.

STATUS INDICATIONS

- Pump Running.
- Pump in Local/Remote.
- Pump Speed.
- Pump Fail.

Total Available Charnock Treatment Flow is the sum of the capacities of all the Well Pumps (13, 15, 16, 18, & 19) in "Auto" mode sending water to the raw water tank.

The well pump capacities will be entered by the operator and shown on the well pump production table.

4.2.2.1 Pressure Filter Feed Pump Monitoring

The discharge of the pressure filter feed pumps will be monitored for pressure (C-RW-PIT-1001), flow rate (C-RW-FIT-1001), temperature / pH (C-RW-AIT-1004), free chlorine (C-RW-AIT-1005), and turbidity (C-RW-AIT-1006).

The pressure filter feed pump instruments have the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)

- Pressure filter feed pump discharge pressure is high (C-RW-PIT-1001 > 60 psi).
- Pressure filter feed pump discharge pH is low (C-RW-AIT-1004 pH < 5).
- Pressure filter feed pump discharge pH is high (C-RW-AIT-1004 pH > 9).
- Pressure filter feed pump discharge temperature is high (C-RW-AIT-1004 temperature > 130 F).
- Pressure filter feed pump discharge chlorine is low (C-RW-AIT- 1005 < 0.5 ppm).
- Pressure filter feed pump discharge chlorine is high (C-RW-AIT- 1005 > 2 ppm).
- Pressure filter feed pump discharge turbidity is high (C-RW-AIT-1006 > 500 ppm).

STATUS INDICATIONS

- C-RW-PIT-1001 – Pressure Filter Feed Pump Discharge Pressure
- C-RW-FIT-1001 – Pressure Filter Feed Pumps Discharge Flow
- C-RW-AIT-1004 – Pressure Filter Feed Pump Discharge pH
- C-RW-AIT-1004 – Pressure Filter Feed Pump Discharge Temperature
- C-RW-AIT- 1005 – Pressure Filter Feed Pump Discharge Free Chlorine
- C-RW-AIT-1006 – Pressure Filter Feed Pump Discharge Turbidity

4.2.3 Raw Water Equalization Tank Aeration Recirculation Pump

The raw water equalization tank aeration recirculation pump operates in both remote manual and remote automatic mode.

Remote manual control is provided through the PLC. When remote is selected at the local drive and manual is selected at the HMI, the pump on/off is controlled from the HMI using operator manual commands.

Remote automatic control is provided through the PLC. When the switch for the pump is in the remote position and automatic is selected at the HMI, the pumps are controlled by the level (C-RW-LIT-1001) in the raw water equalization tank.

The raw water equalization tank aeration recirculation pump has the following interlocks:

RUN PERMISSIVE

- Raw water equalization tank has not reached low-low level (C-RW-LSLL-1001 > XX').
- Raw water equalization tank level is above 3', operator adjustable (C-RW-LIT-1001 > 3').

STOP OVERRIDE

- Raw water equalization tank has reached low-low level (C-RW-LSLL-1001 = XX').
- Raw water equalization tank level is low, operator adjustable (C-RW-LIT-1001 is < 2').

AUTO START FOR THE PUMP

- Raw water equalization tank level is at or above 4', (C-RW-LIT-1001 ≥ 4').

AUTO STOP FOR THE PUMPS

- Raw water equalization tank level is at or below 3', (C-RW-LIT-1001 ≤ 3').
- No pressure filter feed pumps are running.

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail signal from the pump starter.

STATUS INDICATIONS

- Pump Running.
- Pump in Local/Remote.
- Pump Fail.

4.3 Pressure Filters

There are three pressure filter vessels each containing 2 cells, pressure filter 1 (C-RW-FLT-1001), pressure filter 2 (C-RW-FLT-2001), and pressure filter 3 (C-RW-FLT-3001).

4.3.1 Pressure Filters Digital Input

READY-TO-RECEIVE FEED WATER

A ready-to-receive-feed-water signal is maintained from the Pressure Filter PLC to the pressure filter feed pumps as long as the pressure filters are ready to receive feed water from the raw water equalization tank.

The Pressure Filter PLC provides the options of remote manual and remote auto modes. In manual mode the Pressure Filter PLC isolates the filter cell and closes all the filter cell valves. The operator is able to manually open and close any of the filter cell valves in manual mode through the Pressure Filter PLC. During normal operation the pressure filters are in remote automatic mode. In auto mode the Pressure Filter PLC automatically opens, closes, and modulates the filter cell valves based on 1 of the 3 operation models below.

a. Auto On-line Mode – The filter cell is available for treating the feed water.
b. Auto Off-line Mode – The filter cell is isolated and is not used to treat the feed water.
c. Auto Backwash Mode – The filter cell is in backwash operation.

BACKWASH REQUEST

A backwash request is maintained from the Pressure Filter PLC to the backwash supply pumps as long as there is a need for filtered water during the backwash process.

The Pressure Filter PLC queues up the backwash request from different filter cells. Only one backwash is allowed at a time from a pressure filter cells or GAC vessel. The Pressure Filter PLC also monitors the Plant PLC and only requests for a backwash when the backwash permissive is received.

The Pressure Filter PLC provides four different automatic backwash control options: reset headloss, preset time, preset amount of totalized flow, and operator initiated.

BACKWASH IN PROGRESS

A backwash in signal is maintained from the Pressure Filter PLC as long as there is a backwash in progress.

4.3.2 Pressure Filters Digital Output

BACKWASH PERMISSIVE

This signal is maintained from Plant PLC only when all of the following backwash permissives are met:

1. Filtered Water Tank Level (C-BW-LIT-1001) > 7' (operator adjustable)
2. Backwash Recovery Tank Level (C-WW-LIT-1001) < 2' (operator adjustable)
3. No Backwash Supply Pump failure from both pumps.
4. Backwash In Progress from Pressure Filter PLC in not given.

BACKWASH ABORT REQUEST

Any of the following conditions will cause a backwash abort request from the Plant PLC:

1. Filtered Water Tank Level (C-BW-LIT-1001) < 4' (operator adjustable)
2. Backwash Recovery Tank Level (C-WW-LIT-1001) > 6' (operator adjustable)
3. Both Backwash Supply Pumps fail.

PRESSURE FILTER FEED PUMP RUNNING STATUS

This signal is maintained from Plant PLC as long as a pressure filter feed pump is running.

BACKWASH SUPPLY PUMP RUNNING STATUS

This signal is maintained from Plant PLC as long as the backwash supply pump is running.

4.3.3 Pressure Filters Analog Input

AVAILABLE PRESSURE FILTERS CAPACITY

The Pressure Filter PLC provides the total available pressure filter cell capacity for the process water. This signal only includes the filter cells that are ready to receive feed water and will not include the capacity from any filter cell that is off-line, in manual mode, in any failure mode, in backwash mode, etc.

COMBINED FILTERS TREATED WATER FLOW

The Pressure Filter PLC provides a total treated water flow from all on-line filter cells.

BACKWASH FLOW DEMAND

The Pressure Filter PLC sends a flow demand signal for backwash water from the filtered water tank.

4.3.4 Pressure Filters Analog Output

TOTAL AVAILABLE CHARNOCK TREATMENT FLOW

The Plant PLC provides the **Total Available Charnock Treatment Flow** signal to the Pressure Filter PLC which determines the number of filter cells needed to be on-line to treat the water. The Pressure Filter PLC will only consider the cells that are in auto mode. The filter cells that are not required will be changed from auto on-line to auto off-line.

An alarm is generated by the Pressure Filter PLC if the **Total Available Charnock Treatment Flow** is greater than the available pressure filters capacity.

PRESSURE FEED PUMP DISCHARGE PRESSURE FEEDBACK

The Plant PLC provides the pressure filter feed pump discharge pressure to the Pressure Filter PLC, which controls the pressure filter effluent valves to maintain a constant discharge pressure (operator adjustable setpoint) for the pressure filter feed pump while providing an even effluent flow on all on-line filters. If the pressure filter feed pump discharge pressure feedback is above the pressure setpoint, the Pressure Filter PLC raises the flow setpoint for all on-line filter effluent valves which opens more to reach the new flow setpoint. All of the on-line filter effluent valves have the same flow setpoint.

BACKWASH FLOW FEEDBACK
The Plant PLC provides the backwash flow feedback to the Pressure Filter PLC.

4.4 GAC

There are five GAC trains each with 2 GAC vessels; GAC train 1 (C-GAC-GAC-1001), GAC train 2 (C-GAC-GAC-2001), GAC train 3 (C-GAC-GAC-3001), GAC train 4 (C-GAC-GAC-4001), and GAC train 5 (C-GAC-GAC-5001). The GAC trains have flowmeters to monitor the effluent flow from each train; GAC train 1 (C-GAC-FIT-1001), GAC train 2 (C-GAC-FIT-2001), GAC train 3 (C-GAC-FIT-3001), GAC train 4 (C-GAC-FIT-4001), and GAC train 5 (C-GAC-FIT-5001).

4.4.1 GAC Vessel Inputs and Outputs

4.4.1.1 GAC Digital Input

READY-TO-RECEIVE FEED WATER
This signal is maintained from the Pressure Filter PLC as long as the GAC vessels are ready to receive process water from the pressure filters.

The Pressure Filter PLC provides the selection between manual and auto mode for the GAC trains. In manual mode the Pressure Filter PLC isolates the GAC train and closes all the valves and the operator is able to manually open and close any of the valves. In auto mode the Pressure Filter PLC automatically opens, closes, and modulates the GAC vessel valves based on 1 of the 3 operation models below.

a. Auto On-line Mode – When the operator selects this option, the Pressure Filter PLC lines up all the valves for the GAC vessel to be ready to receive feed water from the pressure filters.
b. Auto Off-line Mode – When the operator selects this option, the Pressure Filter PLC isolates the GAC vessel so no feed water can go through it.
c. Auto Backwash Mode - When the operator selects this option, the Pressure Filter PLC lines up all the valves for the GAC vessel to be ready for backwash operation. This option is only available to the operator when there is no other backwash is in process and the Plant PLC has a Backwash Permissive output.

BACKWASH REQUEST
This signal is maintained from the Pressure Filter PLC as long as there is a need for backwash water during the backwash process.

The Pressure Filter PLC will queue up the backwash requests from different GAC vessels while allowing only one backwash at a time. The Pressure Filter PLC also monitors the Backwash Permissive from the Plant PLC and only requests for Bachwash when the Backwash Permissive is received.

BACKWASH IN PROGRESS
This signal is maintained from the Pressure Filter PLC as long as there is a backwash in progress.

GAC 1 ON-LINE
This signal is maintained from the Pressure Filter PLC as long as the GAC 1 is on-line.

The Plant PLC uses this signal to release the GAC 1 effluent valve to be modulated.

GAC 2 ON-LINE
This signal is maintained from the Pressure Filter PLC as long as the GAC 2 is on-line.

The Plant PLC uses this signal to release the GAC 2 effluent valve to be modulated.

GAC 3 ON-LINE
This signal is maintained from the Pressure Filter PLC as long as the GAC 3 is on-line.

The Plant PLC uses this signal to release the GAC 3 effluent valve to be modulated.

GAC 4 ON-LINE
This signal is maintained from the Pressure Filter PLC as long as the GAC 4 is on-line.

The Plant PLC uses this signal to release the GAC 4 effluent valve to be modulated.

GAC 5 ON-LINE
This signal is maintained from the Pressure Filter PLC as long as the GAC 5 is on-line.

The Plant PLC uses this signal to release the GAC 5 effluent valve to be modulated.

4.4.1.2 GAC Digital Output

BACKWASH PERMISSIVE
This signal is maintained from Plant PLC only when all of the following backwash permissives are met:

1. Filtered Water Tank Level (C-BW-LIT-1001) > 7' (operator adjustable)
2. Backwash Recovery Tank Level (C-WW-LIT-1001) < 2' (operator adjustable)
3. No Backwash Supply Pump failure from both pumps.
4. There is no Backwash In Progress signal from Pressure Filter PLC.

BACKWASH ABORT REQUEST

This signal is only maintained from the Plant PLC when one of the following conditions is true:

1. Filtered Water Tank Level (C-BW-LIT-1001) < 4' (operator adjustable)
2. Backwash Recovery Tank Level (C-WW-LIT-1001) > 6' (operator adjustable)
3. Both Backwash Supply Pumps fail.

BACKWASH SUPPLY PUMP RUNNING STATUS

This signal is maintained from the Plant PLC as long as the backwash supply pump is running.

4.4.1.3 GAC Analog Input

AVAILABLE GAC VESSELS CAPACITY

The Pressure Filter PLC provides the total available GAC vessels capacity for the process water. This signal only includes the GAC vessels that are ready to receive feed water, in auto on-line mode. This signal does not include the capacity from any GAC vessel that is off-line, in manual, in any failure mode, in backwash, etc.

BACKWASH FLOW DEMAND

The Pressure Filter PLC sends a flow demand signal for backwash water.

4.4.1.4 GAC Analog Output

BACKWASH FLOW FEEDBACK

The Plant PLC provides the backwash flow feedback to the Pressure Filter PLC.

4.4.2 GAC Effluent Valves

Each GAC train has a process effluent valve, GAC train 1 (C-FLT-VBF-1001), GAC train 2 (C-FLT-VBF-2001), GAC train 3 (C-FLT-VBF-3001), GAC train 4 (C-FLT-VBF-4001), and GAC train 5 (C-FLT-VBF-5001). These valves are controlled in local manual, remote manual and remote auto. Local manual controls for valves are provided through manual overrides on the valve actuator. Remote manual controls are provided through the PLC. When manual is selected at the HMI, the valve is positioned using the operator entered position. Remote automatic controls are provided through the PLC.

When the switch on the valve actuator is in the computer position and auto is selected at the HMI, the effluent valves for all the on-line GAC vessels are controlled in one of the following two modes selected by operator.

Mode 1: The operator manually enters a fixed flow setpoint.

Mode 2: The valve automatically adjusts as required to proportionally split the flow through the online GAC vessel based on the operator entered proportional flow ratio to each vessel.

The control scheme uses the "most open valve" control algorithm. The algorithm monitors the position of the "on-line automatic" vessels inlet valves. If the valve which is the "most open" is not nearly full open (between 85 to 95%, initially 85%) the algorithm slightly raises the flow setpoint to all vessel inlet valves for the vessels on-line in automatic mode until the "most open" valve is between the 85 to 95% position. The flow feedback for individual valve is from the corresponding GAC effluent flowmeter.

Release to modulate

1. GAC vessel on-line signal is active from the Pressure Filter PLC, and
2. At least one of the Charnock filter feed pumps is running.

4.4.3 GAC Changeout Procedures

When it is determined that a GAC vessel has lost its adsorption capacity for MTBE, the GAC within that vessel must be replaced with fresh GAC. This is planned to be performed with a service agreement with a GAC vendor, which hauls in fresh GAC for the vessel, and hauls away the exhausted GAC.

The GAC vessel to be changed out should be removed from service and the operator should verify that the entire train is isolated. Once isolated and all valves on the train are closed, then the truck hoses should be connected to the quick connect fittings connected to the top and bottom of the vessel and the manual isolation valves should be opened for carbon transfer. The carbon in the vessel is conveyed out and into the truck for disposal. New carbon is conveyed from the truck to the vessel. Once this process is completed, the carbon piping isolation valves should be closed and the hoses disconnected.

After a fresh bed of GAC is installed, the fines must be removed before it is brought into service. Fines are removed by an extended backwash (typically 15 to 20 minutes at 10 gpm/sf). Note that fines do not register as turbidity on a turbidimeter, because carbon particles adsorb the light instead of scattering the light. To verify that there are no fines present, a manual sample can be collected in the effluent of the GAC vessel, and it can be filtered through standard filter paper to see if GAC fines are present.

After removal of fines is complete, the GAC train can be placed back into operation.

4.5 Filtered Water Tank and Backwash Supply Pumps

4.5.1 Filtered Water Tank

The water level in the filtered water tank is monitored with a level indicator (C-FLT-LIT-1001). High-high and low-low indicators are also provided on the tank (C-FLT-LSHH-1001 and C-FLT-LSLL-1001, respectively).

The filtered water tank has the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)

- Filtered water tank level is high (C-FLT-LIT-1001 > 9'6").
- Filtered water tank level is low (C-FLT-LIT-1001 < 2').
- Filtered water tank has reached high-high level (C-FLT-LSHH-1001 = XX').
- Filtered water tank has reached low-low level (C-FLT-LSLL-1001 = XX').

STATUS INDICATIONS

- C-FLT-LIT-1001 – Filtered Water Tank Level
- C-FLT-LSHH-1001 – Filtered Water Tank Level High-High
- C-FLT-LSLL-1001 – Filtered Water Tank Level Low-Low

4.5.2 Backwash Supply Pumps

There are two backwash supply pumps that feed the pressure filter cells and GAC vessels with backwash water from the filtered water tank; backwash supply pump 1 (C-BW-PVE-1101) and backwash supply pump 2 (C-BW-PVE-1201). The pressure and flow for the backwash supply pumps are measured on the discharge header with a pressure indicator (C-BW-PIT-1001) and a flowmeter (C-BW-FIT-1101). The backwash supply pumps are depicted on the washwater supply display. The pumps can be placed in manual mode locally through the local drive. These pumps also operate in remote manual and remote auto mode through the PLC when remote is selected at the local drive.

Remote manual control is provided when manual is selected at the HMI, the pump on/off and speed is controlled from the HMI using operator manual commands.

Remote automatic control is provided when auto is selected at the HMI, the pumps are controlled by a Proportional Integral (PI) controller. The setpoint for the controller is either the pressure filter backwash flow demand signal or by the GAC backwash flow demand signal from the Pressure Filter PLC through the datalink. The controller feedback signal is from the backwash supply pump discharge flowmeter, (C-BW-FIT-1101). The output of the PI controller is the pump speed.

The pumps are designed for duty and standby controls. The duty pump changes speed to meet the flow demand signal.

The standby pump is started to replace the tripped duty pump. The duty and standby pumps automatically rotate every time when the duty pump is stopped.

The backwash supply pumps have the following interlocks:

RUN PERMISSIVE

- Low-low level on the filtered water tank is not reached, (C-FLT-LSLL-1001 ≠ XX').
- Filtered water tank level is greater than 5', operator adjustable (C-FLT-LIT-1001 > 5').

STOP OVERRIDE

- Filtered water tank low-low level is reached, (C-FLT-LSLL-1001 = XX').
- Filtered water is level reaches 2', operator adjustable, (C-FLT-LIT-1001 ≤2').
- Backwash pump discharge is greater than 60 psi, operator adjustable, (C-BW-PIT-1001 > 60 psi).

AUTO START FOR THE DUTY PUMP

- The backwash request signal is received.

AUTO STOP FOR THE PUMPS

- The backwash request signal is stopped.

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail signal from the pump AFD.

STATUS INDICATIONS

- Pump Running
- Pump in Local/Remote
- Pump Speed
- Pump Fail

4.6 Backwash Recovery Tank and Pumps

4.6.1 Backwash Recovery General Monitoring

Level indicator, level switches, and flowmeter (C-WW-LIT-1001, C-WW-LSHH-1001, C-WW-LSLL-1001, and C-WW- FIT-1001, respectively) are provided with the backwash recovery system to monitor the conditions of the system. These instruments are depicted on the associated backwash recovery display.

The following interlocks are provided for the backwash recovery instruments:

ALARMS (All alarm setpoint are operator adjustable)

- Backwash recovery tank level is greater than 6' (C-WW-LIT-1001 > 6').
- Backwash recovery tank level is less than 1' (C-WW-LIT-1001 < 1').

- Backwash recovery tank high-high level is reached (C-WW-LSHH-1001 = XX')
- Backwash recovery tank low-low level is reached (C-WW-LSLL-1001 = XX')

STATUS INDICATIONS
- C-WW-LIT-1001 – Backwash Recovery Tank Level
- C-WW-LSHH-1001 – Backwash Recovery Tank Level High-High
- C-WW-LSLL-1001 – Backwash Recovery Tank Level Low-Low
- C-WW-FIT-1001 – Backwash Recovery Pump Discharge Flow

4.6.2 Backwash Recovery Mixers

The backwash recovery tank has two submersible mixer to keep the solids suspended in the tank; backwash recovery tank mixer 1 (C-WW-MXP-1101) and backwash recovery tank mixer 2 (C-WW-MXP-1201). The backwash recovery mixers are depicted on the backwash recovery display.

The mixers operate with local manual controls through the local drive. When ON is selected on the local drive the pump runs. The mixers also operate in remote manual and remote automatic modes through the PLC when the local switch is in the remote position.

Remote manual control is provided when manual is selected at the HMI, the mixer ON/OFF is controlled using operator manual commands.

Remote automatic control is provided when auto is selected at the HMI, the mixers start/stop is controlled by level in the backwash recovery tank. Start and stop levels are adjustable at the HMI. During normal operation the mixers are in remote automatic mode.

RUN PERMISSIVE
- Backwash recovery tank low-low level is not reached (C-WW-LSLL-1001 ≠ XX').
- Backwash recovery tank level is greater than 2', operator adjustable (C-WW-LIT-1001 > 2').

STOP OVERRIDE
- Backwash recovery tank low-low level is reached (C-WW-LSLL-1001 = XX').
- Backwash recovery tank level is less than 1.5', operator adjustable (C-WW-LIT-1001 < 1.5').

AUTO START
- Backwash recovery tank level is greater than 3', operator adjustable (C-WW-LIT-1001 > 3').

AUTO STOP
- Backwash recovery tank level is less than 2', operator adjustable (C-WW-LIT-1001 < 2').

ALARMS (All alarm setpoint are operator adjustable)

- Mixer fail signal is received from the pump starter.

STATUS INDICATIONS

- Mixer Running
- Mixer in Local/Remote
- Mixer Fail.

4.6.3 Backwash Recovery Pumps

There are two backwash recovery pumps which supply the packaged treatment unit for solids removal; backwash recovery pump 1 (C-WW-PSP-1101) and backwash recovery pump 2 (C-WW-PSP-1201). These pumps can be run with local manual controls through the local drive, when ON is selected the pump will run. The pumps also run in remote manual and remote auto modes through the PLC when the switch on the pump is set to the remote position. The backwash recovery pumps are depicted on the wash water recovery display.

Remote manual control is provided when manual is selected at the HMI, the pump ON/OFF is controlled from the HMI using operator manual commands.

During normal operation the pumps operate in remote automatic mode. Remote automatic control is provided when auto is selected at the HMI. The duty pump start/stop is controlled by the level in the backwash recovery tank. Start and stop levels are adjustable at the HMI.

The standby pump is started to replace the tripped duty pump. The duty and standby pumps automatically rotate every time the duty pump stops.

The backwash recovery pumps have the following interlocks:

RUN PERMISSIVE

- Low-low level in the backwash recovery tank is not reached (C-WW-LSLL-1001 ≠ XX').
- Backwash recovery tank level is greater than 3', operator adjustable (C-WW-LIT-1001 > 3').

STOP OVERRIDE

- Low-low level in the backwash recovery tank is reached (C-WW-LSLL-1001 = XX').
- Backwash recovery tank level is less than 1', operator adjustable (C-WW-LIT-1001 < 1').

AUTO START

- Backwash recovery tank level is greater than 5', operator adjustable (C-WW-LIT-1001 > 5').

AUTO STOP

- Backwash recovery tank level is less than 2', operator adjustable (C-WW-LIT-1001 < 2').
- The raw water equalization tank is greater than 8.5', operator adjustable (C-RW-LIT-1001 > 8.5').

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail signal is received from the pump starter.

STATUS INDICATIONS

- Pump Running
- Pump in Local/Remote
- Pump Fail

4.7 Packaged Treatment Unit

The packaged treatment unit is the plate settler which treats backwash flow to remove the solids.

4.7.1 Packaged Treatment General Monitoring

Turbidity analyzer and flowmeter (C-WW-AIT-1001 and C-WW- FIT-1002, respectively) are provided for the packaged treatment unit to monitor the conditions of the system. These instruments are depicted on the associated backwash recovery display.

The following interlocks are provided for the packaged treatment system instruments:

ALARMS (All alarm setpoint are operator adjustable)

- Effluent flow from the packaged treatment unit turbidity is greater than 100 ppm (C-WW-AIT-1001 > 100 ppm).

STATUS INDICATIONS

- C-WW-AIT-1001 – Backwash Recovery Return Flow Turbidity
- C-WW-FIT-1002 – Plate Settler Sludge Discharge Flow

4.7.2 Plate Settler

The backwash recovery plate settlers (C-WW-PSE-1101) are part of the packaged treatment unit. The plate settlers can be operated in both manual and auto mode locally through the local control panel. The plate settler is depicted on the associated backwash recovery display.

The following interlocks are associated with the plate settlers:

ALARMS (All alarm setpoint are operator adjustable)

- Plate settler system fail.

STATUS INDICATIONS

- Plate Settler System Running.
- Fail from the plate settler.

4.7.3 Flocculation Mixer

4.7.4 Sludge Scrapper

4.8 Chemical Feed Systems

Normal operation of chemical feed system is discussed herein.

4.8.1 Chemical Storage Replenishment Procedures

4.8.1.1 Chemical Tank Fill Operation Procedure

The following guidelines need to be observed during tank filling operations for all bulk chemical storage tanks:

1. Disconnect dust cap from the fill line of the appropriate chemical tank. Connect fill line to the cam lock male connector provided.
2. Open tank fill valve and commence filling.
3. Watch level indicator closely until the tank is filled with desired chemical. If the storage tank is not visible from filling point, be alert for the overfill alarm.
4. Stop filling when tank is full and close valve.
5. Disconnect the fill line and replace dust cap.
6. Confirm that any spilled liquid drains to a provided sump or is disposed in accordance with local environmental regulations.

4.8.1.2 Chemical Tote Change Operation Procedure

The following guidelines need to be observed during tote changing operations for chemical storage totes:

1. Stop the pump that is running.
2. Close the three chemical supply valves immediately downstream of tote.
3. Disconnect the male connector from the female connector. Remove empty tote from the weigh scale. Place new and full chemical storage tote on the weigh scale.
4. Connect the cam lock male connector to the female end. Open supply valves and turn on pump.
5. Confirm that any spilled liquid drains to a provided sump or is disposed in accordance with local environmental regulations.

4.8.2 Sodium Hypochlorite Feed System

4.8.2.1 Sodium Hypochlorite Storage

Each sodium hypochlorite storage tank is provided with a level transmitter (C-NOCL-LIT-1101, C-NOCL-LIT-1201) used to monitor the liquid level. The level transmitter will provide high and low level alarms for the operator and in case of low level sends a signal to stop the Sodium Hypochlorite Metering Pumps.

Each level transmitter has the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)
- Sodium Hypochlorite Storage Tank 1 high level (C-NOCL-LIT-1101 > 8')
- Sodium Hypochlorite Storage Tank 1 low level (C-NOCL-LIT-1101 < 2')
- Sodium Hypochlorite Storage Tank 2 high level (C-NOCL-LIT-1201 > 8')
- Sodium Hypochlorite Storage Tank 2 low level (C-NOCL-LIT-1201 < 2')

STATUS INDICATIONS
- C-NOCL-LIT-1101 – Sodium Hypochlorite Storage Tank 1 level
- C-NOCL-LIT-1201 – Sodium Hypochlorite Storage Tank 2 level

4.8.2.2 Sodium Hypochlorite Metering Pumps to Well 13, 15, and 19

The Sodium Hypochlorite Metering Pumps (C-NOCL-PDM-1101, C-NOCL-PDM-2101, C-NOCL-PDM-3101) are used to feed sodium hypochlorite from the Sodium Hypochlorite Storage Tanks to Wells 13, 15 and 19. Pump C-NOCL-PDM-1101 feeds to Well 13. Pump C-NOCL-PDM-2101 feeds to Well 15. Pump C-NOCL-PDM-3101 feeds to Well 19. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump shall be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump shall run and speed shall be controlled using the local adjustment device on the panel. Stroke length control shall be adjusted manually at the pump only.

Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF shall be controlled from the HMI using operator manual commands and the speed shall be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI shall select the mode of control for ON/OFF, and speed.

Remote automatic control for pump C-NOCL-PDM-1101 shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump shall run based on minimum Well 13 discharge flow C-RW-FIT-1001 > 20 gpm (operator adjustable),. Pump speed shall be controlled by the Well 13 discharge flow C-RW-FIT-1001 flow pacing signal and the dosage calculated by a Proportional Integral controller. The setpoint for the controller shall be the desired chlorine residual at the Well 13 discharge flow. The controller feedback signal shall be from the chlorine residual analyzer, C-RW-AIT-1011, measuring chlorine residual downstream of the respective feed points. The output of the PI controller shall be scaled for the dosage range for the feed point to provide the correct units for the calculations shown below. Transfer between manual and automatic modes of the controller shall be bumpless.

Remote automatic control for pump C-NOCL-PDM-2101 shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump shall run based on minimum Well 15 discharge flow C-RW-FIT-1002 > 20 gpm (operator adjustable),. Pump speed shall be controlled by the Well 15 discharge flow C-RW-FIT-1002 flow pacing signal and the dosage calculated by a Proportional Integral controller. The setpoint for the controller shall be the desired chlorine residual at the Well 15 discharge flow. The controller feedback signal shall be from the chlorine residual analyzer, C-RW-AIT-1012, measuring chlorine residual downstream of the respective feed points. The output of the PI controller shall be scaled for the dosage range for the feed point to provide the correct units for the calculations shown below. Transfer between manual and automatic modes of the controller shall be bumpless.

Remote automatic control for pump C-NOCL-PDM-3101 shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump shall run based on minimum Well 19 discharge flow C-RW-FIT-1003 > 20 gpm (operator adjustable),. Pump speed shall be controlled by the Well 19 discharge flow C-RW-FIT-1003 flow pacing signal and the dosage calculated by a Proportional Integral controller. The setpoint for the controller shall be the desired chlorine residual at the Well 19 discharge flow. The controller feedback signal shall be from the chlorine residual analyzer, C-RW-AIT-1013, measuring chlorine residual downstream of the respective feed points. The output of the PI controller shall be scaled for the dosage range for the feed point to provide the correct units for the calculations shown below. Transfer between manual and automatic modes of the controller shall be bumpless.

The metering pumps have the following interlocks:

RUN PERMISSIVE

- Either Sodium Hypochlorite Storage tank level is above 2', operator adjustable (C-NOCL-LIT-1101 > 2' or C-NOCL-LIT-1201 > 2').

STOP OVERRIDE

- Both Sodium Hypochlorite Storage tanks have reached low level, operator adjustable (C-NOCL-LIT-1101 < 1' and C-NOCL-LIT-1201 < 1').

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Pump discharge flow.

4.8.3 Sodium Bisulfite Feed System

4.8.3.1 Sodium Bisulfite Storage

The sodium bisulfite storage tank is provided with a level transmitter (C-NHS-LIT-1001) used to monitor the liquid level. The level transmitter will provide high and low level alarms for the operator and in case of low level sends a signal to stop the Sodium Bisulfite Metering Pumps.

Each level transmitter has the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)

- Sodium Bisulfite Storage Tank 1 high level (C-NHS-LIT-1001 > 8')
- Sodium Bisulfite Storage Tank 1 low level (C-NHS-LIT-1001 < 2')

STATUS INDICATIONS

- C-NHS-LIT-1001 – Sodium Bisulfite Storage Tank 1 level

4.8.3.2 Sodium Bisulfite Metering Pumps

The Sodium Bisulfite Metering Pumps (C-NHS-PDM-1001, C-NOCL-PDM-2001) are used to feed sodium bisulfite from the Sodium Bisulfite Storage Tank to the feed point. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump shall be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump shall run and speed shall be controlled using the local adjustment device on the panel. Stroke length control shall be adjusted manually at the pump only.

Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF shall be controlled from the HMI using operator manual commands and the speed shall be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI shall select the mode of control for ON/OFF, and speed.

Remote automatic control shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump shall run based on minimum combined pressure filter effluent flow > 20 gpm (operator adjustable) from the Pressure Filter PLC, and pump speed shall be controlled by the combined pressure filter effluent flow pacing signal and the dosage. Two modes of determining dosage shall be selectable. Mode 1 shall be through manual entry of the dosage at the HMI. Mode 2 shall be calculation as a ratio of the pressure filter influent chlorine residual. The ratio for calculating the dosage shall be adjustable at the HMI from 0.1 - 5, initially set at 1. C-NHS-PDM-1001 and C-NHS-PDM-2001 shall be designed for duty/standby operation. Operator shall be able to select either pump as the duty pump while the other one shall automatically default as standby. The duty and standby pumps shall automatically rotated whenever the duty pump stops. The standby pump shall automatically start to replace the failed duty pump.

The metering pumps have the following interlocks:

<u>RUN PERMISSIVE</u>

- Sodium Bisulfite Storage tank level is above 2', operator adjustable (C-NHS-LIT-1001 > 2').

<u>STOP OVERRIDE</u>

- Sodium Bisulfite Storage tank has reached low level, operator adjustable (C-NHS-LIT-1001 < 1').

<u>ALARMS (All alarm setpoint are operator adjustable)</u>

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

<u>STATUS INDICATIONS</u>

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Duty/standby selection
- Pump discharge flow.

4.8.4 Polyaluminum Chloride

4.8.4.1 Polyaluminum Chloride Storage

The polyaluminum chloride tote weigh scale is provided with a weight transmitter (C-PACL-WIT-1101) used to monitor the liquid level. The weight transmitter will provide a low level alarm for the operator to stop the Polyaluminum Chloride Metering Pumps.

Each weight transmitter has the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)

- Polyaluminum Chloride Storage Tote low level (C-PACL-WIT-1101 < 20%)

STATUS INDICATIONS

- Polyaluminum Chloride Storage (PACL-WIT-1101, 0 – 100%)

4.8.4.2 Polyaluminum Chloride Metering Pumps

The Polyaluminum Chloride Metering Pumps (C-PACL-PDM-1001, C-PACL-PDM-2001) are used to feed polyaluminum chloride from the Storage Tote to the feed point. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump shall be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump shall run and speed shall be controlled using the local adjustment device on the panel. Stroke length control shall be adjusted manually at the pump only.

Remote manual control shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF shall be controlled from the HMI using operator manual commands and the speed shall be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI shall select the mode of control for ON/OFF, and speed.

Remote automatic control shall be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump shall run based on minimum backwash recovery pump discharge flow, C-WW-FIT-1001, > 20 gpm (operator adjustable). Pump speed shall be controlled by the backwash recovery pump discharge flow, CWW-FIT-1001, flow pacing signal and the dosage entered by the operator on the HMI. Transfer between manual and automatic modes of the controller shall be bumpless. C-PACL-PDM-1001 and C-PACL-PDM-2001 shall be designed for duty/standby operation. Operator shall be able to select either pump as the duty pump while the other one shall automatically default as standby. The duty and standby pumps shall automatically rotated whenever the duty pump stops. The standby pump shall automatically start to replace the failed duty pump.

The metering pumps have the following interlocks:

RUN PERMISSIVE

- Polyaluminum Chloride Storage tote level is above 10%, operator adjustable (C-PACL-WIT-1001 > 10%).

STOP OVERRIDE

- Polyaluminum Chloride Storage tote has reached low level, operator adjustable (C-PACL-WIT-1001 < 5%).

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Duty/standby selection
- Pump discharge flow.

4.9 Solids Disposal

The solids that are collected in the hopper of the plate settler will be disposed of to the sewer. Disposal is set to be on an automated basis, with release of about 50 gpm until the solids in the hopper are removed.

4.10 Electrical

This section discusses electrical power distribution system and the normal operation of electrical equipment for the Charnock Well Field.

4.10.1 Electric Power Distribution

The existing utility feed from LADWP to the existing substation transformer will remain for the service to the school. A new utility feed from LADWP with new service transformer will be provided for the entire plant, including the new expansion. A new intermediate switchboard, rated for service entrance, will be installed on the secondary of the new transformer to feed power to the new facility. A utility metering section will be part of this intermediate switchboard lineup. The secondary service will be a voltage of 480 volts, 3 phase, 60 Hz, 4W. An automatic transfer switch will be provided for transferring of loads to the new stand-by generator. The new treatment facility will have new distribution gear located in the electrical room as shown on the drawings. All lighting and 120/240 volt loads will be fed from distribution panels that are powered from single phase dry type distribution transformers located in the buildings. Uninterrupted power supply (UPS) systems shall be provided for back-up power to the control systems only.

4.10.2 Normal Operation

During normal operation, the low voltage distribution system is in service providing 480/208/120VAC power to the components they serve.

4.11 Stormwater Treatment System

The interceptor unit will operate under continuous deflective separation where water is separated from debris, sediments, oil and grease. Typically the storm water enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the unit's treatment design capacity enter the separation chamber and are treated. Swirl concentration and screen deflection force floating debris and solids to the center of the separation chamber where buoyant debris larger than the screen apertures is trapped. Storm water then moves through the separation screen, under the oil baffle and exits the unit to discharge into the street storm water drain system. When the treatment design capacity is exceeded, the diversion weir bypasses excessive flows around the unit.

5.0 Startup and Shutdown

5.1 Startup Procedures with Empty Tanks

If all of the tanks are empty or near empty, the Operator will have to manually start the well pumps, booster pumps, and other feed pumps to fill up the tanks before proceeding with the normal plant operation startup procedures described in Section 5.2.

1. The Operator will put the Pressure Filters, GAC, and all chemical systems in "Auto" mode.
2. The Operator will select one well pump to run to fill up the Raw Water Equalization Tank.
3. Once the Raw Water Equalization Tank water level reaches an adequate level, the Operator will start one of the Filter Feed Pumps.
4. Once the Filter Feed Pump is running, the Pressure Filters and the GAC system will automatically start to distribute the flow evenly through all the on-line cells and trains respectively.
5. Once the Filtered Water Tank level reaches an adequate level, the Operator will start one of the booster pumps to send water to Arcadia WTP.
6. When all of the tanks have been filled with water, the Operator can follow the normal plant operation startup procedures below to start up the plant.

5.2 Normal Plant Operation Startup Procedures

This normal plant operation startup section assumes that all the tanks have been filled with water, either from the previous plant operation or by the Operator through manual operation.

1. The Operator will manually select which well pumps are to be used to provide feed water on the HMI by placing the selected well pumps in "Auto" mode on the HMI. A Well Pump Production Table (Table 5-1) will be available on the HMI screen to inform the Operator of the capacity of each well pump.

Table 5-1.
Well Pump Production Table

Facility	Anticipated Rated Production Capacity*	
	MGD	gpm
Charnock Well 13 (constant flow)	1.728	1200
Charnock Well 15 (constant flow)	1.728	1200
Charnock Well 19 (variable flow)	1.44 - 2.16	1000 – 1500

Facility	Anticipated Rated Production Capacity*	
	MGD	gpm
Charnock Well 16 (constant flow)	3.168	2200
Charnock Well 18 (constant flow)	2.16	1500
Santa Monica Well 3 (constant flow)	1.12	780
Santa Monica Well 4 (constant flow)	1.17	810
Arcadia Well 4 (constant flow)	0.35	240
Arcadia Well 5 (constant flow)	0.37	260
MWD water line (variable flow)	0 - 2	0 - 1389

* These pump capacities will be confirmed after plant startup and well refurbishment for the Charnock Wellfield. Note that these flows are higher than those listed in the table under the diagram on drawing General Process Flow Diagram (GC0002), because those flows were adjusted to meet the design capacity for mass balance calculations.

The Charnock well pumps will automatically default to "Manual" mode if the well pump has not been run for more than 24 hours (Operator adjustable) or if the well pump (constant speed pump only) has been started more than 3 times (Operator adjustable) within an hour. The Operator will be required to verify that the well pump is acceptable to use before putting it on "Auto" mode. Once a Charnock well pump is on "Auto" mode, it will automatically start when the PLC calls for it.

2. The Operator will manually select which booster pumps at Charnock are to be used to provide feed water to the Arcadia WTP by placing the selected booster pumps in "Auto" mode on the HMI. A Booster Pump Production Table (Table 5-2) will be available on the HMI screen to inform the Operator of the capacity of each booster pump.

Table 5-2.
Charnock Booster Pump Production Table

Facility	Production Capacity	
	MGD	gpm
Booster Pump 1 (constant flow)	2.3	1600
Booster Pump 2 (constant flow)	1.87	1300
Booster Pump 3 (variable flow)	1.73 - 2.88	1200 - 2000
Booster Pump 4 (variable flow)	2.25 - 3.74	1560 - 2600
Booster Pump 5 (constant flow)	4.32	3000

The Plant PLC will provide a **Total Available Flow from Charnock Booster Pumps** for all the Charnock booster pumps that are in "Auto" mode.

3. All of the pressure filter cells and GAC trains will default to "Auto" mode unless the Operator decides to manually select certain pressure filter cells or GAC trains to be in "Manual" mode for manual backwash or other maintenance purposes.

4. The Operator will put all the rest of the Charnock equipment in "Auto" mode for normal plant startup.

5. To place Arcadia WTP on line, refer to Chapter 5 of the Arcadia Operations Plan.

6. Once the Arcadia Contact Tank water level drops below a preset level setpoint, the Arcadia PLC will send a request signal to the Charnock PLC to turn on the Charnock booster pumps that are in "Auto" mode. The operating Charnock booster pumps will either vary the pump speed for the VFD pumps or turn on and off for the constant speed pumps to maintain a constant flow to Arcadia WTP and to maintain the Contact Tank water level within an operating range. The control flow setpoint for the Charnock booster pumps will be the calculated **Total Available Charnock Plant Flow** with a maximum value at the **Required Arcadia Plant Production Flow**.

   Charnock PLC will start the booster pumps up one at a time with the smallest size pump first and the VFD pump last.

7. If the Charnock variable speed booster pump(s) are running at 100% and the available flow from Charnock to Arcadia WTP is less than the required flow for the RO units, the MWD 24" water line valve will automatically modulate to provide the required additional flow and to maintain the Contact Tank water level within an operating range. If the Arcadia Contact Tank water level is above the operating range, the MWD 24" water line valve will close to reduce the Arcadia Plant Inlet Flow before the Charnock variable speed booster pumps will lower the pump speed.

8. Once the booster pumps are running and the Charnock Filtered Water Tank water level drops below a preset level setpoint, the Charnock Pressure Filter Feed Pumps will automatically come on and vary the pump speed to maintain a constant flow. The control flow setpoint for the filter feed pumps will be the calculated **Total Available Charnock Treatment Flow**. The normal flow path for Well 16 and Well 18 is to bypass the Charnock Treatment Facility and enter the Filtered Water Tank directly. The Operator has the option to manually direct Well 16 and/or Well 18 to go through the Charnock Treatment Facility by opening (C-RW-VPL-1004 and C-RW-VPL-1005, respectively) and closing (C-RW-VPL-1006 and C-RW-VPL-1007, respectively) manual isolation valves. The Operator will be required to make the selection on the HMI to indicate if the flow from Well 16 and/or Well 18 is going through the Charnock Treatment Facility or going directly to the Filtered Water Tank.

9. Once the Pressure Filter Feed Pumps are running, the pressure filter effluent valves (C-FLT-VBF-1103, 1203, 2103, 2203, 3103, and 3203) for all on-line filter cells in "Auto" mode will modulate to maintain the Filter Feed Pump discharge header pressure and provide even flow for all the on-line filter cells.

10. Once the Pressure Filter Feed Pumps are running, the GAC effluent valves (C-FLT-VBF-1001, 2001, 3001, 4001, and 5001) for all the on-line GAC trains in "Auto" mode will modulate to provide even flow for each on-line GAC train.

11. Once the Filter Feed Pumps are running and the Raw Water Equalization Tank water level drops below a preset level setpoint, the Charnock PLC will turn on the well pumps that are in "Auto" mode. If Well 19 is in operation, the well pump will vary the pump speed to maintain the Raw Water Equalization Tank level within an operating range before the other operating constant speed well pumps are cycled on and off. All the constant speed well pumps are limited for 3 starts per hour. If both Wells 13 and 15 are in operation, the Charnock PLC will alternate the start and stop of each pump to maintain the Raw Water Equalization Tank level.

    Charnock PLC will start the well pumps up one at a time with the smallest size pump first and the VFD pump last.

12. The chemical systems will automatically start based on the plant flow.

5.3 *Normal Plant Operation Shutdown Procedures*

1. The Arcadia Plant PLC will send a stop command to Charnock PLC to shut down the well pumps, booster pumps, and all feed pumps when the Arcadia WTP is taken off line.

2. Ensure the backwash recovery mixers remain on-line and operating.

3. Once the Plant Flow drops below a preset flow setpoint, all of the running chemical systems will automatically stop.

5.4 *Long Term Shutdown Procedures*

If the facility is shutdown for extended periods of time, then the GAC filters should be refreshed every three days with influent flow for about 45 minutes (twice the empty bed contact time through the two GAC vessels). The pressure vessel filter beds do not need to be refreshed as frequently – every one to two weeks, due to chlorine being used in the pressure filter influent.

5.5 *Solids Disposal*

The only solids disposal will be from the packaged treatment unit which removes solids from the pressure filter and GAC backwash flows. The solids flow is routed to a sewer.

5.6 *Start-up of Wells*

When any of the wells are returned to service after not being used for an extended period of time (e.g., greater than 2 months, possibly due to maintenance or repair), the initial 30 minutes of flow will usually contain elevated levels of suspended solids. Due to restrictions on surface discharge (due to volatile and other contaminants), this start-up flow is plumbed to the Backwash Recovery Tank. It will be treated by the Package Treatment Unit to remove solids, and recycled into the Raw Water Equalization Tank. When this occurs, the production through the Treatment Facility will need to be lowered, so that the backwash volume from greensand filters is lessened, to allow this first flush from the well to be treated.

The valves which direct well flow to either the Raw Water Equalization Tank or Backwash Recovery Tank are manual valves.

5.7 *Draining of Underground Tanks*

The following procedures will be used for draining the underground storage tanks for maintenance or inspection.

5.7.1 Raw Water Equalization Tank

This tank contains a sump pump for drainage. The volume to drain could be as much as the total volume (58,500 gallons) or, if the Pressure Filter Feed Pumps are operated until the low tank level triggers a pump shut-down, the volume to drain will be the remainder of water below the low-level indicator. This remaining volume will be delivered to the sewer, because it potentially contains MTBE, selenium, and other volatile compounds.

5.7.2 Backwash Recovery Tank

This tank is drained by first pumping as much volume from the tank into the packaged treatment unit. Recessed submersible pumps will drain water to below the main floor surface of the tank.

5.7.3 Filtered Water Tank

This tank contains a sump pump for drainage. The tank should be drained down until the low tank level switch triggers a process pump shutdown. The sump pump should be used to drain the remainder of the water below the low-level switch. This remaining volume will be delivered to the sewer as it has the potential to contain selenium.

6.0 Abnormal Operation

The following sections outline procedures or troubleshooting for abnormal operating conditions.

6.1 *Increased GAC Effluent Turbidity*

There will be one turbidity meter (C-GAC-AIT-1101) on the combined effluent header from the five GAC treatment trains. The turbidity should be < 1 NTU. As a biomass develops on the GAC, some sloughing of biomass may occur and would likely appear as turbidity. Operations staff should monitor the turbidity and if it exceeds 1 NTU, or increases above a baseline level (which could be less than 1 NTU, and would be determined at start-up), then samples should be collected to determine the source of the problem.

The effluent of each vessel should be sampled and analyzed for turbidity. This will help to identify if the problem is occurring in a single vessel, a single train, or throughout the five trains. For any vessel with elevated effluent turbidity, additional sampling should be conducted to ascertain: 1) the presence/absence of total coliforms; 2) heterotrophic plate counts (HPCs) ; 3) dissolved oxygen (DO) concentration; 4) pH; and, 5) temperature. Total coliforms should be absent, but HPCs will be high (levels in the tens of thousands are not uncommon). The rule-of-thumb for dissolved oxygen is that it should be between 3 and 5 mg/L entering the GAC vessel, and above 0 mg/L in the GAC effluent.

There are several options to help correct the elevated turbidity levels: 1) backwash the GAC vessel(s), and reduce the frequency between routine vessel backwashes; 2) allow chlorinated water to be treated through the GAC for 24 hours; or, 3) backwash the GAC with chlorinated water (i.e., by increasing the chlorine concentration in wells 16 and 18, which feed the Filtered Water Tank, or by feeding chlorine into the backwash water). Note that biological degradation in the GAC vessels will be the mechanism for TBA removal, so any chlorination of the GAC (options 2 and 3 above) will disrupt the biogrowth and could possibly impact subsequent TBA removal.

Backwashing with regular procedures should be the first operation to be performed. If it does not lower the finished water turbidity, the dissolved oxygen should be checked, and then one of the chlorine options could be initiated. GAC consumes chlorine, so its addition will cause only temporary and partial removal/control of biogrowth, but it will also affect the performance of GAC for organics adsorption. If none of these procedures is effective, the GAC in the vessel could be replaced.

Note that there are taps on the GAC vessels to allow sampling throughout the depth of the media. Biological and DO samples could be taken from these taps to identify if the problem is throughout the depth of the media, or in a specific layer of the bed.

6.2 Increased Chlorine Demand

6.2.1 Raw Water Chlorine Demand

If the chlorine demand of the raw water increases, the chlorine dose to each individual well can be increased so that the blended water in the Raw Water Equalization Tank has sufficient chlorine for manganese oxidation. Manual sample taps can be used to verify chlorine residuals for each individual well (C-RW-VBM-1003, C-RW-VBM-1103, C-RW-VBM-1203, C-RW-VBM-1303, C-RW-VBM-1403).

To check the concentration of chlorine in the Raw Water Equalization Tank, manual samples can be taken from the tank, from the manual sample tap that is upstream of hypochlorite addition. Alternatively, the hypochlorite dosing pumps can be terminated briefly to allow the downstream chlorine analyzer to record the chlorine residual, or manual samples could be collected from the turbidity meter (C-RW-AIT-1006).

6.2.2 Raw Water Equalization Tank Chlorine Demand

If the chlorine demand at the feed to the greensand Pressure Filters is higher than usual or increasing over time, the Operator should check to see if: 1) the wells are being dosed with enough chlorine, and 2) sodium bisulfite (SB) is being overfed upstream of the GAC.

SB is a dechlorinating agent, and a portion of flow containing SB is recycled through backwashing and backwash treatment to the head of the plant. As a result, water in the Filtered Water Tank could contain elevated SB, which would create a higher chlorine demand for the filtered water chlorine feed point (fed by pump C-NOCL-PPS-6001, see also 6.2.3 below), as well as in the pre-greensand feed point (fed by pump C-NOCL-PPS-4001).

The SB feed point is set to be 1.5 times the chlorine residual of the greensand inlet (C-RW-AIT-1005), and automatically adjusted if chlorine is detected at the chlorine analyzer (C-GAC-AIT-1001) upstream of the GAC vessels. The Operator should check that the SB feed is close to 1.5 times the chlorine residual to quench, and not an elevated dose rate.

6.2.3 Filtered Water Chlorine Demand

If the chlorine demand of the Filtered Water Tank effluent (fed by pump C-NOCL-PPS-6001) is elevated or increasing, it could be a result of an overfeed of the SB system. Refer to section 6.2.2 for information regarding checking the SB dose.

6.3 Increased Sodium Bisulfite Usage

Sodium bisulfite (SB) is used to quench the chlorine residual upstream of the GAC vessels. In general, about 1.5 parts of SB are required for every part of chlorine to quench. If the SB usage is increasing, the residual chlorine level must also be increasing. Operators should check the level of chlorine dosing in Wells 13, 15, and 19, as well as in the pretreatment to the Greensand Filters.

Once operational, the Greensand Filters should exert very little chlorine demand, so the chlorine residual (C-RW-AIT-1005) upstream of the filters should be nearly equal to the desired residual in the Greensand Filter effluent. Note that pilot testing showed that a chlorine residual of about 1.0 mg/L was optimal for iron and manganese removal upstream of reverse osmosis membranes such as at Arcadia WTP, but a lower chlorine dosage (e.g., 0.5 mg/L) may provide enough manganese and iron removal for GAC vessels. Note that verification of a chlorine residual downstream of the filters is a manual sample that should be collected at least weekly.

6.4 Increased Iron and/or Manganese in Greensand Filter Effluent

Iron and manganese are removed at the Charnock site by oxidation, which begins in the wells and through the Raw Water Equalization Tank, followed by physical removal by filtration on the Greensand Filters. As the filters operate, iron and manganese (but usually manganese first) will break through the filters and eventually exceed an allowable level (i.e. 0.05 mg/L manganese). When this occurs, the filter is backwashed, and acceptable iron/manganese removal resumes.

Backwashing the filter would be the first operational procedure to try. If the water quality after backwashing is not acceptable, the backwashing procedure should be investigated. This includes checking the air and water flow rates, and backwash duration. If possible, a visual inspection of the filter vessel should be made to identify any possible cause of uneven flow distribution during backwashing.

If the filter run time (FRT) is decreasing (which also means that the frequency of backwashing is increasing), the oxidation chemistry upstream should be investigated. During the pilot study, a 24 hour backwash frequency was needed to achieve acceptable water quality for downstream RO. However, for the Charnock facility, where there will be a higher tolerance for manganese in the greensand filtrate, backwashing may be required at longer intervals. The upstream oxidation chemistry can be modified by adjusting either the chlorine dose applied at the wells, or the chlorine dose applied upstream of the Greensand Filters.

If backwashing and upstream chemistry appear to be working properly, Operators should consider a reactivation of the greensand media. This is typically necessary only every 5 to 10 years; however, as a troubleshooting measure, it can be performed to see if iron and manganese removal improves afterwards. The activation procedures are discussed later in this chapter.

6.5 Increased GAC Differential Pressure

The particle load entering the GAC vessels will be very low, because the Greensand Filters are removing iron, manganese, and other particles upstream of the GAC vessels. Over time however, even the low particle load will cause the differential pressure to increase, and the GAC vessel will require backwashing.

It is also possible that biogrowth within the vessel is contributing to a higher headloss, and thus a higher pressure differential. To verify this, check the turbidity and HPCs of the effluent from the vessel. Elevated turbidity and HPCs would indicate a possible excessive biogrowth within the vessel.

The first operational procedure would be to backwash the vessel. If the differential pressure is not much improved, operations staff can introduce chlorine to the GAC vessels (either in the feed water or in the backwash water) as described in Section 6.1.

6.6 Standby Power Facilities

A possible abnormal operation for the Charnock electrical system is upon loss of utility power. In this event, the Automatic Transfer Switch will detect the loss of utility power, signal the generator to start, and transfer Plant load to the generator. When utility power is available, the Automatic Transfer Switch will transfer Plant load back to the utility service and signal the generator to shutdown.

6.7 Activation of Greensand Filter Media

The greensand layer in the Pressure Filers has a manganese dioxide coating that may require re-activation periodically (e.g. every 5 to 10 years) to maintain satisfactory performance for iron and manganese removal. Likewise, when greensand is new and installed into a filter, the activation procedure must be performed.

Activation is accomplished by soaking (for a minimum of 4 hours) the media in an oxidized solution. This can be of either free chlorine or potassium permanganate. During the pilot study of 2008, free chlorine was used for the activation of the pilot filter greensand media, and the system performed well. One benefit of free chlorine is that it can be neutralized and disposed of easily, whereas potassium permanganate will contain manganese solids when it is neutralized.

Check with the supplier of the greensand to verify proper regeneration procedures, but an example is shown below for reference.

Each filter cell contains 18 inches of greensand. The volume of greensand is approximately 342 cubic feet. For example, the Inversand Company, which supplies greensand, recommends a chlorine solution of 50 gallons of 6% bleach for every 100 cubic feet of media, or 20 gallons of 15% bleach for every 100 cubic feet of media. This equates to approximately 171 gallons of 6% bleach or 69 gallons of 15% bleach.

Backwash and then shutdown the filter cell that will be activated or reactivated. The vessel should be nearly full of water. Open the hatch on the pressure vessel cell and transfer the chemical solution into the water above the media. Next, open the effluent valve to allow the chlorinated water to slowly move through the filter media. Care should be taken not to expose the media in this step. When a chlorine residual is detected in the effluent, close the valve and let the cell soak for at least 4 hours. Backwash the pressure vessel filter cell. The highly chlorinated water will enter the Backwash Recovery Tank, and be pumped up to the backwash recovery plate settler. This flow can be wasted to the sewer through the plate settler sludge hopper connection, or recycled to the head of the Plant.

If the chlorinated backwash is recycled to the head of the Plant for treatment, the chemical dosing within the Plant (i.e. chlorine feed upstream of the pressure vessels and SB upstream of the GAC) will be affected until it has passed through the system.

6.8 Loss of Pressure Filter Media

It is not uncommon to observe losses of filter media over time as the system operates. The losses are typically in the backwash flow. A filter inspection should be conducted:

1. If media loss is occurring, it will be detected by observing media in the tank during tank drain-down of the Backwash Recovery Tank. If this occurs, the backwash rate and air flow rate should be checked and adjusted to minimize media carryover.
2. After first six months of operation; a service company can conduct inspections to determine the media depth.
3. Every 2 to 5 years if filter operation appears to be normal.

Note that these procedures would also apply to the GAC media. However, the backwash frequency is expected to be much less than the backwash frequency for the filter media, and thus media losses are not expected.

6.9 Optimizing PACl Dosing for Backwash Water Treatment

If the turbidity of the backwash plate settler system is high (i.e. > 2 NTU), the Operator should adjust the coagulant dosage. The coagulant is polyaluminum chloride (PACl), and the adjustment may be higher or lower than the current dosing level.

A jar test can be used to identify the optimum PACl dosage. Water from the Backwash Recovery Tank should be collected and poured into the jars for the test. Usually, there are 2-liter jars for jar tests. These are then mixed to replicate rapid mixing (15 seconds at the maximum stirrer speed) followed by flocculation (5 minutes and ranging from between 15 and 60 rpm). A jar test (possibly more than one) should first be performed to try to mimic what is happening in the full-scale plate settler system. For example, mixer speeds should be adjusted so that the water quality at the applied PACl dose at the end of the jar test matches the water quality of the plate settler effluent. A settling time of 8.3 minutes (based on a 0.3 gpm/sf loading rate and 10 cm settling height in the jar relative to the sample extraction point) should be allowed in the jars to replicate the plate settler sedimentation process.

Once the mixer settings for speed are known for the system, the PACl dose can be adjusted to identify the optimum dose for achieving the lowest settled water turbidity. The full-scale PACl dosing system can then be adjusted.

7.0 Process and Water Quality Monitoring

This Chapter outlines the various types of monitoring to be conducted by the operations staff. Note that much of the monitoring is for operations and process control, but some regulatory monitoring is required for this site because of the potential MTBE and TBA contamination.

7.1 Operating and Monitoring Records

Operating and monitoring records are necessary to document treatment settings and performance, such that future evaluations and decisions can be based on historical operating data. Most operating data is collected automatically via the SCADA system, and reports are generated electronically. There are some manual records that are required.

Operations data that are automatically collected are listed in Table 7-1.

Table 7-1.
Automated On-Line Sampling at the Charnock Facility

Parameter	Units	Location
RAW WATER		
Well Flow (13, 15, 16, 18, 19)	gpm	C-RW-FIT-1001, C-RW-FIT-1002, C-RW-FIT-1003, C-RW-FIT-1004, C-RW-FIT-1005
PRESSURE FILTER INFLUENT FLOW		
Pressure Filter Influent flow	gpm	C-RW-FIT-1001
pH & Temperature	--/oC	C-RW-AIT-1004
Turbidity	NTU	C-RW-AIT-1006
Chlorine Residual	mg/L	C-RW-AIT-1005
PRESSURE FILTER EFFLUENT		
Turbidity (for each of 6 cells)	NTU	C-PF-AIT-1104, C-PF-AIT-1204, C-PF-AIT-2104, C-PF-AIT-2204, C-PF-AIT-3104, C-PF-AIT-3204
Flow from each cell	gpm	C-PF-FIT-1105, C-PF-FIT-1205, C-PF-FIT-2105, C-PF-FIT-2205, C-PF-FIT-3105, C-PF-FIT-3205
Differential Pressure on each cell	psi	C-PF-DPIT-1103, C-PF-DPIT-1203, C-PF-DPIT-2103, C-PF-DPIT-2203, C-PF-DPIT-3103, C-PF-DPIT-3203
GAC INFLUENT		
Chlorine residual	mg/L	C-GAC-AIT-1001
GAC VESSEL EFFLUENT		
Flow	gpm	C-GAC-FIT-1001, C-GAC-FIT-2001, C-GAC-FIT-3001, C-GAC-FIT-4001,

Parameter	Units	Location
		C-GAC-FIT-5001
Turbidity (combined flow)	NTU	C-GAC-AIT-1101
Differential Pressure on each vessel	psi	Vendor supplied
FILTERED WATER		
Flow	gpm	Existing flow meter
Chlorine Residual	mg/L	C-FLT-AIT-1011
BACKWASH FLOWS		
Pressure Vessel and GAC Vessel Backwash Flow	gpm	C-FLT-FIT-1101
Plate Settler Influent Flow	gpm	C-WW-FIT-1001
Plate Settler Solids Flow	gpm	C-WW-FIT-1002
Turbidity (recycle flow)	gpm	C-WW-AIT-1001

Other manual operation tasks at Charnock include:

1. Starting a well that has been off-line, and directing the first 30 minutes of well flow into the Backwash Recovery Tank.
2. Draining the tanks for cleaning, inspection, or maintenance of equipment.

An operations log book should document that these procedures have been performed, including the date, time, duration of the procedure, and outcomes.

7.2 Water Quality Monitoring

Water quality monitoring is necessary to track the performance of the Greensand Pressure Filter and GAC systems at the Charnock facility. Table 7-2 outlines the recommended process monitoring for the facility. The SCADA system will be used to store on-line monitoring data; however, site field samples, such as manual chlorine, pH, or turbidity measurements, should be documented in a field data book at the site.

7.2.1 Contaminant Monitoring

Table 7-2 displays the anticipated initial sampling frequency for contaminants at the Charnock and Arcadia facilities. The frequency and location of sampling may change as the Plant operates, so requirements should be checked with the water quality supervisor for the City.

Note that 'In-house' refers to the City's laboratory being used to monitor for some of the contaminants in Table 7-2. 'Contract' refers to a contract laboratory for sampling of these contaminants; they may require the use of the City's sampling bottles for analysis. The City should check with the Contract laboratory and plan ahead so that enough sample bottles are available, and that the proper chain of custody forms are completed with each sample.

Table 7-2.
Anticipated Initial Sampling Frequency for Contaminants at the Charnock and Arcadia Facilities

Parameter and Sampling Location	Regulatory or Process	Frequency	Laboratory / Turn-Around
MTBE			
Wells 13, 15, 19	Reg	Quarterly (1)	In-House / Standard
Wells 16, 18	Reg	Quarterly (1)	In-House / Standard
Combined influent	Process	As needed	Contract / As needed
Post lead GAC vessels	Process	Monthly/Weekly (2)	Contract / 7-day
Post lag GAC vessels	Process	Monthly	Contract / 7-day
Treated Charnock Water	Process	Monthly/Weekly (2)	Contract / 7-day
RO influent	Process	As needed	In-House / Standard
RO permeate	Process	As needed	In-House / Standard
Finished water	Reg	Weekly	In-House / Standard
TBA			
Wells 13, 15, 19	Reg	Quarterly (1)	Contract / 7day
Wells 16, 18	Reg	Quarterly (1)	Contract / 7-day
Combined influent	Process	As needed	Contract / As needed
Post lead GAC vessels	Process	Monthly/Weekly (2)	Contract / 7-day
Post lag GAC vessels	Process	Monthly	Contract / 7-day
Treated Charnock Water	Process	Monthly/Weekly (2)	Contract / 7-day
RO influent	Process	As needed	Contract / Standard
RO permeate	Process	As needed	Contract / Standard
Finished water	Reg	Monthly/Weekly (2)	Contract / 7-day
TDS (3)			
Wells 13, 15, 19, 16, 18	Process	Quarterly (1)	In-House / Standard
Santa Monica Wells	Process	Quarterly (1)	In-House / Standard
Arcadia Wells	Process	Quarterly (1)	In-House / Standard
RO influent	Process	Monthly	On-line / immediate
RO permeate	Process	Monthly	On-line / immediate
Finished water	Process	Weekly	On-line / immediate
Uranium			
Wells 13, 15, 19, 16, 18	Reg	Quarterly or less (4)	Contract/ Standard
RO influent	Process	As needed	Contract/ As needed
RO permeate	Process	As needed	Contract/ As needed
Finished water	Reg	Monthly	Contract/ Standard
Iron and Manganese			
Wells 13, 15, 19, 16, 18	Process	Quarterly (1)	In-House / Standard
Santa Monica Wells	Process	As needed	In-House / Standard
Arcadia Wells	Process	As needed	In-House / Standard
Charnock Pressure Filter Influent	Process	As needed	Field Kit /As Needed
Charnock Pressure Filter Effluent	Process	As needed	Field Kit /As Needed
Arcadia Pressure Filter Influent	Process	As needed	Field Kit /As Needed
Arcadia Pressure Filter Effluent	Process	As needed	Field Kit /As Needed

Parameter and Sampling Location	Regulatory or Process	Frequency	Laboratory / Turn-Around
RO influent	Process	As needed	Field Kit /As Needed
Finished water	Reg	Monthly	In-House / Standard
TCE (and 1,1-DCE)			
Wells 13, 15, 19, 16, 18	Reg	Quarterly (1)	In-House / Standard
Santa Monica Wells	Reg	Monthly (1)	In-House / Standard
5 MG Reservoir Inlet	Process	Weekly	In-House / Standard
Finished water	Reg	Weekly	In-House / Standard

(1) Monitoring increases to Monthly for those parameters that exceed an MCL. Monitoring is only done on wells that are in service during scheduled sampling events.
(2) Frequency will be Monthly until the first detection at any well; Weekly thereafter for as long as contaminant is detected in any Charnock well.
(3) Conductivity measurements will be used as a surrogate for TDS.
(4) Initial monitoring for four quarters for compliance with the Radionuclides Rule will be performed upon start-up of the Charnock Wells. Thereafter, ongoing monitoring will be performed as specified by Title 22 Section 64442 (i.e. Ave>MCL=quarterly monitoring).

Occasionally, filter water quality profiles should be performed to observe the performance of the Pressure Filters for iron and manganese removal. This filter profile involves measuring the total iron and manganese (and sometimes the dissolved species, if the City is trouble-shooting the system for poor iron and manganese removal) in the feed and filter effluent over an entire filter run time. An example would be to collect the raw and filtered samples at time zero after the initiation of a filter run, followed by measurements every 10 minutes until 30 minutes into the filter run, followed by measurements every 2 or so hours. Measurements should be continued until the iron and manganese concentrations have increased to unacceptable levels (e.g. <0.3 mg/L total iron, and <0.05 mg/L total manganese). These data should be documented in a log book or computer file to show filter performance over time. If the filers are performing well, and iron and manganese removal is satisfactory with filter run times being acceptable as well (i.e. > 24 hours), then filter profiles do not need to be performed.

One of the most important process monitoring steps for this facility is tracking the water quality with in the GAC vessels of each train. As outlined in Table 7-2, monitoring of MTBE and TBA will be monthly for the effluent of the lead and lag vessels until the contaminant is detected in the wells, and then the monitoring will be increased to weekly. Note that the detection of either of these contaminants in the GAC effluent of the lag vessel at concentrations greater than the treatment goals (i.e. <3 ug/L for MTBE, and < 2 ug/L for TBA) will warrant an immediate resampling and shutdown of that treatment train until sample analysis confirmation is made.

The California DPH may set an MTBE concentration that triggers when the GAC in the lead vessel will be the changed out, but this is not currently known. At meetings during 2009, DPH indicated that the lead vessel can be operated to near exhaustion prior to change out, and this is acceptable because there is a lag vessel as a second barrier. Exhaustion would be when the effluent concentration of MTBE is equal to the influent concentration of MTBE. A standard practice for the City will be, however, to change out the GAC once the concentration of water leaving the lead vessel is at 80 percent of the influent concentration.

TBA will be controlled differently. It is not removed by adsorption. It is removed by biodegradation within the GAC vessels. Removal will likely occur in both the lead and lab vessel. A high TBA concentration (> 2 ug/L) in the effluent of the lag vessel will trigger an investigation of the TBA removal throughout the Plant, and possible remedies, such as adjustments to raw water aeration, well field blends, bioactivity levels, and/or TBA-specific bio-inoculation for the GAC.

7.2.2 Continuous (On-Line) Water Quality Monitoring

The on-line instruments for the Charnock Facility include:

- Feed water to Pressure Filters: pH & temperature (C-RW-AIT 1004), turbidity (C-RW-AIT-1006), and free chlorine (C-RW-AIT-1005)
- Pressure Filter effluent: turbidity (C-PF-AIT-1104, C-PF-AIT-1204, C-PF-AIT-2104, C-PF-AIT-2204, C-PF-AIT-3104, C-PF-AIT-3204)
- GAC vessel common header inlet: chlorine residual (C-GAC-AIT-1001)
- GAC vessel common header outlet: turbidity (C-GAC-AIT-1101)
- Treated water leaving site: free chlorine (C-FLT-AIT-1011)
- Backwash recycle: turbidity (C-WW-AIT-1001)

Data from each should be stored via the SCADA system, such that it can be retrieved to view and trend the data, as desired.

Of the on-line monitors, one is directly linked to regulatory monitoring: GAC combined effluent turbidity (C-GAC-AIT-1101). DPH requested that the turbidity of the GAC effluent be monitored as a means of tracking the performance of the GAC vessels. High turbidity would be indicative of a problem, such as excessive biogrowth.

7.2.3 Bench or Field Sample Collection and Monitoring

Table 7-1 includes some bench or field sampling and monitoring for iron and manganese. It will be necessary to document the performance of the Pressure Filters for iron and manganese removal. During start-up and trouble-shooting, it may be necessary to monitor the total iron and manganese (and possibly the dissolved species as well) in the feed and filtered water over an entire filter run (e.g. every two hours over 24 hour period) to confirm filter performance. Once the filter run time which creates satisfactory water quality over the entire filter run is known, operations staff can set the equipment to operate with this backwash frequency.

Other bench or field tests include pH, turbidity, chlorine residual, and total chlorine residual.

7.2.4 Disinfectant Residual and CT

The biological GAC at the Charnock Wellfield location will require that the system provide at least 4.0 log virus inactivation of water treated by GAC, and this disinfection must occur downstream of the GAC contactors. The design includes chlorination in the Charnock Filtered

Water Tank, 3.4 miles of pipeline between the Charnock and Arcadia sites, the Arcadia WTP Contact Tank, Pressure Filters at the Arcadia site, and chloramination in the existing 5 MG reservoir at Arcadia.

The level of disinfection is determined by calculating the 'CT,' which is the chlorine concentration, C, multiplied by the contact time, T. The contact time must be adjusted for mixing with the use of a 'baffling factor', which is the ratio of contact time for 10 percent of the water passing to the theoretical contact time (i.e. T_{10}/T_{theo}). The baffling factor for a pipeline is 1.0, thus offering the most efficient disinfection contactor arrangement for CT. Based on the virus inactivation table of the Surface Water Treatment Rule, the required CT will be 4 mg-min/L for a water at 15 °C with pH between 6 and 9.

Although the pipeline between the two sites can provide enough CT for the required level of disinfection, the Pressure Filters at the Arcadia WTP will be used for calculating the CT for regulatory purposes. See the Arcadia Operations Manual, Chapter 7 for more information.

7.2.5 Calibration/ Verification Procedures

This procedure should be used to verify that the chemical feed pump is drawing the proper amount of chemical. The calibration column should be used with the following procedure:

1. Check that calibration column is empty and without scale or debris. Remove, clean, and reinstall if necessary.
2. Turn OFF only the pump that is being checked. The other pumps supplying chemicals can remain in operation.
3. Open the isolation valve to the calibration column for the pump being checked.
4. Allow the calibration column to fill with the chemical, but do not over fill.
5. Once the column is full close the skid isolation valve.
6. Note the "start" level of the chemical in the calibration column and begin timing as the pump to be tested is turned on.
7. Stop timing and check the level in the calibration column (the longer the time, the more accurate the reading will be).
8. Allow the remaining chemical to be pumped from the column.
9. Open the skid isolation valve and close the calibration column isolation valve.
10. Continue with normal operation.
11. To verify the chemical feed rate divide the amount of chemical by the elapsed time, e.g. if the calibration column is delineated into millilitres (ml) and 250 ml were pumped from the column in 30 seconds, the chemical feed rate would be 250ml/30 seconds = 8.3 ml/s. To convert units 8.3 ml/s*60*60/(1000*3.785) = 8 gallons per hour (gph).

12. Compare the calculated gph to the programmed feed rate for the pump and the feed rate indicated by the chemical flow meters.

8.0 Preventative Maintenance Program

Operating staff should consult the equipment manuals provided by the equipment supplier for preventative maintenance recommendations for each piece of equipment.

Standby Diesel Generator – TBD
Low Voltage Motor Control Centers – TBD
Control System and Instrumentation – Beavens Systems Inc
GAC System – Westech
Chemical Feed Equipment – Chem Flow
Submersible Mixers – JCI
Static Mixers – Mixtech
Pressure Filter Equipment – Westech
Tank Aeration System – Mazzei Injector Corporation
Packaged Water Treatment Unit – Meurer Research Inc.
FRP Tanks – Belding Tank Technologiers Inc
Equalization Pumps – Lee Mathews Equipment Inc
Backwash Supply Pumps – Lee Mathews Equipment Inc
Backwash Recovery Pumps – Lee Mathews Equipment Inc
Basin Drain Pumps – Lee Mathews Equipment Inc
Sodium Hypochlorite System – TBD
Sodium Bisulfite System – TBD
Polyaluminum Chloride System – TBD

9.0 Safety

There are many elements to a safety program for a water treatment system. This section highlights those safety areas related to process equipment and procedures.

9.1 General Guidelines

The WTP is designed with safety in mind, however mechanical dangers, hazards and chemical exposure exist that may cause injuries or death if proper precautions are not taken while working on or around the WTP equipment. Only trained and experienced maintenance and operations personnel who are familiar with the WTP equipment should be allowed to operate and maintain the facility.

The following are some of the many precautions that should be taken when working within the WTP facility:

- The WTP can be a wet environment and care should be taken to avoid slips. Ensure handrails are used. Post warning signs whenever such conditions are first noticed and resolve them at the earliest opportunity.
- The WTP employs several chemicals that can be hazardous and Operators should review MSDS's to ensure the proper precautions are taken. Rope off and contain any spills and follow the City's chemical spill procedure. Immediately notify your Supervisor should a spill pose personnel and/or environmental hazards. All chemicals are stored with secondary containment.
- The City's Electrical Safety Procedure should be followed when working around the WTP equipment and components. Prior to working on WTP equipment never assume that the tagging procedure has been properly conducted: perform your own checks and test.
- Some WTP systems operate with high pressure air, water, and oil sub-systems. Never open a vent or drain valve or open a flange connection unless it is proven that the pressure source has been shutdown and the pressure has dissipated.
- Several WTP components and tanks are designated as Confined Spaces. Ensure that you get a Confined Space Permit and follow proper Confined Space Procedures prior to, and during, maintenance.
- Notify the plant Supervisor should you notice any potential safety hazards in or around the WTP.

- For emergency showers and eyewash stations to be effective, the American National Standards Institute (ANSI) Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-2004) recommends that the affected body part must be flushed immediately and thoroughly for at least 15 minutes using a large supply of clean fluid under low pressure. Water does not neutralize contaminants -- it only dilutes and washes them away. This fact is why large amounts of water are needed.

  However, other references recommend a minimum 20-minute flushing period if the nature of the contaminant is not known. The flushing or rinsing time can be modified if the identity and properties of the chemical are known. For example:

  - a minimum 5-minute flushing time is recommended for mildly irritating chemicals,
  - at least 20 minutes for moderate-to-severe irritants,
  - 20 minutes for non-penetrating corrosives, and
  - at least 60 minutes for penetrating corrosives.

  Review the MSDS before you enter the particular WTP hazardous chemical area for emergency shower and eyewash requirements to determine wash time periods.

10.0 Staffing Plan

Staff for both the Charnock and Arcadia facilities will be primarily be based at the Arcadia WTP. Gary Richinick, Supervisor, resides on the property of the Arcadia WTP, and provides a rapid response to any alarms. John Watts also resides on the property and provides a rapid response to operational needs.

Operation of the Charnock equipment can be conducted remotely from the Arcadia site; however, weekly or more on-site inspections and sampling events will be conducted. During start-up, daily site visits and sampling events will be needed to determine chemical dosing for proper stable operation.

The table on the following page outlines the staff for the treatment system.

City of Santa Monica
Water Production and Treatment Operations Staff

	Position	Treatment Grade	Distribution Grade	Hours	Home Phone	Cell Phone	Distance from WTP
Cardenas, Myriam	Assistant Manager	T4 #12794	D5 #14585	M-Th 7am-5:30 pm	(310) 543-5226	(310) 621-8835	17 mi
Richinick, Gary	Supervisor	T4 #22490	D5 #9352	Tu-F 7am-5:30 pm	(310) 979-4554	(213) 709-1888	.1 mi
Arroyo, Abel	Operator	T3 #24569	D2 #34287	Various	(661) 723-6651	(661) 433-9169	65 mi
Bussart, Randy	Operator	T3 #27880	D4 #18896	Various	None	(707) 761-0187	5 mi
Milton, Eddie	Operator	T3 #24816	D4 #18896	Various	(323) 934-0349	(323) 934-0349	7 mi
Noriega, Abel	Operator	T2 #22479	D2 #27487	M-Th 7am-5:30 pm	(661) 267-2336	(661) 435-7164	60 mi
Paxman, Gary	Operator	T3 #15582	D4 #3135	Various	(805) 526-0131	(805) 526-0131	31 mi
Watts, John	Operator	T4 #17232	D5 #6303	Sa-Tu 7am-5:30 pm	(424) 832-3316	(424) 832-3316	.1 mi

revised 11/24/09

11.0 Emergency Procedures and Contacts

11.1 Emergency Procedures

11.1.2 Power Outages

TBD

11.1.3 Earthquakes

TBD

11.1.4 Chemical Spill

TBD

11.1.5 Fire

TBD

11.2 Emergency Contacts

The following page contains the emergency contacts for the City of Santa Monica.

State of California—Health and Human Services Agency

California Department of Public Health

CDPH

MARK B HORTON, MD, MSPH
Director

ARNOLD SCHWARZENEGGER
Governor

WATER QUALITY EMERGENCY NOTIFICATION PLAN

Name of Utility: City of Santa Monica/ Water Resources

Physical Location/Address: 1212 5th St., Santa Monica, CA 90404

The following persons have been designated to implement the plan upon notification by the State Department of Public Health that an imminent danger to the health of the water users exists:

	Water Utility: Contact Name & Title	Email Address	Telephone Day	Evening	Cell
1.	Myriam Cardenas/ Acting Water Prod. & Treatment Superintendent	myriam.cardenas@smgov.net	310 826-6712 310 434-2659	310 543-5225	310 621-8835
2.	Gary Richinick/ Acting Water Treatment Plant Supervisor	gary.richinick@smgov.net	310 434-2660	310 979-4554	213 709-1888
3.	Jeffrey Moss/ Water Chemist	jeffrey.moss@smgov.net	310 434-2658	661 250-7564	818 426-5804

The implementation of the plan will be carried out with the following State and County Health Department personnel:

	State & County Health Departments: Contact Name & Title	Telephone Day	Evening
1.	Stefan Cajina, P.E., District Engineer California Department of Public Health	(213) 580-3127 Fax (213) 580-5711	H (323) 259-5069 M (213) 210-6810
2.	Grazyna Newton, P.E., Associate Sanitary Engineer Sutida Bergquist, P.E., Associate Sanitary Engineer James Ko, P.E., Associate Sanitary Engineer Milagros Alora, Sanitary Engineer Jim Jablonski, P.E., Associate Sanitary Engineer California Department of Public Health	(213) 580-5734 (213) 580-3126 (213) 977-6808 (213) 580-5726 (213) 580-5709	(818) 349-7960 (562) 493-2175 (626) 447-9477 (818) 993-9351 (949) 786-0733
3.	Alfonso Medina, Director Mihue Shur, Chief of Small Water Systems Program Bureau of Environmental Protection County Environmental Health Department Local Primacy Agency 5050 Commerce Drive Baldwin Park, CA 91706-1423	(626) 430-5280 (626) 430-5420	Emergency Operator (213) 974-1234

4. If the above personnel cannot be reached, contact:

Office of Emergency Services Warning Center (24 hrs) (800) 852-7550 or (916) 845-8911
When reporting a water quality emergency to the Warning Center, please ask for the California Department of Public Health – Drinking Water Program Duty Officer.

NOTIFICATION PLAN

Attach a written description of the method or combination of methods to be used (radio, television, door-to-door, sound truck, etc.) to notify customers in an emergency. For each section of your plan give an estimate of the time required, necessary personnel, estimated coverage, etc. Consideration must be given to special organizations (such as schools), non-English speaking groups, and outlying water users. Ensure that the notification procedures you describe are practical and that you will be able to actually implement them in the event of an emergency. Examples of notification plans are attached for large, medium and small communities.

Report prepared by:

Signature and Title _______________ Date _______________

Southern California Drinking Water Field Operations Branch, Southern California Section
1449 West Temple St., Room 202, Los Angeles, CA 90026
Telephone: (213)580-5723 Fax: (213)580-5711
Internet Address: www.cdph.ca.gov

City of Santa Monica

Charnock Wellfield Restoration Project

Operations Plan - Arcadia

Prepared by
Black & Veatch Corporation
December 10, 2009

B&V Project 160823

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1.0 Introduction

The City of Santa Monica (City) is undertaking the Charnock Well Field Restoration Project (Project). The Project is to fully restore local groundwater supplies, to reduce the use of imported water from Northern California and the Colorado River, and to meet sustainability objectives. System Operations and the Project's key components include: pre-treatment facilities at the Charnock Well Field and additional water treatment at the Santa Monica Water Treatment Plant (SMWTP), also referred to as the Arcadia Water Treatment Plant (Arcadia WTP).

1.1 Report Purpose

This Operations Plan identifies the raw water quality, treatment process, monitoring system, the control systems, the equipment operations, and startup and shutdown procedures for the Arcadia WTP.

1.2 Project Overview

The Charnock Well Field has been used as a source of water for potable service since 1924. In 1996, the Charnock Well Field was found to be contaminated with methyl tertiary-butyl ether (MTBE), a gasoline compound. The source of the gasoline compound was leakage from underground storage tanks at gasoline service stations located south of the well field. The wells were shut down and subsurface investigations and source remediation analyses were undertaken. The well field is considered an extremely impaired water source by the California Department of Public Health (DPH). The loss of the Charnock Well Field supply caused the City to increase the amount of imported water purchased from Metropolitan Water District of Southern California (MWD) to approximately 85 percent of its total consumption.

DPH has approved Granular Activated Carbon (GAC) for the treatment of drinking water contaminated with MTBE and tertiary-butyl alcohol (TBA). In 1996, at the time of the well field shutdown, TBA was not detected in any of the production wells. Since then, TBA has been detected in the regional groundwater monitoring wells surrounding the site, as well as in one unconfirmed sample collected from well 15 in 2008 (at a concentration of 2.2 μg/L, which is just above the lab's method detection limit of 2 μg/L).

The City also owns and operates the Arcadia WTP, which has an existing treatment capacity of 14 million gallons per day (mgd). The water treatment facilities were originally designed to reduce water hardness and to remove iron, manganese, and trichloroethylene (TCE). The ion exchange (IX) softening beds and associated brine facilities have not been used for a number of years and have now been demolished. The original treatment processes and structures that remain at the existing WTP therefore comprise gas chlorination facilities, a 5 million gallon (MG) potable water reservoir, booster pump station, lab/workshop and main office. The reservoir contains mechanical aerators for Volatile Organic Compound (VOC) removal, with an associated off-gas scrubbing system.

Both the Charnock and Arcadia sites are located in the city of Los Angeles.

The Charnock Well Field sends water approximately 3.4 miles via a pipeline to the Arcadia WTP for treatment and entry into the distribution system. Along that pipeline, there is a single MWD connection and input of additional ground water from the Olympic Well Field (also referred to as Santa Monica Wells). The Arcadia Wells, located on the WTP site, also contribute to the incoming groundwater.

As part of this Project, the Charnock Well Field is to be returned to full production, with the installation of a well head treatment system. The treatment system to be constructed at the well field comprises GAC adsorption to treat water from three (3) contaminated wells. The treated water will be combined with water from two (2) non-contaminated wells, and the combined flow will be pumped to the Arcadia WTP. The water treatment facilities at the Arcadia WTP will be upgraded to include a Reverse Osmosis (RO) softening system, with the existing reservoir aeration system continuing to remove TCE before the finished water is put into distribution. Evaluations of the sustainable production capacity of the City's well field have been carried out by WorleyParsons Komex, with the recommendation that the upgraded Arcadia WTP be designed for a maximum flow of 10.0 mgd.

2.0 Source of Supply

2.1 Well Field and Treated Water

Groundwater for treatment and subsequent boosting into the distribution system is received at Arcadia WTP via the Charnock Pipeline. Along the pipeline, there is a single MWD connection (MWD Feeder #2) and connections to the Santa Monica Wells. The Arcadia Wells also discharge into the Charnock Pipeline where it enters the WTP site.

The Charnock Pipeline enters the Arcadia site in the southwest corner, along S. Bundy Drive. The pipeline has an existing connection to the reservoir. Prior to recent structural demolition work, there was also a connection to the contact tank upstream of the IX softening beds. As part of this Project, the pipe will be diverted and a connection will be made to the new RO softening plant. In a similar way to the original plant, the treated water from the RO softening plant will then enter the reservoir, where it will be aerated to remove volatile organics. In addition to mechanical mixers, the reservoir is baffled to provide a serpentine flow. A riser pipe at the inlet ensures that when the water surface is low, the influent water cascades into the reservoir. Downstream of the baffling, there is a chlorine gas feed point.

There are two outlets from the reservoir: one outlet passes water to booster pumps to supply the 350 foot distribution zone, and potable water from the second outlet flows by gravity directly to the 250 foot zone.

As discussed, MWD Feeder #2 is also connected to the Charnock pipeline. Treated MWD water can be directly routed to the reservoir for storage if the wells are off line. During normal operation the reservoir is fed by treated water from the Arcadia WTP and not MWD Feeder #2.

The water to be treated at the Arcadia WTP will therefore comprise a blend of the following:

- Charnock Treatment Facilities treated water (Wells 13, 15 and 19)
- Charnock Wells 16, 18
- Santa Monica Wells 3, 4
- Arcadia Wells 4, 5

Due to aquifer drawdown levels and pump interference, the Arcadia Wells are operated on a duty/standby basis.

It should be noted that MWD Feeder #1 also enters the Arcadia WTP site from the southwest. This pipeline contains fully treated water and is directly connected to the City's 500 foot zone without being treated in the WTP.

2.2 *Raw Water Quality*

Feed water at the Arcadia WTP will be received from the Charnock Well Field treatment facility, Santa Monica Wells and Arcadia Wells. Although water from the Charnock Well Field will have received treatment to remove iron and manganese, the downstream Santa Monica and Arcadia Wells also contain iron and manganese and receive no specific treatment prior to entering the WTP. However, each well can be chlorinated in the well casing to control biological growth and to help maintain production. As a result of this chlorination, iron and some of the manganese will be oxidized prior to reaching the treatment facility.

Table 2-1 summarizes the blended water quality that will be treated at the Arcadia WTP.

Table 2-1
Water Quality of Feed Water to the Arcadia WTP

Characteristic	Units	DPH Primary or Secondary Limit	Value
Conductivity	Umho/cm	--	1,134
pH	--	--	7.3
Total Dissolved Solids (TDS)	mg/l	500 (SMCL)	781
Turbidity	NTU	5	7.2
Alkalinity	mg/l*	--	322
Chloride	mg/l	250 (SMCL)	72
Fluoride	mg/l	2	0.18
Sulfate	mg/l	250 (SMCL)	206
Nitrate, as NO_3	mg/l	45	2.3
Dissolved Organic Carbon	mg/l	--	<0.5
Total Organic Carbon	mg/l	--	<0.5
Calcium	mg/l	--	119
Iron	mg/l	0.3 (SMCL)	0.28
Magnesium	mg/l	--	50.6
Hardness	mg/l*	--	500
Potassium	mg/l	--	2.6
Silica, total	mg/l	--	35
Sodium	mg/l	--	71
Aluminum	mg/l	1 (MCL) 0.2 (SMCL)	0.013
Barium	mg/l	1	0.057
Manganese	µg/l	50 (SMCL)	31.6
Strontium	µg/l	--	824
Radium – 226	pCi/l	--	ND
Radium – 228	pCi/l	--	ND
Radium – 226 + Radium - 228	pCi/l	5	ND
Strontium – 90	pCi/l	8	ND
Tritium	pCi/l	20,000	ND
Uranium	pCi/l	20	16.9
Gross Alpha	pCi/l	15	12.8
1,1 Dichloroethylene (1,1-DCE)	µg/l	6	3

Characteristic	Units	DPH Primary or Secondary Limit	Value
tert-Butyl alcohol (TBA)	µg/l	12‡	<2
Methyl-t-butyl ether (MTBE)	µg/l	13 (MCL) 5 (SMCL)	<3
Tetrachloroethlyene (PCE)	µg/l	5	2.1
Trichloroethylene (TCE)	µg/l	5	4.8
* mg/l as $CaCO_3$ ‡ a notification level			

Sampling of the wells during the summer of 2008 revealed elevated concentrations of uranium and gross alpha (Table 2-2). Note that only the concentrations in Well #19 appear to be above the respective Maximum Contaminant Level (MCL). Blending with the other Santa Monica Wells will lower the concentration of the radionuclides to values less than the MCL at the Arcadia WTP. Furthermore, RO is a best available technology for uranium and gross alpha. The new RO System at the Arcadia WTP will therefore remove the radionuclides, which will be concentrated in the waste stream.

Table 2-2
Uranium and Gross Alpha Concentration in Santa Monica Wells

	Uranium (pCi/l)	Gross Alpha (pCi/l)
DPH MCL	20	15
Well #13	13	3.5
Well #15	9.4	10
Well #16	9.4	4.0
Well #18	<0.7	8.4
Well #19 (resampled 9/10/08)	67 74	39.2 52
Arcadia Well #4	NA	NA
Arcadia Well #5	NA	NA
Santa Monica Well #4	NA	NA

3.0 Water Treatment Facilities

The two main processes that will be installed at the Arcadia WTP are greensand filtration to remove iron and manganese, and RO for softening. A portion of the water treated by greensand filtration will bypass the RO treatment and will be blended with the RO-treated permeate.

The treatment facilities at Arcadia WTP will include:

- Raw Water Inlet (with pre-chlorination)
- Contact Tank and Filter Feed Pump Station
- Greensand Pressure Filters
- Backwash Holding Tank and Pump Station
- Washwater Recovery System
- Reverse Osmosis Feed Tank and Pump Station
- Reverse Osmosis Membrane and Clean-in-Place Systems
- Decarbonators
- Chemical Storage and Feed Systems

The main purpose of the Pressure Filters will be to remove iron and manganese from the feed water to protect the RO membranes. Although the concentrations of iron and manganese in the blended water arriving at the Arcadia WTP will be less than the secondary MCL (0.3 mg/l and 0.05 mg/l respectively), iron and manganese oxide particles can foul RO membranes by deposition on the membrane surface. Iron and manganese will be removed through oxidation (in this case using sodium hypochlorite) and filtration. A pre-oxidant chlorine dose applied at the upstream Raw Water Inlet Vault will be followed by 15 minutes hydraulic detention within a baffled Contact Tank. This will allow adequate chlorine contact time for iron and partial manganese oxidation prior to filtration. The pre-oxidant chlorine dose will be adequate to maintain a free chlorine residual across the filters and continuously regenerate the greensand media.

The Filter Complex will be an above-grade, outdoor facility, consisting of six pressure filter vessels. Each filter will be divided into two, independently-operating cells. The filter vessels will be located on partially buried concrete tanks. These tanks will support the filtration system by providing: 1) contact time for iron and manganese oxidation; 2) collection of filtered water for backwash supply; and 3) collection of filtered, dechlorinated water for RO feed. Spent washwater from filter backwashing will be collected in an adjacent partially buried tank. A package lamella unit located above the tank will allow consolidation of the backwash solids and recovery of settled washwater, which will be returned to the head of the Plant.

Cartridge filters upstream of the RO system serve to protect the membranes by capturing any particulates that may be in the feed water. The cartridge filters for the RO feed water will be located above grade adjacent to the filter complex.

The RO softening facility will be enclosed in a building that will house four (4) RO trains. During normal operation, all of the pressure filters and three (3) of the RO skids will be in operation. The supporting RO clean-in-place (CIP) facility, used to maintain the RO membranes, will be located adjacent to the RO building. Two (2) Decarbonators, in combination with sodium hydroxide dosing, will be used to adjust the pH of the blended RO softened water and bypass water to suit the distribution system.

A covered chemical storage and feed area will house the chemical tanks and metering pumps required to add a pre-oxidation sodium hypochlorite dose upstream of the pressure filters, dechlorinate the RO feed water, provide chemicals for additional pH control, supply anti-scalant to the RO membranes and disinfect the finished water with ammonium sulfate in conjunction with sodium hypochlorite to create chloramines. Fluoride, in the form of sodium fluoride, will be stored, made up and dosed from a separate, enclosed building.

Treated water will be collected in the existing 5 million gallon reservoir, which feeds the 350 foot and the 250 foot pressure zones. As part of this project, new sample pumps and analyzers will be provided to sample the potable water from the outlets of the existing reservoir into distribution.

A 3-D rendering of the new facilities is shown in Figure 3-1.

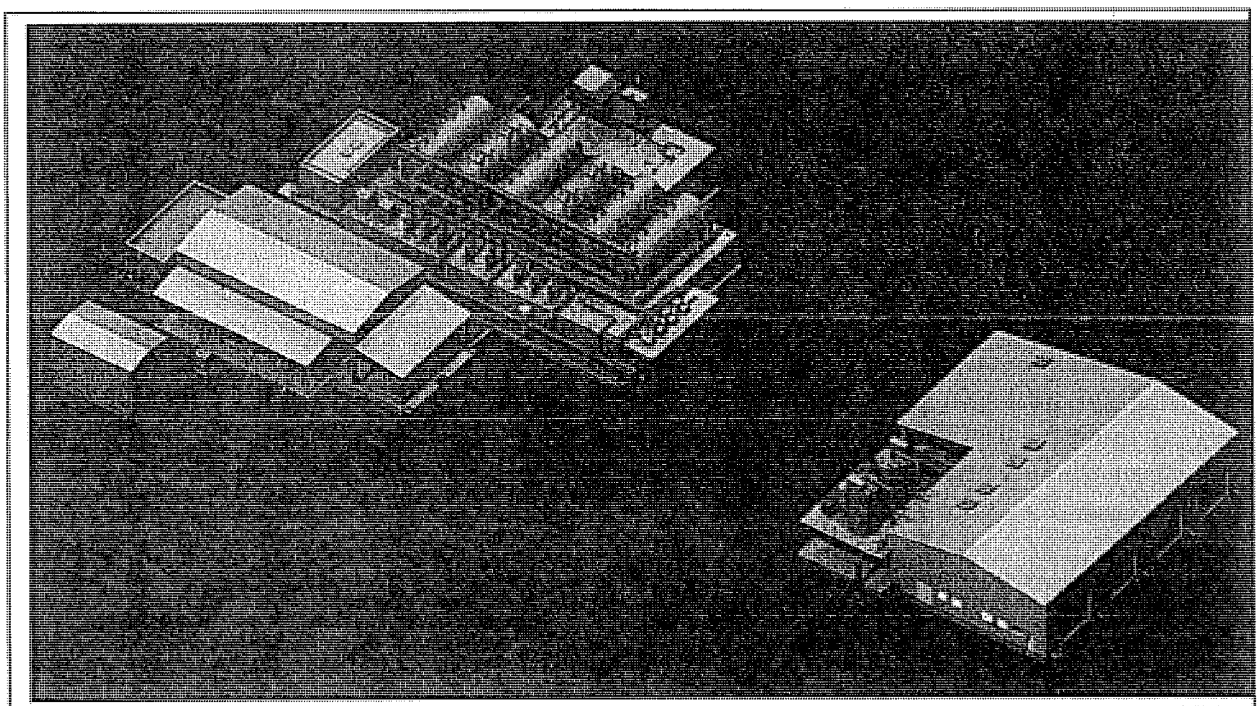


Figure 3-1: New Facilities at the Arcadia WTP
(From L to R: Fluoride Building, Chemical Storage; Pressure Filters and Washwater Recovery; Decarbonators and RO Building)

3.1 Treatment Plant Capacity

The new facilities at the Arcadia WTP will treat water from three sources: Charnock Well Field (comprising partially treated and untreated water), Santa Monica Wells and Arcadia Wells.

The maximum well capacities are summarized in Table 3-1.

Table 3-1
Well Capacities

	Rated Capacity (gpm)	Design Output (gpm)
Charnock Well 13)	1,200	5,000 – 6,600
Charnock Well 15) To be treated at Charnock	1,200	
Charnock Well 19)	1,000 – 1,500	
Charnock Well 16	2,200	
Charnock Well 18	1,500	
Santa Monica Well 3	780	1,000
Santa Monica Well 4	810	
Arcadia Well 4	240	300
Arcadia Well 5	260	

* Well 19 is equipped with a variable frequency drive to adjust the flow from the well.

** This is the rated capacity of each well, and the actual capacity will be evaluated after refurbishment of the well infrastructure. Note that the well flow values shown in the table below the General Charnock Process Flow Diagram (GC00002) are lower because they were adjusted for the mass balance to achieve the peak plant capacity flow of 3,750 gpm.

Based on previous investigations, the sustainable production capacity of the City's well field is 7,000 gpm (10 mgd), which is less than the combined, maximum pumping capacity from all of the wells. The Charnock treatment facility and wells connecting into the Charnock pipeline will be appropriately controlled and operated so that only 10 mgd will be passed forward to the WTP as a maximum flow.

The upgraded Arcadia WTP will be designed to treat a flow of 10 mgd. Reverse Osmosis will be the principal treatment system, primarily to remove hardness, although it will also remove varying amounts of MTBE, TBA, uranium, and gross alpha. The treatment process will include pre-chlorination, contact time, and pressure filtration for precipitation and removal of the iron and manganese upstream of the RO System.

The maximum Plant capacities are summarized in Table 3-2.

Table 3-2
Treatment Plant Capacities

	Design Capacity	
	gpm	mgd
Charnock GAC Treatment Facility	3,000*	4.32
Charnock Filtered Water Pumps (to Arcadia)	5,000	7.2
Arcadia WTP Combined Well Feed Flow	7,000	10.0

* Flow is based on equalized well flows into the raw water equalization tank. Note that with all five GAC treatment trains in operation, a peak equalized flow of 3,750 gpm (5.4 mgd) can be treated at Charnock.

3.2 *Treatment Process*

3.2.1 Raw Water Inlet

A new 24-inch raw water pipeline will connect to the existing 24-inch plant influent and convey water to the new RO softening plant. The incoming raw water flows will be chlorinated in the Raw Water Inlet Vault upstream of the contact tank. An isolation valve, chlorine injection point, inline static mixer, and magnetic flow meter will be installed on the raw water pipeline where it passes through the Vault. Treated washwater from the Washwater Recovery System will also be returned via an 8-inch pipeline and mixed with the influent well water prior to the chlorination point. Design criteria for the washwater storage and treatment system are provided later in this report.

Sample points will be included upstream of the chlorine injection point and downstream of the static mixer to measure chlorine concentrations in the raw water.

The design criteria for the Raw Water Inlet are provided in Table 3-3.

Table 3-3
Raw Water Inlet Design Criteria

Parameter	Criteria
Design Flow, gpm	
Raw Water, gpm	7,000
Recycled Washwater, gpm	542
Total Design Flow, gpm	7,542
Flow Meter	
Type	Magnetic
Size, inches	18
Velocity, feet per second	8.83
Chemical Feed	Sodium Hypochlorite
Inline Static Mixer	
Type	Inline
Size, inches	24
Headloss, feet	4
Velocity, feet per second	5.42

3.2.2 Contact Tank and Filter Feed Pumps

A Contact Tank will be constructed to provide sufficient detention time to allow for oxidation of the iron and manganese in the raw water. The Contact Tank will be located below the pressure filters. The tank will be designed to provide a minimum of 15 minutes of detention time at maximum flow. A baffle wall will be provided in the tank to provide a longer flow path and improve hydraulic efficiency. The 24-inch inlet pipe will include a diffuser to evenly distribute incoming flows across the tank. At the downstream end of the flow path, the tank will be equipped with vertical turbine pumps to deliver chlorinated raw water to the pressure filters.

The design criteria for the contact tank and filter feed pumps are summarized in Table 3-4.

Table 3-4
Contact Tank and Filter Feed Pumps Design Criteria

Parameter	Criteria
Design Flow, gpm	7,542
Detention Time, minutes	15
Hydraulic Efficiency, percent	70
Minimum Capacity, gallons	149,000
Plan Dimensions	
Length, feet	65
Width, feet	40
Side Water Depth	
Design, feet	7
Maximum, feet	10
Floor Elevation, feet	239.00
Overflow Elevation, feet	249.00
Inlet Pipe	
Diameter, inches	24
Maximum Flow, gpm	7,650
Velocity, fps	5.42
Material	Cement mortar lined and coated Ductile Iron Pipe
Contact Tank Pump Station (Filter Feed Pumps)	
Number	3; 2 duty and 1 standby
Type	Vertical Diffusion Vane
Rated Capacity, gpm, each	3,800
Rated Head, feet	60
Motor, hp	100
Efficiency, percent	75
Drive	Adjustable Frequency
Contact Tank Sump Pump	
Number	1
Type	Submersible
Rated Capacity, gpm	100
Rated Head, feet	20
Motor, hp	2

3.2.3 Pressure Filters

The purpose of the Pressure Filters is to remove iron and manganese from the feed water prior to softening by the RO System. Although the concentrations of iron and manganese in the blended water to the Arcadia WTP are less than the secondary MCL, iron and manganese oxide particles can foul RO membranes by deposition on the membrane surface. Pressure filtration will be used to remove iron and manganese to lower levels to protect the RO membranes. Oxidized iron is primarily removed through filtration, while manganese is removed through adsorption on to the filter media in the presence of an oxidant such as free chlorine. The new Filter Complex will comprise six pressure filter vessels containing greensand media. Each filter vessel will be split into two, independently-operating cells, giving a total of 12 filter cells. The filters and their associated valves and pipe work will be installed on a slab over the Contact Tank, Backwash Holding Tank, and RO Feed Tank. The filters are sized to ensure that the surface loading rate does not exceed 3 gpm/sf when one cell is off-line for backwashing.

The Pressure Filters will be operated with up to 1 mg/l free chlorine residual passing through the filter at all times. Over time, the greensand filter media becomes coated with manganese dioxide and ferric hydroxides or ferric oxides under an oxidized environment. By maintaining free chlorine residual through the filter, continuous adsorptive uptake of divalent manganese by chemical oxidation on the media surface is achieved.

A layer of larger anthracite media over the greensand media is provided to remove a portion of the precipitating ferric hydroxide particles, thereby reducing overall rate of headloss accumulation through the filter and maximizing the pressure filter's run time prior to backwashing.

The Pressure Filters will include air scour to assist in removal of iron/manganese oxide deposits. During the first 15 to 25 minutes following a backwash, turbidity in the filter effluent may be elevated as the filter is "ripening" with deposited particles. The filter effluent during this period is wasted either to the Contact Tank or the Washwater Equalization Tank, a backwashing step referred to as "filter-to-waste" (FTW). This practice ensures high quality RO feed water with low iron and manganese concentrations at all times of on-line operation.

The design criteria for the pressure filters are summarized in Table 3-5.

Filtered water will pass to the RO Feed Tank for further treatment (refer to Sections 3.2.7 to 3.2.12). A portion will also be diverted to the Backwash Holding Tank for storage and use during subsequent filter backwashing.

Table 3-5
Pressure Filters Design Criteria

Parameter	Criteria
Filters	
Number	6
Cells Per Filter	2
Design Loading Rate, gpm/sf	3.0
Type of Filter Control	Rate Of Flow Control
Filter Size	

Parameter	Criteria
Overall Length, feet (2 filter cells)	40
Diameter, feet	12
Working Pressure, psi	75
Filter Media	
Media Surface Area, sf per cell	227
Media Type	Dual
Media Depth, inches	36
Media Material	
Anthracite	
Depth, inches	18
Effective Size, mm	0.6 – 0.8
Uniformity Coefficient	<1.6
Greensand	
Depth, inches	18
Effective Size, mm	0.3 – 0.35
Uniformity Coefficient	<1.6
Backwash	
Rate, gpm/sf	15
Duration, min	10

3.2.4 Backwash Holding Tank and Backwash Supply Pumps

Backwashing of the Pressure Filters will remove the waste solids and expand the media bed. The backwash is carried out using water that has previously passed through the filters and into the Backwash Holding Tank. The Backwash Holding Tank will be located adjacent to the Contact Tank, underneath the Pressure Filters. It will be sized to hold the volume required to carry out a backwash of two filter cells. The Backwash Holding Tank will be equipped with vertical turbine pumps to deliver backwash water to the pressure filters. The design criteria for the backwash tank and pump station are summarized in Table 3-6.

Table 3-6
Backwash Holding Tank and Pump Station Design Criteria

Parameter	Criteria
Filter Backwash Rate, gpm	3,450
Filter Backwash Duration, minutes	15
Plan Dimensions	
Length, feet	65
Width, feet	22
Side Water Depth, feet	10
Capacity Criteria	2 filter backwashes
Minimum Capacity, gallons	99,000
Capacity, gallons	
Minimum, gallons	52,700
Maximum, gallons	105,300
Floor Elevation, feet	239.00
Overflow Elevation, feet	249.00
Inlet Pipe	
Diameter, inches	12
Maximum Flow, gpm	500
Velocity, fps	1.4
Material	Cement mortar lined and coated DI
Backwash Supply Pumps	
Number	2; 1 duty and 1 standby
Type	Vertical Diffusion Vane
Rated Capacity, gpm, each	3,450
Rated Head, feet	45
Motor, hp	75
Efficiency, percent	75
Drive	Adjustable Frequency
Backwash Holding Tank Sump Pump	
Number	1
Type	Submersible
Rated Capacity, gpm	100
Rated Head, feet	20
Motor, hp	2

3.2.5 Washwater Equalization Tank and Washwater Recovery Pumps

The spent backwash water from the Pressure Filters will flow by gravity to the Washwater Equalization Tank located adjacent to the Filter Complex. Solids will be kept in suspension within the tank using submersible propeller-type mixers. From the Equalization Tank, the washwater will be pumped to a Package Treatment Unit. The Equalization Tank and the associated pumps will be designed to empty between filter backwashes. The capacity of the tank allows for at least two 15-minute filter backwashes.

FTW flows, as part of returning a filter to service after backwashing, will be directed either back to the Washwater Equalization Tank or to the Contact Tank.

The design criteria for the Washwater Equalization Tank and Washwater Recovery Pumps are summarized in Table 3-7.

Table 3-7
Washwater Equalization Tank and Washwater Recovery Pumps Design Criteria

Parameter	Criteria
Filter Backwash Rate, gpm	3,300
Filter Backwash Duration, minutes	15
Washwater Equalization Tank Plan Dimensions	
Length, feet	50
Width, feet	20
Side Water Depth	11
Capacity Criteria	2 x 15-minute filter backwashes
Minimum Capacity, gallons	54,480
Capacity, gallons	82,280
Floor Elevation, feet	238.50
Overflow Elevation, feet	249.00
Inlet Pipe	
Diameter, inches	14
Maximum Flow, gpm	3,300
Velocity, fps	5.27
Material	Cement mortar lined and coated Ductile Iron
Washwater Recovery Pumps	
Number	2; 1 duty and 1 standby
Type	Submersible
Rated Capacity, gpm, each	650
Rated Head, feet	42
Motor, hp	10
Efficiency, percent	70
Drive	Adjustable Frequency

3.2.6 Package Treatment Unit

Prior to entering the Package Treatment Unit (PTU), a coagulant will be injected into the flow stream from the Washwater Recovery Pumps, upstream of an inline static mixer. The inline mixer will provide sufficient mixing to make the solids within the water amenable to settling.

The PTU will include a flocculation basin equipped with vertical flocculator, a sedimentation basin equipped with inclined plate settlers, and a sludge collection system. The clarified effluent from the PTU will flow by gravity to the Raw Water Inlet Vault. Sludge collected from the inclined plate settlers will be intermittently drained to an existing sewer line.

The design criteria for the PTU are summarized in Table 3-8.

Table 3-8
Package Treatment Unit Design Criteria

Parameter	Criteria
Number	1
Design Capacity, gpm	650
Flocculation	
Type	Vertical Mixer
Detention Time, min	5
Sedimentation	
Type	Inclined Plate Settler
Effective Surface Loading Rate, gpm/sf	0.3
Total Horizontal Projected Plate Area, sf	1,950
Piping	
Influent, inches	8
Return, inches	8
Residuals Drawoff, inches	4

3.2.7 Reverse Osmosis Feed Tank

The RO Feed Tank will provide a hydraulic buffer to equalize the flow to the RO System. This will ensure that the RO System can be operated in a steady state, irrespective of the operation of the Pressure Filters. Provisions for the addition of sodium bisulfite at either the tank inlet or outlet are provided to de-chlorinate the filtered water from the Pressure Filters. Typically, the filtered water is de-chlorinated in the influent to the feed tank. Periodically, chlorine residual will be maintained through the RO Feed Tank to control biological growth; the water will then be de-chlorinated downstream of the feed tank.

The RO Feed Tank will be located adjacent to the Backwash Holding Tank, underneath the Pressure Filters. An overflow pipe will not be provided, in order to prevent potential contamination with the other tank overflows to the storm drain in this area. The structural design of the top slab allows for some uplift pressure, to allow overflows to be discharged from the vents. For the same reason, the tank sump will be drained using a fixed submersible sump pump with a quick-connect coupling on the top slab, rather than permanent pipe work into the storm drainage system.

Design criteria for the RO Feed Tank are given in Table 3-9.

Table 3-9
RO Feed Tank Design Criteria

Parameter	Criteria
Design Flow, gpm	7,000
Reaction Time From Midpoint, minutes*	15
Capacity, gallons	220,000
Plan Dimensions	
Length, feet	65
Width, feet	46
Side Water Depth, feet	10
Floor Elevation, feet	239.00
Overflow Elevation, feet	Via tank vents 253.00
Inlet Pipe	
Diameter, inches	24
Maximum Flow, gpm	7,000
Velocity, fps	4.9
Material	Cement mortar lined and coated DI Pipe
RO Feed Tank Sump Pump	
Number	1
Type	Submersible
Rated Capacity, gpm	100
Rated Head, feet	20
Motor, hp	2

* Reaction time refers to the amount of time that an operator has to react to (1) High pressure pump failure leading to filling of the RO Feed Tank or (2) Low pressure pump failure leading to draining of the RO Feed Tank. The reference point is the midpoint of the tank and assumes the water level starts there. The actual consequence of exceeding the High-High or Low-Low set points would be a plant shutdown.

3.2.8 Low Pressure RO Feed Pumps and Cartridge Filters

Cartridge filters will be provided upstream of the RO membranes to serve as a final barrier for removal of any particulate matter that may be present in the RO Feed Tank. Removal of particulate material is critical to prevent fouling of the feed channels in the RO membrane elements.

Low pressure, vertical turbine pumps at the RO Feed Tank will convey water from the RO Feed Tank through the Cartridge Filters. Water pumped by these Low Pressure RO Feed Pumps will be split upstream of the Cartridge Filters, with about 18 percent directed to the RO Bypass Pipeline and about 82 percent directed to the suction side of the High Pressure RO Feed Pumps (refer to Section 3.2.9).

Design criteria for the Low Pressure RO Feed Pump Station are given in Table 3-10.

Table 3-10
Low Pressure RO Feed Pump Station Design Criteria

Parameter	Criteria
Number	3 units (2 duty and 1 standby)
Type	Vertical Diffusion Vane
Rated Capacity, gpm, each	3,500
Rated Head, feet	100
Motor, hp	150
Efficiency, percent	75
Drive	Adjustable Frequency

A total of four cartridge filter vessels (3 duty and 1 standby) will be provided. The allowable loading rate is 3.5 to 4.0 gpm/10-inch equivalent length of cartridge filter element. Each of the cartridge filter vessels is designed to treat 1,889 gpm, providing one standby unit. The cartridge filter vessels will be connected to a common feed and discharge header. They will be valved to allow isolation of a single vessel. During normal operation, all duty vessels will be used irrespective of the number of RO units operating, to prevent water stagnation within a cartridge filter and biological growth. When the differential pressure between the feed and discharge header exceeds a setpoint, the spare vessel will be brought into service and elements in each of the duty vessels will be sequentially replaced. The last duty vessel will then become the spare vessel.

The design criteria for the Cartridge Filters are summarized in Table 3-11.

Table 3-11
Cartridge Filters Design Criteria

Parameter	Value
Number of cartridge filter vessels	4 units (3 duty, 1 standby)
Design flow rate per vessel	1,900 gpm
Design loading rate	3.5 gpm/10" equivalent length
Vessel orientation	Horizontal
Pressure rating	100 psi
Cartridge filter element dimensions	2.5" diameter and 40" long
Cartridge filter element rating	5 μm nominal pore size

3.2.9 Reverse Osmosis

High Pressure RO Feed Pumps will boost the pressure of the feed water coming off the Cartridge Filters through the RO membranes and to the Decarbonators. The Decarbonators are discussed in more detail in Section 3.2.11.

To allow for different operating conditions on individual membrane trains, as determined by the degree of membrane fouling, each RO train will be served by its own, dedicated pump. Each pump will be a vertical turbine type mounted in a dedicated suction can. The speed of each RO Feed Pump will be controlled through an adjustable frequency drive (AFD) to maintain the permeate (product) flow set point of its respective RO train. This arrangement simplifies the pump controls to match flows when skids are brought online or taken offline. As the membranes age and fouling of the membranes increases, the required feed pressure will increase to maintain the same product flow. The recovery will be controlled by the energy recovery device and a concentrate control valve.

The amount of Bypass coming from the Pressure Filters for blending with the permeate will be varied to meet treated water quality goals, if the raw water quality exhibits any variations.

The design criteria for the High Pressure RO Feed Pumps are summarized in Table 3-12.

Table 3-12
High Pressure RO Feed Pumps

Parameter	Criteria
Number of feed pumps	4 (one dedicated for each RO unit)
Nominal Flow rate (gpm)	1,900
Rated head, psi (ft)	156 (360)
Type	Vertical turbine in barrel
Motor, hp	Variable Speed

The water pumped from the Cartridge Filters will be treated by four RO trains (3 duty and 1 standby). The RO trains will remove the dissolved salts and contaminants, which will be discharged or wasted in the concentrate stream. The RO System is expected to operate over a recovery range of 82 to 85 percent (but designed for between 70 and 85 percent), depending on the silica concentration and effectiveness of the anti-scalant chemical that is applied.

The RO trains will treat about 82 percent of the water that has passed through the Pressure Filters. The remaining 18 percent will bypass the RO System. This bypass flow is blended with the RO permeate prior to final stabilization.

Each RO train is designed with three stages. Each stage will consist of several pressure vessels connected in parallel. A three-stage RO system uses pressure vessels that house 6 elements (referred to as 6M vessels). In the 3-stage system, each stage consists of a set of pressure vessels connected in parallel. The number of pressure vessels is decreases by a factor of 2 sequentially. A 38:19:9 array using 440 ft2 element area will be used at Arcadia. The pressurized feed water enters the first stage. Part of it passes through the membrane and becomes 1st stage permeate. The remaining feed water, referred to as 1st stage concentrate flow, is routed to the second stage as its feed water through an energy recovery device (ERD). The ERD will be equipped with a motor to provide any additional boost required for the second stage that is not provided by the energy in the third stage concentrate.

The permeate from all stages will be blended and leave the system through a common header. The residual head on the RO permeate will convey the softened water to the Decarbonators.

Table 3-13 below lists the design parameters for the RO System. Where relevant, values are shown for recovery at 82 percent and 85 percent.

Table 3-13
Reverse Osmosis Design Criteria

Parameter	Value	
	85% recovery	82% recovery
RO trains		
Number of RO trains	4 (3 duty, 1 standby)	
Design permeate flow rate per train (gpm)	1,615	1,560
Design feed water flow rate per train (gpm)	1,900	
Number of stages per train	3	
Minimum number of pressure vessels per train (stage 1: stage 2: stage 3)[1]	38:19:9 using 440 ft^2 elements	
Number of elements per pressure vessel	6	
Pressure in the permeate header (psi)	20	
Flux		
First stage permeate flux (gfd)	< 15	
System flux (gfd)	13.5 to 14	
RO membrane elements		
Membrane diameter and length (inches)	8 x 40	
Membrane material	Polyamide based	
Membrane area (ft2)	440	
Energy recovery device (ERD)		
Type	Concentrate pressure driven turbine type energy recovery device integrated with a centrifugal booster pump	
Drive	Direct by motor	
Concentrate influent to ERD: flow & pressure	284 gpm @ 70 to 95 psi depending on membrane used	
Feed water influent to ERD	879 gpm @ 74 to 88 psi pressure depending on age of membrane	
Pressure boost (psi)	18	

(1) The system will need 42:21:10 pressure vessels if it is required to accommodate the more common 400ft2 elements. If elements with the higher 440ft2 area are used in a 42:21:10 array, some pressure vessels will be left blank to allow for future conversion to 400ft2 if necessary. This it to maintain the same flux irrespective of which elements are used during the life of the facility.

The High Pressure RO Feed Pumps and the RO trains will be located in the RO Building. In addition, there will be 'dry rooms' housing the AFDs for the pumps, the switchgear and control panels for the plant, as well as a number of distribution and lighting panels.

3.2.10 Reverse Osmosis Support Systems

The systems that support the RO system are the following:

- Reverse Osmosis Flush System
- Clean-In-Place System

3.2.10.1 *Flush System*

The number of RO trains in operation will depend on the amount of ground water available. For each operating RO train, a certain amount of filtered water bypasses the RO System to meet the treated water quality goals, particularly hardness. Periodically, RO trains will be taken out of service due to reduced demand and to constantly rotate the various RO trains in operation. For instance, even if the facility is operating at full capacity, the spare train will be brought into operation periodically to prevent degradation of membranes and all moving parts. This will typically be achieved by operating membranes in a round robin fashion, to ensure that no train is left off-line for an extended period of time. Whenever an RO train is taken out of service, it is flushed automatically with permeate.

The Flush System will consist of a permeate flush tank and pumps as summarized in Table 3-12. One system will be provided to flush all the units. A portion of the permeate from the common outlet header off the RO System will be diverted to fill the flush tank. The flush tank is designed to hold sufficient permeate for roughly one volumetric displacement of the water in one RO train and the associated piping. If all the RO trains need to be taken out of service, the last train will make sufficient water to flush itself.

During flushing, some concentrate and some permeate will be generated. The concentrate will be disposed of in the same manner as during normal operation. The permeate will be diverted to drain.

Table 3-14
RO Flushing System Design Criteria

Parameter	Value
Flush tank	1
Flush tank usable volume (gallons)	3,800
Flush tank material	FRP
Number of Flush Pumps	2 (1 duty, 1 standby)
Flush pump parameters	2,100 gpm @60 psi

If demand at the WTP is consistently low, and the off-line period of an RO train will exceed a certain period (typically a few days), the train will be flushed periodically with permeate.

3.2.10.2 *Clean-In-Place System*

The RO trains are typically operated close to design flow to ensure that the hydraulics within the system meet specific criteria to minimize fouling potential. However, the RO membranes will become gradually fouled with inorganic and organic material over time. A clean-in-place (CIP) system will be installed for cleaning the membranes periodically and maintaining their performance.

The degradation in the performance of the RO membranes, indicating that cleaning may be required, will be assessed based on three parameters:

- Normalized permeate flow drops by more than 10%

- Normalized differential pressure across any stage increases by 15%
- Normalized salt passage increases by 10%.

Depending on the membrane element selected, these values may be adjusted to meet membrane element manufacturer's recommendations. Normalization is typically done to account for variations in operational practices such as recovery, water temperature and quality.

When any of the above mentioned parameters trigger a cleaning, the relevant RO train will be taken out of service. Depending on the nature of foulants, cleaning will be performed using either acidic or basic solutions or both. Typically, acidic cleaning solutions are used to remove inorganic foulants, while basic solution is used for removal of organic foulants. It is anticipated that for this water, acidic cleaning will be done more frequently than basic. Typically, citric acid is used for cleaning inorganic constituents and caustic with detergents is used for removal of organic material.

The CIP system will consist of two chemical solution makeup tanks, a neutralization tank, CIP pumps and a cartridge filter. The cartridge filter ensures that no particulate contaminants in the makeup tanks are inadvertently pumped through the RO units during recirculation of the CIP chemical.

The makeup tanks are sized to clean one RO train at a time. Typically, cleaning is performed on each stage of each RO train. Hence the cleaning system is sized for the first stage of an RO train, as it has the most number of pressure vessels.

After each cleaning (either acidic or basic), the cleaning solution will be sent to the neutralization tank, either directly from the RO train or pumped from the chemical solution makeup tank. The RO train will then be flushed; the spent flush water will also be diverted to the neutralization tank. The pH of the contents of the neutralization tank will then be adjusted in the tank, and the neutralized waste will be discharged to the local sewer. The neutralization system is designed to hold one volume of each makeup tank and the post-CIP flush water of one train.

The CIP chemicals will be the following:

- Citric Acid – for acid cleaning of the RO membranes to remove inorganic material
- Sodium Hydroxide (detergent blend) – for caustic cleaning of the RO membranes to remove organic material

Drainage from the CIP containment area will be collected within a sump equipped with a fixed sump pump. Liquid collected in the sump will be pumped to the neutralization tank and discharged to the sewer after pH correction.

Table 3-15 summarizes the CIP System criteria.

Table 3-15
Clean-In-Place System Criteria

Parameter	Value
CIP pump	
Number of pumps	2 (1 duty, 1 standby)
Nominal capacity	2,100 gpm
Rated head	60 psi
Motor	Variable speed
Cartridge filter	
Nominal flow rate	2,100 gpm
Element loading rate	5 gpm/10" equivalent length
Orientation	Vertical
CIP tanks	
Number	2
Usable Capacity per tank	4,500 gallons
Material	FRP
Heater	Provided to increase water temperature by 15 deg C (160 kW)
CIP Chemical Information	
Delivered Chemical	50% Citric Acid
Feed Point	RO CIP Make-up Tank – Acid Clean
Chemical Dosage as CA	5,000 mg/l (100% chemical)
CA Volume per Makeup Tank, gal	36.3
Chemical Storage	IBC Tote
Tote Number	One (1)
Tote Volume	440 gallons
Tote Dimensions	4' on a side
No. of cleaning cycles per tote	12
Chemical Transfer Pump	Rotary Peristaltic Metering pump
Pump Number	One (1)
Pump Flow (gpm)	5.0
Time for chemical transfer (mins)	8
Neutralization tanks	
Number	1
Capacity per tank	5,500 gallons
Material	FRP
Method of Mixing	Through a top mounted mixer

3.2.11 Decarbonators

Post-treatment of RO permeate is required to adjust alkalinity and pH. Post-treatment stabilizes the finished water and mitigates the corrosive nature of the permeate. Decarbonators will be located downstream of the RO System. They are designed to treat the combined RO permeate from the RO System and the Bypass flow from the Low Pressure RO Feed Pumps. Decarbonation will remove carbon dioxide from the blended permeate to increase pH, and reduce the amount of sodium hydroxide (NaOH) required for stabilization of the water before it enters the existing reservoir.

Two (2) Decarbonators will be installed, each treating 50-percent of the flow. To meet the treated water goals, and a reduced NaOH dose, 5 feet depth of media will be required. Each Decarbonator will have a dedicated blower to force air through the media, counter-current to the direction of the water flow. Valves will be provided on the inlet and outlet piping to isolate the equipment for maintenance purposes.

The design criteria for the Decarbonators are summarized in Table 3-16.

Table 3-16
Decarbonator Design Criteria

Parameter	Criteria
Number	2
Design Capacity	
Each Unit, gpm (mgd)	3,050 (4.4)
Total, gpm (mgd)	6,100 (8.8)
Size	
Diameter, Feet	11
Blower Capacity, Scfm	9,000
Fill Media	
Type	2" polypropylene media
Depth, Feet	5
Inlet Pipeline	
Diameter, Inches	16
Velocity, Fps	4.9
Material	Stainless Steel
Outlet Pipeline	
Diameter, Inches	24
Velocity, Fps	2.2
Material	Stainless Steel

The new Decarbonators will be located adjacent to the RO Building, which will provide some screening for the residents on Saltair Avenue. Based on the inlet stand pipe elevation at the reservoir, the Decarbonators will need to be elevated to allow the treated water to flow into the reservoir by gravity.

The Decarbonators and the associated blowers will be installed on top of a concrete Decarbonator Effluent Tank. In addition to raising the elevation of the equipment, the Decarbonator Effluent Tank will also allow air introduced into the water during the decarbonation process to escape. Small air bubbles entrained in the water may otherwise interfere with the sampling and flow measurement instrumentation in the piping downstream. The Decarbonator Effluent Tank will provide at least 10 minutes of retention time between the minimum and maximum water levels at maximum flow, and will contain a baffle wall to prevent short-circuiting between the inlet and outlet of the tank.

The design criteria for the Decarbonator Effluent Tank are summarized in Table 3-17.

Table 3-17
Decarbonator Effluent Tank Design Criteria

Parameter	Criteria
Design Flow, gpm	6,100
Capacity, gallons	76,530
Plan Dimensions	
Length, feet	33
Width, feet	31
Side Water Depth, feet	10
Floor Elevation, feet	246.00
Minimum Water Surface Elevation, feet	254.75
Maximum Water Surface Elevation, feet	256.25
Minimum Retention Time, minutes	10
Inlet Pipes	
Number	2 (one per Decarbonator)
Diameter, inches	24
Maximum Flow, gpm, each	3,050
Velocity, fps	2.2
Material	Stainless Steel
Outlet Pipe (Finished Water Pipeline)	
Diameter, inches	24
Maximum Flow, gpm	6,100
Velocity, fps	4.9
Material	Stainless Steel
Overflow	
Diameter, inches	24
Maximum Flow, gpm	6,100
Velocity, fps	4.9
Material	PVC

Before it is stabilized, the blended water will be aggressive, with a pH that will make it corrosive to concrete. NaOH will be dosed into the Finished Water Pipeline from the Decarbonator Effluent Tank, to raise the pH and alkalinity to levels that are compatible with the existing concrete pipework and the reservoir. The chemicals required for disinfection (chloramination) and fluoridation of the finished water, namely sodium hypochlorite, sodium fluoride and ammonium sulfate, will also be dosed into the Finished Water Pipeline, where it is above grade adjacent to the Decarbonator Effluent Tank.

The Finished Water will be sampled before it enters the reservoir to measure pH/temperature, fluoride, conductivity, turbidity and free chlorine levels. The sampling point will be located on the Finished Water Pipeline where it runs alongside the Chemical Storage Area. The sample pump and analyzers will be located at the Filter Complex.

Because it may contain VOCs, vented air from the Decarbonators will need to be routed to an on-site off-gas treatment system. The Decarbonators and off-gas system will require a permit from the Air Quality Management District (AQMD) before they can be brought into service. Although there has been a moratorium on permits, it is anticipated that the Decarbonators will be permitted prior to start-up of the Arcadia WTP. The project approach will be to install the Decarbonator Effluent Tank and Decarbonators during construction. Pipework will be installed such that the Decarbonators can be bypassed by sending the flow directly to the Decarbonator Effluent Tank. An additional NaOH feed point will be installed on the pipework upstream of the Decarbonators to support start-up operations.

If the Decarbonators are being bypassed, the NaOH dose required will be much higher, since the NaOH will be removing carbon dioxide (changing the pH) in addition to alkalinity correction. Further information is available in Section 3.2.12.4.

3.2.12 Chemical Systems

The following chemicals will be utilized as part of the treatment system:

- Sodium Hypochlorite - to aid in the oxidation of iron and manganese through the Pressure Filters; used for disinfection as part of the chloramination process; for down-hole chlorination to prevent bio-growth in the wells

- Sodium Bisulfite - to remove any residual free chlorine present in the RO feed water

- Sulfuric Acid - added to the RO feed water to maintain the desired pH within the range of 6.7 to 7.0 to minimize scaling on the RO membranes

- Sodium Hydroxide – to increase the pH / alkalinity of the softened, treated water and reduce its corrosivity

- Antiscalant (Threshold Inhibitor) - added to the RO feed water to minimize the potential for inorganic scaling on the membrane surface

- Ammonium Sulfate - added along with sodium hypochlorite to form a combined monochloramine residual in the treated water from the Plant

- Sodium Fluoride – added to the water to reduce the incidence of tooth decay in the community, particularly in children

- Polyaluminum Chloride – added upstream of the plate settlers to act as the primary coagulant

- Citric Acid – added to clean the RO Membranes

Chemical storage and feed systems will generally be installed in a common location, in the area freed up by demolition of the existing brine storage tank and IX regeneration equipment. The exceptions are the CIP chemicals, sodium fluoride and the polyaluminum chloride. The main Chemical Storage and Feed Area and the CIP System area will be covered by structural steel roof canopies to shade the equipment from the sun and to reduce the amount of rain water that can collect in the containment areas. There will be a fire sprinkler system installed in the main chemical area. The fluoride storage, make-up and feed facilities will be housed within a separate, enclosed building. This will be constructed in the area of the welding shop (currently used for storing gardening supplies and temporary fluoride make-up equipment), which is also to be demolished. The Fluoride Building will also contain a fire sprinkler system. The polyaluminum chloride will be stored and dosed from a separate skid located adjacent to the Washwater Equalization Tank. Chemicals will have combined secondary containment sufficient to hold the volume of the largest tank plus, where appropriate, 20 minutes of sprinkler flow, in accordance with the California Fire Code.

Vehicular access will be available for deliveries to all of the chemical storage units. Deliveries will generally be in bulk by tanker truck or as liquids in totes. The sodium fluoride will be delivered as a dry powder in sacks or super-sacks.

Drainage from bulk chemical containment areas will be collected within separate spill containment curbs or pits, each with a collection sump. The CIP area will contain a submersible drain pump. A portable sump pump with hose will be used for the main Chemical Storage Area. Washdown and spillages from the Fluoride Building will drain to a blind sump adjacent to the building. Flows collected in the sump will need to be disposed of using a tanker truck and proper off-site disposal.

3.2.12.1 Sodium Hypochlorite

One sodium hypochlorite feed system will be supplied to feed 12.5 trade percent sodium hypochlorite to the well pumps, raw water inlet and to the finished water from the RO system. Sodium hypochlorite will be delivered to the site by tanker truck and will be stored in bulk storage tanks sized to accept a full truck load. While only one bulk storage tank is required for storage requirements, the California Department of Public Health usually requires an installed spare sodium hypochlorite storage tank. As such, two bulk storage tanks will be installed. The sodium hypochlorite will be delivered to the feed points by metering pumps designed to feed sodium hypochlorite over the full range plant flows and doses. Two pumps will be installed to feed sodium hypochlorite to the Arcadia Wells, three for feed to the Raw Water Inlet and Contact Tank, and two for feed to the Finished Water Pipeline (Table 3-18).

Table 3-18
Sodium Hypochlorite Design Criteria

Sodium Hypochlorite Feed System	Criteria		
Chemical Information			
Delivered Chemical	12.5% (trade) sodium hypochlorite, 10.6% as chlorine, SG = 1.175		
Fed Chemical	12.5% (trade) sodium hypochlorite, 10.6% as chlorine, SG = 1.175		
Feed Point	Arcadia Well #4	Arcadia Well #5	
Chemical Dosage as 100% Cl_2 (chlorine)			
Maximum, mg/l	8.0	8.0	
Average, mg/l	2.5	2.5	
Minimum, mg/l	1.0	1.0	
Well Pump Flow, gpm	240	260	
Chemical Feed Flow			
Maximum, gph	0.92	1.00	
Average, gph	0.29	0.31	
Minimum, gph	0.11	0.13	
Turndown Ratio	8 : 1	8 : 1	
Feed Point	Raw Water Inlet		
Chemical Dosage as 100% Cl_2 (chlorine)			
Maximum, mg/l	2.0		
Average, mg/l	0.5		
Minimum, mg/l	0.2		
Plant Flow			
Maximum, MGD	10.0		
Average, MGD	10.0		
Minimum, MGD	2.8		
Chemical Feed Flow			
Maximum, gph	6.67		
Average, gph	1.67		
Minimum, gph	0.19		
Turndown Ratio	35 : 1		
Feed Point	RO Permeate	RO Bypass	Total FW Flow
Chemical Dosage as 100% Cl_2 (chlorine)			
Maximum, mg/l	3.0	2.0	
Average, mg/l	2.0	1.0	
Minimum, mg/l	0.3	0.3	
Plant Flow			
Maximum, MGD	7.0	1.8	8.8
Average, MGD	7.0	1.8	8.8

Sodium Hypochlorite Feed System	Criteria		
Minimum, MGD	2.3	0.6	2.9
Chemical Feed Flow			
Maximum, gph	7.0	1.2	8.2
Average, gph	4.7	0.6	5.3
Minimum, gph	0.23	0.06	0.29
Turndown Ratio			28.3 : 1
Chemical Storage	Vertical tanks		
Tank Material	FRP		
Tank Number	Two (2) – one duty, one spare		
Tank Volume	5,425 gallons		
Tank Dimensions	10' diameter x 11' straight side (13'-6" to tank apex)		
Days of storage (single tank), avg / max	30 / 13.5		
Feed Equipment	Diaphragm metering pumps		
Feed Point	Well Pumps		
Pump Number	Two (2 duty)		
Pump Flow	0.11 – 1.0 gph		
Pump Control	Manual stroke length and automatic stroke speed control with local override		
Feed Point	Raw Water Inlet		
Pump Number	Three (2 duty, 1 standby)		
Pump Flow	0.19 – 6.67 gph		
Pump Control	Manual stroke length and automatic stroke speed control with local override		
Feed Point	Finished Water Pipeline		
Pump Number	Two (1 duty, 1 standby)		
Pump Flow	0.29 – 8.2 gph		
Pump Control	Manual stroke length and automatic stroke speed control with local override		

3.2.12.2 Sodium Bisulfite

One sodium bisulfite feed system will be supplied to feed 25 percent sodium bisulfite upstream of the RO units. Sodium bisulfite will be delivered to the site by tanker truck and will be stored in bulk storage tanks sized to accept a full truck load. One bulk storage tank will be installed. The sodium bisulfite will be delivered to the feed point by metering pumps designed to feed sodium bisulfite over the full range flows and dosages. Two metering pumps will be installed to feed the sodium bisulfite to the feed points up- and downstream of the RO Feed Tank (Table 3-19).

Table 3-19
Sodium Bisulfite Feed System Design Criteria

Sodium Bisulfite Feed System	
Chemical Information	
Delivered Chemical	25% sodium bisulfite, SG = 1.19
Fed Chemical	25% sodium bisulfite, SG = 1.19
Feed Point	Upstream of RO Feed Tank
Chemical Dosage as 100% $NaHSO_3$	
Maximum, mg/l	3.0
Average, mg/l	1.5
Minimum, mg/l	0.3
Plant Flow	
Maximum, MGD	8.27
Average, MGD	8.27
Minimum, MGD	3.3
Chemical Feed Flow	
Maximum, gph	3.48
Average, gph	1.74
Minimum, gph	0.14
Turndown Ratio	25:1
Chemical Storage	Vertical tanks
Tank Material	FRP (Fiberglass Reinforced Plastic)
Tank Number	One (1)
Tank Volume	5,450 gallons
Tank Dimensions	10' diameter x 11' straight side (13'-6" to apex)
Days of storage, avg / max	132 / 67
Feed Equipment	Diaphragm metering pumps
Pump Number	Two (1 – duty, 1 standby)
Pump Flow	0.14 – 3.48 gph
Pump Control	Manual stroke length and automatic stroke speed control with local override

3.2.12.3 Sulfuric Acid

One sulfuric acid feed system will be supplied to feed 93 percent sulfuric acid upstream of the RO System. Sulfuric acid will be delivered to the site by tanker truck and will be stored in a bulk storage tank sized to accept a full truck load. The sulfuric acid will be delivered to the feed point by two metering pumps designed to feed sulfuric acid over the full range flows and doses (Table 3-20). An additional pump is added for transfer of sulfuric acid to the CIP System for solution neutralization. Carrier water will be added to the sulfuric acid prior to leaving the chemical area. The quantity of water will be sufficient to minimize the effects of the exothermic acid dilution reaction.

Table 3-20
Sulfuric Acid Design Criteria

Sulfuric Acid Feed System	Criteria
Chemical Information	
Delivered Chemical	93% sulfuric acid, SG = 1.84
Fed Chemical	93% sulfuric acid, SG = 1.84
Feed Point	Upstream of RO Units
Chemical Dosage as 100% H_2SO_4	
Maximum, mg/l	44
Average, mg/l	20
Minimum, mg/l	5
Plant Flow	
Maximum, MGD	8.2
Average, MGD	8.2
Minimum, MGD	2.7
Chemical Feed Flow	
Maximum, gph	8.8
Average, gph	4.0
Minimum, gph	0.33
Turndown Ratio	26.7 : 1
Chemical Storage	Vertical tanks
Tank Material	Carbon Steel, Epoxy Novolac lining
Tank Number	One (1)
Tank Volume	3, 600 gallons
Tank Dimensions	9' diameter x 9' straight side (11'-3" to the apex)
Days of storage, avg / max	37.5 / 17
Feed Equipment	Diaphragm metering pumps
Pump Number	Three (2 – duty, 1 standby)
Pump Flow	0.33 – 8.8 gph
Pump Control	Manual stroke length and automatic stroke speed control with local override

3.2.12.4 Sodium Hydroxide

One sodium hydroxide feed system will be supplied to feed 25 percent sodium hydroxide to the finished water. Sodium hydroxide will be delivered to the site by tanker truck as a 50 percent solution and stored in a heat traced and insulated bulk storage tank sized to accept a full truck load. The 50% sodium hydroxide will be fed to a dilution unit so that 25% sodium hydroxide is fed to the process. The sodium hydroxide will be delivered to the finished water by two metering pumps designed to feed sodium hydroxide over the full range of flows and doses (Table 3-21). In addition, one pump will be supplied to transfer sodium hydroxide to the CIP System for solution neutralization.

Table 3-21
Sodium Hydroxide Design Criteria

Sodium Hydroxide Feed System	Criteria	
Chemical Information		
Delivered Chemical	50% sodium hydroxide, SG = 1.53	
Fed Chemical	25% sodium hydroxide, SG = 1.28	
Feed Point	Finished Water (before 5 MG Reservoir)	
Chemical Dosage as 100% NaOH	With Decarbonator	Without Decarbonator
Maximum, mg/l	12	40
Average, mg/l	9	9
Minimum, mg/l	2	2
Plant Flow		
Maximum, MGD	5	8.85
Average, MGD	5	8.85
Minimum, MGD	2.9	2.9
Chemical Feed Flow		
Maximum, gph	13.84	46.12
Average, gph	10.38	10.38
Minimum, gph	0.76	0.76
Turndown Ratio	18.2:1	61:1
Chemical Storage	Vertical tanks	
Tank Material	Carbon Steel – Heat Traced & Insulated	
Tank Number	Two (2)	
Tank Volume	7,000 gallons	
Tank Dimensions	10' diameter x 13' straight side (17' to apex)	
Days of storage, avg / max	82 / 82	
Transfer Equipment for Dilution		
Pump Number	Two (1 – duty, 1 – standby)	
Pump Flow	18 gpm	
Pump Control	On/Off Constant Speed	
Dilution Equipment	One assembly	
Feed Equipment	Diaphragm metering pumps	
Pump Number	Two (1 – duty, 1 – standby)	
Pump Flow	0.76 – 13.84 gph	
Pump Control	Manual stroke length and automatic stroke speed control	
Pump Number	Two (1 – duty, 1 – standby)	
Pump Flow	1.5 – 4.61 gph	
Pump Control	Manual stroke length and automatic stroke speed control	
Transfer Equipment		
Pump Number	One (1 – duty)	
Pump Flow	5 gpm	
Pump Control	On/Off constant speed	

3.2.12.5 Ammonium Sulfate

One ammonium sulfate feed system will be supplied to feed 40 percent ammonium sulfate to the Finished Water Pipeline. Ammonium sulfate will be delivered to the site in totes and will be stored in the delivered totes. The ammonium sulfate will be delivered to the Finished Water by two metering pumps designed to feed ammonium sulfate over the full range flows and doses (Table 3-22).

Table 3-22
Ammonium Sulfate Design Criteria

Ammonium Sulfate Feed System	Criteria
Chemical Information	
Delivered Chemical	40% ammonium sulfate, 10.3% as ammonia (NH_3) SG = 1.23
Fed Chemical	40% ammonium sulfate, 10.3% as ammonia (NH_3) SG = 1.23
Feed Point	Finished Water Pipeline (at Decarbonators)
Chemical Dosage as 100% NH_3	
Maximum, mg/l	0.6
Average, mg/l	0.4
Minimum, mg/l	0.06
Plant Flow	
Maximum, MGD	8.8
Average, MGD	8.8
Minimum, MGD	2.9
Chemical Feed Flow	
Maximum, gph	1.7
Average, gph	1.2
Minimum, gph	0.06
Turndown Ratio	28 : 1
Chemical Storage	Totes
Tote Number	Two (2) with auto-changeover
Tote Volume	440 gallons
Tote Dimensions	4' x 4'
Days of storage, avg / max	30.6 / 21.6
Feed Equipment	Diaphragm metering pumps
Pump Number	Two (1 – duty, 1 standby)
Pump Flow	0.06 – 1.7 gph
Pump Control	Manual stroke length and automatic stroke speed control with local override

3.2.12.6 Antiscalant

One antiscalant feed system will be supplied to feed antiscalant upstream of the RO System. Antiscalant will be delivered to the site in totes and will be stored in the delivered totes. Antiscalant will be delivered to the feed point by metering pumps designed to feed over the full range flows and doses. Two metering pumps will be installed to feed antiscalant (Table 3-23).

Table 3-23
Antiscalant Design Criteria

Antiscalant Feed System	Criteria
Chemical Information	
Delivered Chemical	100% antiscalant, SG = 1.25
Fed Chemical	100% antiscalant, SG = 1.25
Feed Point	Upstream of RO Units
Chemical Dosage as 100% Antiscalant	
Maximum, mg/l	5
Average, mg/l	4
Minimum, mg/l	2
Plant Flow	
Maximum, MGD	8.2
Average, MGD	8.2
Minimum, MGD	2.7
Chemical Feed Flow	
Maximum, gph	1.37
Average, gph	1.09
Minimum, gph	0.18
Turndown Ratio	7.6 : 1
Chemical Storage	IBC Totes
Tote Number	Two (2) with auto-changeover
Tote Volume	440 gallons
Tote Dimensions	4' on a side
Days of storage, avg / max	34 / 27
Feed Equipment	Diaphragm metering pumps
Pump Number	Two (1 – duty, 1 standby)
Pump Flow	0.18 – 1.37 gph
Pump Control	Manual stroke length and automatic stroke speed control with local override

3.2.12.7 Sodium Fluoride

The Fluoride Building will store dry granulated sodium fluoride in 50 pound bags or 1,000 pound bulk bags (super-sacks). The granules will be converted to a 4 percent solution and stored in saturators prior to being fed to the injection point. Softened water for the solution make-up will be provided off the RO permeate line, with cartridge-type water softeners provided in case the RO System is not operating. A small pump and tubing will be provided off the saturators to fill the portable solution tank for the remote well SM-1, where there is an existing feed system. The 50 lb bags of sodium fluoride will be delivered and stored on pallets and unloaded into a bag dump station. A scissor lift table will be provided to assist with lifting the bags into place. The building will also be provided with an overhead monorail crane system to lift 1-ton super-sacks and empty them into the saturators (Table 3-24).

Table 3-24
Fluoride Design Criteria

Sodium Fluoride Feed System		
Chemical Information		
Delivered Chemical, % F	44%	
Delivered Form	Dry	
Concentration of solution as NaF	4%	
Feed Point 1	Finished Water	
Feed Point 2	Well SM-1	
Dosage, as F		
Maximum, mg/l	0.8	
Average, mg/l	0.6	
Minimum mg/l	0.4	
Flow	**Finished Water**	**Well SM-1***
Maximum, MGD	8.8	0.43
Average, MGD	8.8	0.43
Minimum, MGD	2.9	0.43
Feed Rate, Dry Wt, as F		
Maximum, ppd as F	58.8	2.9
Average, ppd as F	44.1	2.2
Minimum, ppd as F	9.7	1.4
Feed Rate, Dry Wt, as NaF		
Maximum, ppd bulk	133.8	6.5
Average, ppd bulk	100	4.9
Minimum, ppd bulk	22	3.3
Feed Rate, Liquid		
Maximum, gph	16.7	0.82
Average, gph	12.5	0.62
Minimum, gph	2.75	0.41
Turndown Ratio	5.7 : 1	
Saturator/Solution Tanks		
Number of Saturators	Two (2)	
Volume, each, gal	345	
NaF Capacity, lbs each	1000	
Feed Equipment	Diaphragm metering pumps	
Pump Number	Two (1 – duty, 1 – standby)	
Pump Flow	2 – 18.1 gph	
Pump Control	Manual stroke, automatic speed control with manual override	

* Fluoride solution will be delivered by truck to an existing feed system at Well SM-1.

3.2.12.8 Polyaluminum Chloride

One polyaluminum chloride feed system will be supplied to feed chemical upstream of the PTU. Polyaluminum chloride will be delivered to the site in totes and will be stored in the delivered totes. The polyaluminum chloride will be delivered to the feed point upstream of the PTU by metering pumps designed to feed chemical over the full range of flows and dosages. Two metering pumps will be provided to feed the polyaluminum chloride to the feed point. Design criteria for the polyaluminum chloride feed system are provided in Table 3-25.

Table 3-25
Polyaluminum Chloride Feed System Design Criteria

Polyaluminum Chloride Feed System	
Chemical Information	
Delivered Chemical	51% polyaluminum chloride, SG = 1.40
Fed Chemical	51% polyaluminum chloride, SG = 1.40
Feed Point	Upstream of Package Plate Settler
Chemical Dosage as 100% PaCl	
Maximum, mg/L	20
Average, mg/L	10
Minimum, mg/L	5
Plant Flow	
Maximum, gpm	694
Average, gpm	542
Minimum, gpm	174
Chemical Feed Flow	
Maximum, gph	1.17
Average, gph	0.46
Minimum, gph	0.07
Turndown Ratio	4:1
Chemical Storage	Storage Totes (One)
Feed Equipment	Diaphragm metering pumps
Pump Number	Two (1 – duty, 1 standby)
Pump Flow	0.06 – 2.0 gph
Pump Control	Manual stroke length and automatic stroke speed control with local override

3.2.12.9 Citric Acid

One citric acid feed system will be supplied to the RO membranes for acid cleaning to remove inorganic material. Citric acid will be delivered to the site in totes and will be stored in the delivered totes. Citric acid will be delivered to the CIP make-up tanks by a transfer pump designed to feed the required amount of chemical based on the CIP tank volume and dosage. Design criteria for the citric acid feed system are provided in Table 3-26.

Table 3-26
Citric Acid Feed System Design Criteria

Citric Acid Feed System	
Chemical Information	
Delivered Chemical	50% citric acid, SG = 1.24
Fed Chemical	50% citric acid, SG = 1.24
Feed Point	CIP make-up tanks
Chemical Dosage as 100% Citric Acid, mg/L	5000
Make-up tank volume, gallons	4,500
Chemical Feed Flow	
Citric acid volume per makeup tank, gal	36.3
Average, gph	0.46
Minimum, gph	0.07
Chemical Storage	IBC Tote
Tote Number	One (1)
Tote Volume	440 gallons
Tote Dimensions	4' on a side
No. of cleaning cycles per tote	12
Chemical Transfer Pump	Rotary Peristaltic Metering pump
Pump Number	One (1)
Pump Flow (gpm)	5.0
Time for chemical transfer (mins)	8

3.3 Residuals Treatment and Disposal

There will be three residuals streams from the new treatment processes at the Arcadia WTP: (1) Pressure Filter solids resulting from backwashing, (2) concentrate from the RO System, and (3) CIP solution from RO membrane cleaning.

3.3.1 Pressure Filter Backwash Solids

Based on pilot test results, the Pressure Filters will be backwashed about once per day. The backwash flow will contain a chlorine residual and iron and manganese solids. The backwash flow will be treated in a PTU that employs inclined plate settlers. The decant will be recovered and returned to the Contact Tank at the head of the treatment plant. The settled solids will be disposed of via a local sewer connection. The anticipated total suspended solids concentration and flow of the concentrated solids from the backwash plate settler is shown in Table 3-27.

Table 3-27
Anticipated Flow and Water Quality of Pressure Filter Backwash Waste Stream

Type of Backwash	Lowest Discharge Flow		Highest Discharge Flow	
	Flow, gpd	TSS, mg/l	Flow, gpd	TSS, mg/l
Pressure Filter Backwash Only	1,971	5,000	4,932	2,000

3.3.2 RO Concentrate and Clean-in-Place Residuals

Operation of the RO System produces two different waste streams: concentrate (or reject) and spent CIP solution.

The concentrate will consist of concentrated ions from the well water feed flow and will be approximately 15 to 18 percent of the total RO feed flow. The concentrate stream will be disposed of via a 15" City of LA sewer in Bundy Drive.

Spent CIP solution will result from the RO membranes being cleaned every three months (on average). The cleaning procedure requires a soak and circulation of a citric acid solution, and sometimes a caustic solution, which may be combined with special detergents as required by the RO membrane supplier. These chemical soak and circulation solutions are collected, neutralized to pH near 7.0 and disposed of to the local sewer connection. Table 3-28 summarizes the anticipated flow and water quality of the RO concentrate and CIP waste.

Table 3-28
Anticipated Flow and Water Quality of Concentrate and CIP Waste

Types of Backwashes	Lowest Discharge Flow		Highest Discharge Flow	
	Flow, gpd	TDS, mg/l	Flow, gpd	TDS, mg/l
RO Concentrate, predominantly TDS	415,000	5,990	1,245,000*	5,990
CIP waste: Neutralized citric acid Neutralized NaOH (with detergent)	 4,000 gallons produced every three weeks 4,000 gallons produced every three weeks			
* based on RO recovery of 85%; if the RO recovery is 82%, the concentrate volume would be about 1.5 MGD.				

As previously discussed, water from Charnock Wells 13, 15, and 19 will have uranium and gross alpha concentrations in excess of the drinking water MCLs specified by the DPH. The design assumes no uranium or gross alpha removal by greensand or GAC, and that it will pass into the water to be treated by RO System at the Arcadia WTP. The backwash flow and waste concentrate stream will therefore also have concentrations of up to 32 and 18.2 pCi/l for uranium and gross alpha, respectively.

3.4 Storm Water Treatment

To comply with the City best management practices (BMPs), the Arcadia water treatment plant will be provided with two storm water interceptors aimed at preventing pollutants, sediment, and debris from discharging off site.

The rain run-off method was calculated using the rational method and meets the Urban Flood Protection of the Los Angeles County Department of Public Works (Water Resource Division). The Urban Flood Level Protection bases the peak flow on a 25-year storm event.

There will be two (2) storm interceptor units. Each storm water interceptor is sized to treat the flow of runoff produced from a rain event equal to at least 0.2 in/hr intensity. One unit will be located on the west end of the site adjacent to the Decarbonator Effluent Tank, another on the east, by the Bundy Drive main site entrance.

The interceptors will be CDS units provided by Contech. The CDS units operate under continuous deflective separation where water is separated from debris, sediments, oil and grease. Typically the storm water enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the units' treatment design capacity enter the separation chamber and are treated. Swirl concentration and screen deflection force floating debris and solids to the center of the separation chamber where buoyant debris larger than the screen apertures is trapped. Storm water then moves through the separation screen, under the oil baffle and exits the unit to discharge into the street storm water drain system. When the treatment design capacity is exceeded, the diversion weir bypasses excessive flows around the units.

The units will be capable of treating flows up to 0.7 cfs; they will have a minimum sediment storage capacity of 0.5 CY and a minimum oil storage capacity of 70 gallons.

3.5 Standby Power Facilities

The existing facility engine-generator will be replaced with a new generator capable of powering the new RO softening plant and all of the associated processes and equipment. The engine-generator will be installed west of the existing L.A. Department of Water and Power (LADWP) substation, with sufficient space between the two for LADWP to access the substation.

The proposed emergency generator will be subject to AQMD Best Available Control Technology (BACT) Regulations for carbon monoxide (CO) and nitrogen oxides (NOx), since emissions of these pollutants from the engine will be greater than the BACT applicability threshold. However, the generator will meet United States Environmental Protection Agency (USEPA) Off-Road Tier 2 emission standards from internal combustion engines.

For the Arcadia WTP project site, VOC emissions from the proposed Decarbonators will need to be determined and added to the VOC emissions from the emergency generator being installed onsite. A combined application will need to be filed with the AQMD for the installation of an emergency generator and the Decarbonators/off-gas treatment at the WTP site.

4.0 Normal Operation and Controls

For the purpose of this Operations Plan, when signal =1 it is considered to be active or is being maintained and when the signal = 0 it is considered to be inactive or stopped.

4.1 Arcadia WTP Raw Water Inlet Vault

4.1.1 Influent Valve

The Charnock Pipeline will combine water from the Charnock Wells, Santa Monica Wells and Arcadia Wells before entering the Arcadia WTP through the plant influent valve, A-RW-VBF-1001. This valve will be a modulating, fail-in-place, butterfly valve that will operate in both local and remote manual mode to allow influent water into the Arcadia WTP. Remote manual mode will be operated through the PLC with the valve depicted on the associated Raw Water Mixing display.

The modulating function of the valve will allow control of a bypass flow rate, if a plant bypass is required in future. During the initial operating phases (no bypass), the valve will operate as an open/close type valve.

The Arcadia WTP influent valve will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Valve fails alarm when the valve position indicates that the valve did not reach the commanded position.

STATUS INDICATIONS

- Valve in manual/auto.
- Valve position (0-100%).
- Valve closed.
- Valve fail.

4.1.2 Chlorine Analyzer

A sample pump (A-RW-PCL-1001) will convey Arcadia WTP influent water to a free chlorine analyzer (A-RW-AIT-1003). The instrument will be depicted on the associated Raw Water Mixing display.

The Arcadia WTP influent chlorine analyzer will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Free chlorine level is less than 2 ppm (A-RW-AIT-1003 < 2 ppm).

STATUS INDICATIONS

- A-RW-AIT-1003 – Free chlorine level

4.1.3 Influent Flowmeter

The combined flow from the Charnock Pipeline into the Arcadia WTP will be measured through a flowmeter (A-RW-FIT-1001). The instrument will be depicted on the associated Raw Water Mixing display.

The Arcadia WTP influent flowmeter will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- The influent flow is 10% less than plant demand setpoint for 10 minutes (A-RW-FIT-1001 < 10% of plant setpoint).

STATUS INDICATIONS

- A-RW-FIT-1001 – Flow.

4.1.4 Static Mixer

A static mixer will be provided on the raw water influent line for proper mixing of sodium hypochlorite with raw water.

4.1.5 Raw Water Inlet Vault Sump Pump

The inlet vault sump will contain two pumps, inlet vault sump pump 1 (A-PL-SSP-1) and inlet vault sump pump 2 (A-PL-SSP-2), to remove water collected at the sump and discharge it to sewer. These pumps will operate in local manual and automatic modes through the local control panel, and not through the PLC. In local auto control the sump pumps will automatically turn on and off based on the sump level switches. The sump pump will be depicted on the associated Raw Water Mixing display.

The Arcadia WTP inlet vault sump pumps will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Inlet Vault sump pump 1 fail.
- Inlet Vault sump pump 2 fail.
- Inlet Vault sump reaches high-high level.

STATUS INDICATIONS

- Inlet Vault sump pump 1 is running.
- Inlet Vault sump pump 2 is running.

4.1.6 Arcadia Well 4 and 5 Controls

These wells are controlled through the City's existing control system.

4.1.7 Santa Monica Wells Controls

Santa Monica Wells 3 and 4 pumps and valves are controlled on a separate system in manual mode only.

4.2 Contact Tank and Filter Feed Pumps

4.2.1 Contact Tank and Filter Feed Pumps General Monitoring

A level indicator (A-RW-LIT-1001) will be provided to monitor the level in the Contact Tank. High-High and Low-Low level indicators will also be provided (A-RW-LSHH-1001 and A-RW-LSLL-1001, respectively). The discharge of the pressure filter feed pumps will be monitored for pressure (A-RW-PIT-1001), turbidity (A-RW-AIT-1001) and chlorine residual (A-RW-AIT-1002). The instruments will be depicted on the associated Contact Tank display.

The Contact Tank and Filter Feed Pump instruments will have the following interlocks:

<u>ALARMS (All alarm setpoints will be operator adjustable)</u>

- Contact Tank level is outside its operating range (A-RW-LIT-1001 > 9'6" or A-RW-LIT-1001 < 2').
- Contact Tank reaches high-high level (A-RW-LSHH-1001 = XX').
- Contact Tank reaches low-low level (A-RW-LSLL-1001 = XX').
- Filter Feed Pump discharge pressure is above the acceptable range (A-RW-PIT-1001 > 60 psi).
- Filter Feed Pump discharge chlorine residual is lower than the acceptable range (A-RW-AIT-1002 < 2 ppm).

<u>STATUS INDICATIONS</u>

- A-RW-LIT-1001 – Contact Tank level.
- A-RW-PIT-1001 – Filter Feed Pump discharge pressure.
- A-RW-AIT-1001 – Filters inlet turbidity.
- A-RW-AIT-1002 – Filters inlet chlorine residual.

4.2.2 Filter Feed Pumps

There will be three pressure Filter Feed Pumps; pressure filter feed pump 1 (A-RW-PVE-1101), filter feed pump 2 (A-RW-PVE-1201), and filter feed pump 3 (A-RW-PVE-1301). Local manual controls for the pumps will be provided through the local VFDs. When ON is selected the pump will run and pump speed will be adjusted at the AFD.

The Filter Feed Pumps will also operate in remote manual or automatic modes through the PLC when remote is selected on the local drive. The Filter Feed Pump will be depicted on the associated Contact Tank display. Remote manual control will be provided. When manual is selected at the HMI, the pump ON/OFF and the speed will be controlled from the HMI using Operator manual commands.

During normal operation the pumps will be in remote automatic mode which is provided when auto is selected at the HMI. The pumps will be controlled by a Proportional Integral (PI) controller. The setpoint for the controller will be the **Required Arcadia Plant Production Flow** signal and trimmed by the level (A-ROF-LIT-1001) in the RO Feed Tank. The controller feedback signal will be a combined filter effluent flow from the Pressure Filter PLC. The output of the PI controller will be pump speed.

The pumps are designed in lead, lag, and standby controls. The lead pump will be started first and the speed changed to meet the flow demand of the Arcadia WTP.

If the Filter Feed Pump flow is 5% (operator adjustable) less than the **Required Arcadia Plant Production Flow** with the lead pump running at 100% for 5 minutes (operator adjustable), then the lag pump will be started and the speed of both pumps will be reduced to minimum speed (60% - operator adjustable). Both lead and lag pump are adjusted up and down at the same speed to meet the Arcadia WTP plant flow demand.

If the pressure filter feed pump flow is over the **Required Arcadia Plant Production Flow** by 5% (operator adjustable) and both the lead and lag pumps are running at the minimum speed (60%) for 5 minutes (operator adjustable), the lag pump will shut off.

The standby pump will start to replace any tripped pump. The lead, lag, and standby pumps will automatically rotate every time all pumps are stopped.

The PI controller septoint will be trimmed by the RO Feed Tank level (A-ROF-LIT-1001). If the level is above the RO Feed Tank operating band 7' to 8' (operator adjustable), the PI controller septoint will be reduced by 5% (operator adjustable) every 5 minutes (operator adjustable) as long as the level stays above the operating band. The PI controller septoint stays the same as long as the level stays within the operating band. If the tank level is below the operating band, the PI controller septoint is increased by 5% (operator adjustable) every 5 minutes (operator adjustable) as long as the level stays below the operating band.

The Pressure Filter Feed Pumps will have the following interlocks:

<u>RUN PERMISSIVE</u>

- Ready-to-receive feed water signal is active.
- RO Feed Tank level has not reached low-low level (A-RW-LSLL-1001 ≠ XX').
- The Contact Tank level is greater than 5', operator adjustable (A-RW-LIT-1001 > 5').

STOP OVERRIDE

- Contact Tank reaches low-low level (A-RW-LSLL-1001 = XX').
- Contact Tank reaches low level, operator adjustable (A-RW-LIT-1001 < 3').
- Filter Feed Pumps discharge pressure drop below acceptable level, operator adjustable (A-RW-PIT-1001 > 150 psi).

AUTO START FOR THE LEAD PUMP

- RO Feed Tank level is at or below the low end of the RO Feed Tank operating band, operator adjustable (A-ROF-LIT-1001 ≤ 7').
- Feed water request signal is active.
- One of the LP RO Feed Pumps is running.

AUTO STOP FOR THE PUMPS

- RO Feed Tank level is above 9', operator adjustable (A-ROF-LIT-1001 > 9').
- Feed water request signal stops.

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail signal from the pump AFD.

STATUS INDICATIONS

- Pump Running.
- Pump in Local/Remote.
- Pump Speed.
- Pump Fail.

Arcadia Plant Flow Demand Signal is RO Flow Demand Signal from RO PLC + RO Bypass Flow (A-ROB-FIT-1003) + Backwash Supply Flow (A-BW-FIT-1001).

4.2.3 Contact Tank Sump Pump

Contact Tank sump pump (A-RW-PSS-1001) will be provided to drain the contact tank to storm drain for maintenance. This pump will not run during normal operations. This pump will be provided with local controls through the local control panel only. The pump will operate in local manual or automatic mode. In automatic mode the sump pump will automatically turn on and off based on the level switches. The sump pump will be depicted on the associated Contact Tank display.

The Contact Tank sump pump has the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Contact Tank sump pump has failed.

STATUS INDICATIONS

- Pump running.

4.3 Pressure Filters

There will be six pressure filter vessels each containing 2 cells, pressure filter 1 (A-PF-FLT-1001), pressure filter 2 (A-PF-FLT-2001), pressure filter 3 (A-PF-FLT-3001), pressure filter 4 (A-PF-FLT-4001), pressure filter 5 (A-PF-FLT-5001), and pressure filter 6 (A-PF-FLT-6001).

4.3.1 Pressure Filters Digital Input

READY-TO-RECEIVE FEED WATER

A ready-to-receive-feed-water signal will be active from the Pressure Filter PLC to the pressure filter feed pumps as long as the pressure filters are ready to receive feed water from the contact tank.

The Pressure Filter PLC will provide the options of manual and auto modes. In manual mode the Pressure Filter PLC will isolate the filter cell and close all the filter cell valves. The Operator is able to manually open and close any of the filter cell valves in manual mode. In auto mode, normal operation, the Pressure Filter PLC will automatically open, close, and modulate the filter cell valves based on 1 of the 3 operation models below.

a. Auto On-line Mode – The filter cell is available for treating the feed water.
b. Auto Off-line Mode – The filter cell is isolated and is not used to treat the feed water.
c. Auto Backwash Mode – The filter cell is in backwash operation.

BACKWASH REQUEST

A backwash request will be maintained from the Pressure Filter PLC to the backwash supply pumps as long as there is a need for filtered water during the backwash process.

The Pressure Filter PLC will queue up the backwash request from different filter cells. Only one backwash will be allowed at a time. The Pressure Filter PLC will also monitor the Plant PLC and will only request for a backwash when the backwash permissive is received.

The Pressure Filter PLC will provide four different automatic backwash control options: reset headloss, preset time, preset amount of totalized flow, and Operator initiated.

BACKWASH IN PROGRESS

A backwash in progress signal will be maintained from the Pressure Filter PLC as long as there is a backwash in progress.

4.3.2 Pressure Filters Digital Output

BACKWASH PERMISSIVE

This signal will be maintained from Plant PLC only when all of the following backwash permissives are met:

1. Backwash holding tank level (A-BW-LIT-1001) > 7' (operator adjustable).
2. Equalization tank level (A-WW-LIT-1001) < 2' (operator adjustable).
3. No Backwash supply pump failure from both pumps.

4. Backwash in progress from Pressure Filter PLC in not given.

BACKWASH ABORT REQUEST

Any of the following conditions will cause a backwash abort request from the Plant PLC:

1. Backwash Holding Tank level (A-BW-LIT-1001) < 4' (operator adjustable).
2. Backwash Recovery Tank (Washwater Equalization Tank) level (A-WW-LIT-1001) > 6' (operator adjustable).
3. Both backwash supply pumps fail.

FEED PUMP RUNNING STATUS

This signal will be maintained from the Plant PLC as long as a pressure filter feed pump is running.

BACKWASH SUPPLY PUMP RUNNING STATUS

This signal will be maintained from the Plant PLC as long as the backwash supply pump is running.

4.3.3 Pressure Filters Analog Input

AVAILABLE PRESSURE FILTERS CAPACITY

The Pressure Filter PLC will provide the total available pressure filter cell capacity for the process water. This signal will only include the filter cells that are ready to receive feed water and will not include the capacity from any filter cell that is off-line, in manual mode, in any failure mode, in backwash mode, etc.

COMBINED FILTERS TREATED WATER FLOW

The Pressure Filter PLC will provide a total treated water flow from all on-line filter cells.

BACKWASH FLOW DEMAND

The Pressure Filter PLC will send a flow demand signal for backwash water from the Backwash Holding tank.

4.3.4 Pressure Filters Analog Output

TOTAL AVAILABLE CHARNOCK TREATMENT FLOW

The Plant PLC will provide the **Required Arcadia Plant Production** signal to the Pressure Filter PLC which will determine the number of filter cells needed to be on-line to treat the water. The Pressure Filter PLC will only consider the cells that are in auto mode. The filter cells that are not required will be changed from auto on-line to auto off-line.

An alarm will be generated by the Pressure Filter PLC if the **Required Arcadia Plant Production** is greater than the available pressure filters capacity.

PRESSURE FILTER FEED PUMP DISCHARGE PRESSURE FEEDBACK

The Plant PLC will provide the pressure Filter Feed Pump discharge pressure to the Pressure Filter PLC. The Pressure Filter PLC will control the pressure filter effluent valves to maintain a constant discharge pressure (operator adjustable setpoint) for the pressure Filter Feed Pump while providing an even effluent flow on all on-line filters. If the pressure Filter Feed Pump discharge pressure feedback is above the pressure setpoint, the Pressure Filter PLC will raise the flow setpoint for all on-line filter effluent valves which opens more to reach the new flow setpoint. All of the on-line filter effluent valves will have the same flow setpoint.

BACKWASH FLOW FEEDBACK

The Plant PLC will provide the backwash flow feedback to the Pressure Filter PLC.

4.4 RO Feed Tank and Pumps

4.4.1 RO Feed Tank and Pumps General Monitoring

The RO feed system will be monitored with a level indicator, level switches, pressure gauge, flowmeter, sodium bisulfite analyzer, and chlorine residual analyzers. The instruments will be depicted on the associated Raw Water Mixing display.

The RO feed system instruments will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- RO Feed Tank level is greater than 9'-6" (A-ROF-LIT-1001 > 9'-6").
- RO Feed Tank level is less than 2' (A-ROF-LIT-1001 < 2').
- RO Feed Tank reaches high-high level (A-ROF-LSHH-1001 =XX').
- RO Feed Tank reaches low-low level (A-ROF-LSLL-1001 =XX').
- RO Low Pressure Feed Pumps discharge pressure reaches high (A-ROF-PSH-1001 = XX psi).
- Pressure filter permeate to RO Feed Tank chlorine residual is high (A-ROF-AIT-1002 > 0 ppm).

STATUS INDICATIONS

- A-ROF-LIT-1001 – RO Feed Tank level.
- A-ROF-FIT-1003 – RO bypass flow.
- A-NHS-ZSO-1101 – Sodium bisulfite injection after the RO Low Pressure Feed Pumps.
- A-NHS-ZSO-1102 – Sodium bisulfite injection before the RO Feed Tank.
- A-ROF-AIT-1001 – Pressure filter permeate to RO Feed Tank chlorine residual.
- A-ROF-AIT-1002 – RO Feed Tank inlet chlorine residual.

4.4.2 Low Pressure RO Feed Pumps

The RO Feed Tank will be equipped with three vertical diffusion vane LP RO Feed Pumps, low pressure RO feed pump 1 (A-ROF-PVE-1101), low pressure RO feed pump 2 (A-ROF-PVE-1201), and low pressure RO feed pump 3 (A-ROF-PVE-1301). These pumps will operate in local manual control through the local VFD. The pumps will also operate in remote manual and automatic mode through the PLC when the local drive is remote. The Low Pressure RO Feed Pump will be depicted on the associated Contact Tank display. Remote manual control will provide the pump ON/OFF and speed control from the HMI using Operator manual commands.

During normal operation the pumps will be in remote automatic mode which will control the pumps with a Proportional Integral (PI) controller. The controller's setpoint will be the Cartridge Filters inlet pressure (A-ROF-PIT-1101 initially set at 20 psi, operator adjustable). The output of the PI controller is the pump speed.

The pumps are designed for lead, lag, and standby controls. The lead pump will be started first and changed speed to meet the RO suction pressure.

If the Cartridge Filter inlet pressure is less than 95% of the RO suction pressure demand (operator adjustable) and the lead pump has been running at 100% for 5 minutes (operator adjustable), then the lag pump will start and both pump speeds will be placed at minimum speed (60% - operator adjustable). Both lead and lag pump will adjust the speed up and down at the same speed to meet the RO suction pressure demand.

If the Cartridge Filter inlet pressure is more than 105% of the RO suction pressure demand (operator adjustable) and both the lead and lag pumps are running at the minimum speed (60%) for 5 minutes (operator adjustable), the lag pump will stop.

The standby pump will start to replace any tripped pump. The lead, lag, and standby pumps will automatically rotate every time all the pumps are stopped.

When there is a feed water to waste request from the RO PLC, only the lead pump will run at minimum speed.

The Low Pressure RO Feed Pumps will have the following interlocks:

<u>RUN PERMISSIVE</u>

- Ready-to-receive feed water signal is received from the RO PLC.
- RO Feed Tank low-low level is not reached (A-ROF-LSLL-1001 ≠ XX').
- RO Feed Tank level is greater than 5', operator adjustable (A-ROF-LIT-1001 > 5').

<u>STOP OVERRIDE</u>

- RO Feed Tank low-low level is reached (A-ROF-LSLL-1001 = XX').
- LP RO Feed Pumps high discharge pressure is reached (A-ROF-PSH-1001 > XX psi).
- RO Feed Tank level is less than 3', operator adjustable (A-ROF-LIT-1001 < 3').

AUTO START FOR THE LEAD PUMP

- RO start feed pump is requested.

AUTO STOP FOR THE PUMPS

- RO start feed pump request is stopped.

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail signal from the pump AFD.

STATUS INDICATIONS

- Pump Running.
- Pump in Local/Remote.
- Pump Speed.
- Pump Fail.

4.4.3 RO Bypass Valve

A small amount of flow is bypassed around the RO System through the RO Bypass Valve (A-ROB-VBR-1002). This valve will be a butterfly valve operated in local manual, remote manual, and remote automatic. The RO Bypass Valve (flow control) will be depicted on the RO Feed Tank display. In local manual mode the valve will control the RO bypass flow control through manual overrides on the valve positioner.

Remote control will be provided through the PLC for manual and automatic modes. When manual is selected at the HMI, the valve is positioned using the Operator entered position at the HMI.

During normal operations the valve will be in remote automatic mode, which is when auto is selected at the HMI. The valve will be controlled by either of two modes:

- Directly Flow Splitting Control Mode
- Finished Water Hardness Control Mode

When the combined RO effluent flow is equal to 75% of the combined RO demand flow setpoint, the RO Bypass Valve is released to modulate.

If directly flow splitting control mode is selected, the Operator will be able to enter a % of bypass flow based on the combined RO demand flow. The Bypass Valve will be controlled by a PID controller to meet the % of bypass flow entered. The PID controller's flow feedback signal will be from the RO bypass flowmeter (A-ROF-FIT-1003) while the control element of the PID controller will be the valve position.

If Finished Water Hardness Control Mode is selected and the hardness of the finished water is above or below an operator adjustable setpoint (110-130 mg/l, initially set at 120 mg/l) by an amount greater than X%, the amount of bypass flow will be increased or decreased by Y% (operator adjustable). If the hardness is still greater than X% above or below the setpoint after Z minutes (operator adjustable) other adjustments will be made to the bypass flow based on the combined RO demand flow. Hardness has a correlation to conductivity, which will be measured in an analyzer after the decarbonator (A-DC-AIT-1005). The ratio of hardness to conductivity will be adjustable at the HMI, initially set at 0.36 (mg/l) / (µS/cm).

	Condition 1	Condition 2	Condition 3
X %	< or > 50%	< or > 25%	< or > 5%
Y %	10%	5%	1%
Z minutes	2	5	10

The RO Bypass Valve will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- When the difference between the flowmeter setpoint (A-ROB-FIT-1003) and the calculated % of bypass flow is greater than 5% for an adjustable time (0-600 sec, initially set at 60 sec).
- A valve fail alarm is initiated if the valve is commanded to close, and does not close within an adjustable time (0-120 sec, initially set at 60 sec).

STATUS INDICATIONS

- Valve in manual/auto.
- Valve position (0-100%).
- Valve closed.
- Valve fail.

4.4.4 RO Feed Tank Sump Pump

During normal operation the RO Feed Tank sump pump (A-ROF-PSS-1001) will not run. This submersible pump is for draining the tank beyond the low-low level in the tank to the sewer for maintenance or long term shutdown. The sump pump will be depicted on the associated RO Feed Tank display.

This pump will only operate with local controls through the local control panel. The pump will operate in manual mode. A discharge hose will need to be connected to the pump discharge prior to operating the pump.

The RO Feed Tank sump pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- RO Feed Tank sump pump has failed.

STATUS INDICATIONS

- Pump running.

4.5 Cartridge Filter

There are 4 Cartridge Filters; cartridge filter 1 (A-RO-FLC-1101), cartridge filter 2 (A-RO-FLC-2101), cartridge filter 3 (A-RO-FLC-3101), and cartridge filter 4 (A-RO-FLC-4101). A number of instruments will be used to monitor the condition of the Cartridge Filters. The instruments will be depicted on the associated Cartridge Filter display.

The Cartridge Filter instruments will have the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)

- Cartridge Filter inlet pressure is greater than 40 psi (A-ROF-PIT-1101 > 20 psi).
- Cartridge Filter differential pressure is greater than 5 psi (A-ROF-PDIT-1001 > 5 psi).
- Cartridge Filter inlet turbidity is greater than 100 NTU (A-ROF-AIT-1101 > 100 NTU).
- RO inlet oxidation reduction potential is greater than 500 mV (A-ROF-AIT-1102 > 500 mV).
- RO inlet total chlorine is greater than 0.1 ppm (A-ROF-AIT-1103 > 0.1 ppm).
- RO inlet pH is greater than 9 (A-ROF-AIT-1104 pH > 9).
- RO inlet pH is less than 6 (A-ROF-AIT-1104 pH < 6).
- RO inlet temperature is greater than 130 F (A-ROF-AIT-1004 temperature > 130 F).
- RO inlet conductivity is greater than 20 us/cm (A-ROF-AIT-1105 > 20 us/cm).
- RO inlet turbidity is greater than 10 NTU (A-ROF-AIT-1106 > 10 NTU).

STATUS INDICATIONS

- A-ROF-PIT-1101 – Cartridge Filter inlet pressure.
- A-ROF-PDIT-1001 – Cartridge Filter differential pressure.
- A-ROF-AIT-1101 – Cartridge Filter inlet turbidity.
- A-ROF-AIT-1102 – RO inlet oxidation reduction potential.
- A-ROF-AIT-1103 – RO inlet total chlorine.
- A-ROF-AIT-1104 – RO inlet temperature and pH.
- A-ROF-AIT-1105 – RO inlet conductivity.
- A-ROF-AIT-1106 – RO inlet turbidity.

4.6 Reverse Osmosis

The RO System is designed for three RO skids to be on line and one on standby at maximum Plant Flow. To operate the Plant at a lower flow see table 4-1. After X time the standby skid will be brought on line and another skid taken off line. The skid taken off line will be rotated to allow equal operating time of each skid. An RO skid should not be left off line for more then XX (time). When longer shut downs are planned, the RO System or individual skids will be flushed with RO Flush System permeate.

The three stage system will include an energy recovery device (ERD). The concentrate from the first stage, which is also the feed water to stage two, will pass through the ERD where the pressure from the concentrate of the third stage will be used to boost the pressure of the second stage feed water, supplemented by an electric motor.

Table 4-1. RO Unit Capacity Table

No. of Skids On-Line	Permeate (MGD)	Bypass (MGD)	Total WTP Production
1	2.3	0.6	2.9
2	4.7	1.2	5.9
3	7.0	1.8	8.8

4.6.1 Reverse Osmosis Digital Input

FEED WATER REQUEST

This signal will be maintained as long as the RO units are ready to receive process water. This signal will stop if no RO unit is ready to receive process water.

The Plant PLC will start the LP RO Feed Pumps when this signal is active and stop the LP RO Feed Pumps when this signal and feed water to waste request are both inactive.

FEED WATER TO WASTE REQUEST

This signal will be active when the RO PLC opens the feed water to waste valve (A-DRN-VBF-1002), to send the feed water to the Washwater Equalization Tank from the Cartridge Filters for wasting. The RO PLC will monitor the feed water qualities to determine if the feed water should continue to go to waste. The waste is based on the water qualities and time. If the water quality requirements are not met after 5 minutes (operator adjustable) of wasting, the RO PLC will generate an alarm to alert the Operator. The RO PLC will then provide two options to the Operator, either to abort the RO operation or allow the RO operation to continue.

The Plant PLC will run the lead LP RO Feed Pump at minimum speed when this signal is active.

4.6.2 Reverse Osmosis Digital Output

FEED PUMP RUNNING STATUS

This signal will be maintained as long as the feed pumps are running.

RO E-STOP REQUEST

This signal will request the RO PLC to perform an emergency stop for all running RO units. This signal will be stopped when feed water request from the RO PLC is stopped.

When the feed water request is active and any of the following conditions is true, the RO E-stop request will be active.

- The 5MG reservoir level is > 13' (operator adjustable).
- All of the LP RO Feed Pumps are tripped.

4.6.3 Reverse Osmosis Analog Input

TOTAL AVAILABLE RO PERMEATE
The RO PLC will provide a total available RO permeate for the process water. This signal will include the RO units that are ready to receive feed water. This signal will not include the capacity from any RO units that are off-line, in manual, in any failure mode, in cleaning etc.

TOTAL REQUIRED RO FEED WATER
The RO PLC will provide a total required RO feed water demand signal to the Plant PLC. This signal will include all the on-line RO units. This signal is the total feed water that is needed for all the on-line RO units to produce the total available RO permeate.

4.6.4 Reverse Osmosis Analog Output

RO INLET ORP
The Plant PLC will provide the RO inlet ORP signal (A-ROF-AIT-1102) to the RO PLC.

RO INLET TEMPERATURE
The Plant PLC will provide the RO inlet temperature signal (A-ROF-AIT-1104) to the RO PLC.

RO INLET PH
The Plant PLC will provide the RO inlet pH signal (A-ROF-AIT-1104) to the RO PLC.

RO INLET CONDUCTIVITY
The Plant PLC will provide the RO inlet conductivity signal (A-ROF-AIT-1105) to the RO PLC.

RO INLET TURBIDITY
The Plant PLC will provide the RO inlet turbidity signal (A-ROF-AIT-1106) to the RO PLC.

RO INLET CL2
The Plant PLC will provide the RO inlet Cl2 signal (A-ROF-AIT-1103) to the RO PLC.

Operation details of the following items controlled by RO PLC are not included in this Operations manual. Refer RO System Supplier's recommended procedures for details.

- HP RO Feed Pump (A-RO-PVE-X101) – speed controlled to maintain a pre-set permeate flow from each RO train based on flow signal from Flow transmitter FIT-X100.
- A-RO-PSL X101 on Suction side of each HP RO Feed Pump – this pressure signal will shut the respective HP RO Feed Pump and corresponding RO Train
- A-RO-PSH X100 for tripping the pump if the HP RO Feed Pump discharge pressure is over the set point for a pre-set time
- RO Feed Line Isolation Valve (A-RO-VBF-X102)
- RO Flush line Isolation Valve (A-RO-VBF-X103)
- Differential pressure monitoring across each stages of RO trains (A-RO-PI-1101)
- Conductivity monitoring on permeate lines of each stage and at common permeate line of each train (A-RO-AIT-X101, X103, X104 and X102)
- Pressure transmitters at inlet to each stage of RO train (A-RO-PIT-X100, X104, X106)
- Pressure transmitters at common permeate line (A-RO-PIT-X101)
- Pressure transmitters at concentrate lines (A-RO-PIT-X103, X105, X107)
- Energy Recovery Device on each RO train
- Reject Control Valve on each RO train (A-RO-VGL-X101)
- Permeate line isolation valve on each RO train (A-RO-VBF-X107)
- Reject line isolation valve on each RO train (A-RO-VBF-X124)

4.6.6 CIP System

4.6.6.1 RO CIP Tank Chemical Inlet Valves

The CIP System will have four valves to control the chemicals used. There will be two citric acid feed valves, CIP Makeup Tank 1 (A-CA-VG-1201) and CIP Makeup Tank 2 (A-CA-VG-1202). There will also be two caustic detergent feed valves, CIP Makeup Tank 1 (A-DET-VG-1201) and CIP Makeup Tank 2 (A-DET-VG-1202). The valves will be depicted on the associated HMI display. The selection on the HMI will include:

- Citric Acid OR Caustic Detergent to CIP Makeup Tank 1
- Citric Acid OR Caustic Detergent to CIP Makeup Tank 2

The chemical feed valves will be solenoid actuated valves, controlled in remote manual and auto through the PLC. In remote manual mode the valves will open and close with the Operator's commands at the HMI.

When remote auto, which is normal operation, control is selected at the HMI, the valves will open and close as follows:

Citric acid feed to CIP Makeup Tank 1 valve (A-CA-VG-1201) will open when citric acid to CIP Makeup Tank 1 is selected and the RO permeate to the CIP makeup tank 1 valve is open (this valve is located on the makeup tank skid and does not have a tag number). Citric acid feed to CIP Makeup Tank 1 valve will be closed when RO permeate to CIP Makeup Tank 1 valve is closed (from RO PLC).

Citric acid feed to CIP Makeup Tank 2 valve (A-CA-VG-1202) will open when citric acid to CIP Makeup Tank 2 is selected and RO permeate to CIP Makeup Tank 2 valve is open (from RO PLC). Citric acid feed to CIP Makeup Tank 2 valve will be closed when RO permeate to CIP makeup tank 2 valve is closed (from RO PLC).

Caustic detergent feed to CIP Makeup Tank 1 valve (A-DET-VG-1201) will open when caustic detergent to CIP Makeup Tank 1 is selected and RO permeate to CIP Makeup Tank 1 valve is open (from RO PLC). Caustic detergent feed to CIP Makeup Tank 1 valve will be closed when RO permeate to CIP Makeup Tank 1 valve is closed (from RO PLC).

Caustic detergent feed to CIP Makeup Tank 2 valve (A-DET-VG-1202) will be open when caustic detergent to CIP Makeup Tank 2 is selected and RO permeate to CIP Makeup Tank 2 valve is open (from RO PLC). Caustic detergent feed to CIP Makeup Tank 2 valve will be closed when RO permeate to CIP Makeup Tank 2 valve is closed (from RO PLC).

The CIP chemical feed valves have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Citric acid feed to CIP Makeup Tank 1 valve (A-CA-VG-1201) is open and permeate to CIP Makeup Tank 1 valve is closed (from RO PLC).
- Citric acid feed to CIP Makeup Tank 2 valve (A-CA-VG-1202) is open and RO permeate to CIP Makeup Tank 2 valve is closed (from RO PLC).
- Caustic detergent feed to CIP Makeup Tank 1 valve (A-DET-VG-1201) is open and RO permeate to CIP Makeup Tank 1 valve is closed (from RO PLC).
- Caustic detergent feed to CIP Makeup Tank 2 valve (A-DET-VG-1202) is open and RO permeate to CIP Makeup Tank 2 valve is closed (from RO PLC).

STATUS INDICATIONS

- Valve in manual/auto.
- Valve open/closed.
- Valve fail.

4.6.6.2 RO CIP Containment Sump Pump

The CIP containment will have a single submersible pump to convey drains from the CIP System to the neutralization tank for treatment. During normal operation this pump will not be running. This pump is only designed to operate in local manual mode through the local control panel.

The CIP containment sump pump has the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- CIP sump pump has failed.

STATUS INDICATIONS

- Pump running.

4.6.6.3 RO CIP General Monitoring

The CIP System will monitor the discharge flow of the CIP neutralization tank with a flowmeter (A-CIP-FIT-2001) and the containment sump high level with a level switch (A-CIP-LSH-1001) and display the readings on the associated CIP display.

The CIP instruments will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Containment sump has reached high level (A-CIP-LSH-1001 > XX').

STATUS INDICATIONS

- CIP neutralization tank discharge flow (A-CIP-FIT-2001).

4.7 Decarbonator

4.7.1 Decarbonator General Monitoring

The level in the Decarbonator Effluent Tank will be monitored with the Decarbonator Tank level controller (A-DC-LIT-1001) and the Decarbonator Tank level high-high switch (A-DC-LSHH-1001). The discharge from the Decarbonators will be monitored for flow, (A-DC-FIT-1001) temperature and pH (A-DC-AIT-1001), fluoride (A-DC-AIT-1002), total chlorine (A-DC-AIT-1003), turbidity (A-DC-AIT-1004), and conductivity (A-DC-AIT-1005). The instruments will be depicted on the associated Decarbonator display.

The Decarbonator instruments will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Decarbonator Tank has reached high level (A-DC-LIT-1001 > 9'-6").
- Decarbonator Tank has reached low level (A-DC-LIT-1001 < 2').
- Decarbonator Tank has reached high-high level (A-DC-LSHH-1001 = XX').
- Decarbonator discharge has reached high pH level (A-DC-AIT-1001 pH > 9).
- Decarbonator discharge has reached low pH level (A-DC-AIT-1001 pH <6).
- Decarbonator discharge has reached high temperature level (A-DC-AIT-1001 temperature > 150 F).
- Decarbonator discharge has reached high fluoride level (A-DC-AIT-1002 > 8 ppm).

- Decarbonator discharge has reached low total chlorine level (A-DC-AIT-1003 < 1 ppm).
- Decarbonator discharge has reached high turbidity level (A-DC-AIT-1004 > 1 ppm).
- Decarbonator discharge has reached high conductivity level (A-DC-AIT-1005 > 500).

STATUS INDICATIONS

- A-DC-LIT-1001 – Decarbonator Tank level.
- A-DC-LSHH-1001 – Decarbonator Tank level high-high.
- A-DC-FIT-1001 – Decarbonators discharge flow.
- A-DC-AIT-1001 – Decarbonators discharge temperature and pH.
- A-DC-AIT-1002 – Decarbonators discharge fluoride.
- A-DC-AIT-1003 – Decarbonators discharge total chlorine.
- A-DC-AIT-1004 – Decarbonators discharge turbidity.
- A-DC-AIT-1005 – Decarbonators discharge conductivity.

4.7.2 Decarbonator Blowers

There will be two decarbonator blowers, decarbonator blower 1 (A-DC-BLC-1101) and decarbonator blower 2 (A-DC-BLC-1201), provided with the decarbonator system. These blowers will normally be in operation when their associated Decarbonator is in operation in remote auto mode. They will also operate in local manual and remote manual mode. The forced draft decarbonator blowers will be depicted on the Forced Draft Decarbonator display.

Local manual control of the forced draft decarbonator blower will be provided through the on-off-remote switch mounted on the blower control panel.

Remote manual control will be provided through the PLC. When the switch on the blower control panel is in the remote position and manual is selected at the HMI, the blower on/off will be controlled from the HMI using Operator manual commands.

For normal operation the remote position will be selected at the blower and auto will be selected at the HMI. This allows for remote automatic control through the PLC. The duty blower will start when the first RO Unit starts, and will shut down when the last RO unit shuts down.

The decarbonator blowers will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Blower fail signal from the blower control panel.

STATUS INDICATIONS

- Blower running.
- Blower in local/remote.
- Blower in manual/auto.
- Blower fail.

4.8 Washwater (Backwash) Recovery System

4.8.1 Washwater Recovery System General Monitoring

The Washwater Equalization Tank will have three devices to monitor the level in the tank: level indicator (A-WW-LIT-1001), high-high level switch (A-WW-LSHH-1001), and low-low level switch (A-WW-LSLL-1001). The system will also be equipped with a flowmeter for the Washwater Recovery Pump discharge (A-WW-FIT-1001). The instruments will be depicted on the associated Washwater Recovery display.

<u>ALARMS (All alarm setpoints will be operator adjustable)</u>

- Equalization Tank level is above 11'-6"(A-WW-LIT-1001 > 11'6").
- Equalization Tank level is below 1' (A-WW-LIT-1001 < 1').
- Equalization Tank level reaches high-high (A-WW-LSHH-1001 = XX').
- Equalization Tank level reaches low-low (A-WW-LSLL-1001 =XX').

<u>STATUS INDICATIONS</u>

- A-WW-LIT-1001 – Equalization Tank level.
- A-WW-LSHH-1001 - Equalization tank level high-high.
- A-WW-LSLL-1001 - Equalization tank level low-low.
- A-WW-FIT-1001 - Washwater Recovery Pump discharge flow.

4.8.2 Equalization Tank Submersible Mixers

The Washwater Equalization Tank will be equipped with 2 submersible mixers, washwater recovery submersible mixer 1 (A-WW-MXP-1101) and washwater recovery submersible mixer 2 (A-WW-MXP-1201), to prevent solids from settling. The backwash recovery mixers will be depicted on the Washwater Recovery Display. The mixers will operate in local manual, remote manual, and remote auto modes.

In local manual mode the control of the backwash recovery tank mixers will be provided through the local drive. When ON is selected the mixer will run.

In Remote mode the mixers will be operated through the PLC when the switch at the local drive is in the remote position. In manual, the mixer ON/OFF will be controlled from the HMI using Operator manual commands.

Remote automatic control will allow the mixers start/stop to be controlled by level in the Washwater Equalization Tank. Start and stop levels will be adjustable at the HMI. During normal operation the submersible mixers will operate in this mode.

The washwater recovery mixers will have the following interlocks:

RUN PERMISSIVE

- Equalization Tank low-low level has not been reached (A-WW-LSLL-1001 >XX').
- Equalization Tank level is above 2', operator adjustable (A-WW-LIT-1001 is > 2').

STOP OVERRIDE

- Equalization Tank have reached low-low level (A-WW-LSLL-1001 = XX').
- Equalization Tank level is less then 1.5', operator adjustable (A-WW-LIT-1001 < 1.5').

AUTO START

- Equalization Tank is above 3', operator adjustable (A-WW-LIT-1001 > 3').

AUTO STOP

- Equalization Tank is less then 2', operator adjustable (A-WW-LIT-1001 < 2').

ALARMS (All alarm setpoints will be operator adjustable)

- Mixer fail from the mixer starter.

STATUS INDICATIONS

- Mixer running.
- Mixer in local/remote.
- Mixer fail.

4.8.3 Washwater Recovery Pump

The Washwater Equalization Tank will be equipped with 2 submersible pumps, washwater recovery feed pump 1 (A-WW-PSM-1101) and washwater recovery system feed pump 2 (A-WW-PSM-1201), to feed the package treatment unit. The Washwater Recovery Pumps will be depicted on the Washwater Recovery display. These pumps will operate in local manual, remote manual and remote auto mode.

Local manual control of the Washwater Recovery Pumps will be provided through the local drive. When ON is selected the pump will run.

When remote is chosen on the pump, the pump will be controlled through the PLC. In manual, the pump's ON/OFF and speed is controlled from the HMI using Operator manual commands.

During normal operation the Washwater Recovery Pumps will operate in remote automatic mode. In remote automatic mode the duty pump start/stop will be controlled by level in the Washwater Equalization Tank. Start and stop levels will be adjustable at the HMI. The pump will be controlled in either of 2 modes: level control mode, or recovery flow control mode.

If the level control mode is selected, the duty pump's speed will run at 100% all the time.

If recovery flow control mode is selected, the duty pump's speed will be varied by a PI controller to meet the Operator entered recovery flow % based on the Arcadia Plant flow demand.

The standby pump will start to replace the tripped duty pump. The duty and standby pumps will automatically rotate every time the duty pump is stopped.

The Washwater Recovery Pumps will have the following interlocks:

RUN PERMISSIVE

- Equalization Tank low-low level is not reached (A-WW-LSLL-1001 ≠ XX').
- Equalization Tank level is above 4', operator adjustable (A-WW-LIT-1001 > 4').

STOP OVERRIDE

- Equalization Tank has reached low-low level (A-WW-LSLL-1001 = XX').
- Equalization Tank level is less than 2', operator adjustable (A-WW-LIT-1001 < 2').

AUTO START

- Equalization Tank level is above 6', operator adjustable (A-WW-LIT-1001 > 6').

AUTO STOP

- Equalization Tank level is less than 3' operator adjustable (A-WW-LIT-1001 < 3').
- Contact Tank level is above 8.5', operator adjustable (A-RW-LIT-1001 > 8.5').

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from the pump starter.

STATUS INDICATIONS

- Pump running.
- Pump in local/remote.
- Pump fail.
- Pump speed.

4.9 Package Treatment Unit

The Package Treatment Unit is a plate settler for solids removal from backwash flow.

4.9.1 Package Treatment Unit General Monitoring

The system will be equipped with one flowmeter for the plate settler discharge (A-WW-FIT-1006), and an analyzer to measure the turbidity from the plate settler return (A-WW-AIT-1001). The instruments will be depicted on the associated Washwater Recovery display.

The package treatment system instruments will have the following interlocks:

ALARMS (All alarm setpoint are operator adjustable)

- Plate settler return flow turbidity is greater than 500 NTU (A-WW-AIT-1001 > 500 NTU).

STATUS INDICATIONS

- A-WW-FIT-1006 - Plate settler sludge discharge flow.
- A-WW-AIT-1001 - Plate settler return flow turbidity.

4.10 Backwash Supply

4.10.1 Backwash Supply System General Monitoring

The Backwash Holding Tank level will be monitored and controlled with three instruments: Backwash Holding Tank level controller (A-BW-LIT-1002), Backwash Holding Tank high-high level switch (A-BW-LSHH-1001), and Backwash Holding Tank low-low level switch (A-BW-LSLL-1001). The discharge pressure and flow of the Backwash Supply Pumps will be monitored with the pressure analyzer (A-BW-PIT-1001) and flowmeter (A-BW-FIT-1003). These instruments will normally be online and depicted on the Backwash Supply display.

The backwash supply system instruments will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Backwash Holding Tank is above the high level (A-BW-LIT-1002 > 9'-6").
- Backwash Holding Tank is below the low level (A-BW-LIT-1002 < 2').
- Backwash Holding Tank has reached high-high level (A-BW-LSHH-1001 = XX').
- Backwash Holding Tank has reached low-low level (A-BW-LSLL-1001 = XX').
- Backwash Holding Supply Tank discharge pressure is above 60 psi (A-BW-PIT-1001 > 60 psi).

STATUS INDICATIONS

- A-BW-LIT-1002 – Backwash Holding Tank level.
- A-BW-LSHH-1001 – Backwash Holding Tank level high-high.
- A-BW-LSLL-1001 – Backwash Holding Tank level low-low.
- A-BW-PIT-1001 – Backwash Supply Pump discharge pressure.
- A-BW-FIT-1003 – Backwash Supply Pump flow.

4.10.2 Backwash Supply Pumps

The Backwash Holding Tank will contain two Backwash Supply Pumps, backwash supply pump 1 (A-BW-PVE-1101) and backwash supply pump 2 (A-BW-PVE-1201). The Backwash Supply Pumps will be depicted on the Washwater Supply display. During normal operation the pumps will be in remote auto mode, but they also operate in local manual and remote manual mode. In local manual mode the Backwash Supply Pumps will be operated through the local drive.

When the pumps are in remote mode, control will be provided through the PLC. Pump manual control will be provided through the HMI when remote is selected at the local drive and manual is selected at the HMI. The pump ON/OFF and speed will be controlled from the HMI using Operator manual commands.

Remote automatic control will be provided when auto is selected at the HMI. The pumps will then be controlled by a Proportional Integral (PI) controller. The setpoint for the controller will be the pressure filter backwash flow demand. The controller feedback signal will be from the Backwash Supply Pump discharge flow (A-BW-FIT-1003). The output of the PI controller is the pump speed.

The standby pump will be started to replace the tripped duty pump. The duty and standby pumps will automatically rotate every time the duty pump is stopped.

The Backwash Supply Pumps will have the following interlocks:

RUN PERMISSIVE

- Backwash Holding Tank low-low level is not reached (A-BW-LSLL-1001 ≠ XX').
- Backwash Holding Tank level is above 5', operator adjustable (A-BW-LIT-1002 > 5').

STOP OVERRIDE

- Backwash Holding Tank low-low level is reached (A-BW-LSLL-1001 = XX').
- Backwash Holding Tank has reached low level, operator adjustable (A-BW-LIT-1002 < 2').
- Backwash Supply Pumps discharge pressure is above 60 psi, operator adjustable (A-BW-PIT-1001 > 60 psi).

AUTO START FOR THE DUTY PUMP

- The ready to receive backwash water signal is active.

AUTO STOP FOR THE PUMPS

- The ready to receive backwash water signal is stopped.

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail signal from the pump AFD.

STATUS INDICATIONS

- Pump running.
- Pump in local/remote.
- Pump speed.
- Pump fail.

4.10.3 Backwash Holding Tank Sump Pump

A sump pump, Backwash Supply Tank sump pump (A-BW-PSS-1001), will be provided within the Backwash Holding Tank for draining the tank for maintenance. During normal operation this pump will not be running. This pump will run with local controls through the pump local control panel only. The pump will operate in manual and auto mode. In auto mode control of the sump pump will automatically turn on and off based on the level switches.

The Backwash Holding Tank sump pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)
- Backwash Holding Supply Tank sump pump fail.

STATUS INDICATIONS
- Pump running.

4.11 Chemical Feed Systems

The normal chemical feed system procedures are discussed below.

4.11.1 Chemical Replenishment Procedures

4.11.1.1 Chemical Tank Fill Operation Procedure

The following guidelines need to be observed during tank filling operations for all bulk chemical storage tanks:

1. Disconnect dust cap from the fill line of the appropriate chemical tank. Connect fill line to the cam lock male connector provided.
2. Open tank fill valve and commence filling.
3. Watch level indicator closely until the tank is filled with desired chemical. If the storage tank is not visible from filling point, be alert for the overfill alarm.
4. Stop filling when tank is full and close valve.
5. Disconnect the fill line and replace dust cap.
6. Confirm that any spilled liquid drains to a provided sump or is disposed of in accordance with local environmental regulations.

4.11.1.2 Chemical Tote Change Operation Procedure

The following guidelines need to be observed during tote changing operations for chemical storage totes:

1. Stop the pump that is running.
2. Close the three chemical supply valves immediately downstream of tote.
3. Disconnect the male connector from the female connector. Remove empty tote from the weigh scale. Place new and full chemical storage tote on the weigh scale.

4. Connect the cam lock male connector to the female end. Open supply valves and turn on pump.
5. Confirm that any spilled liquid drains to a provided sump or is disposed of in accordance with local environmental regulations.

4.11.2 Sodium Hypochlorite Feed System

4.11.2.1 Sodium Hypochlorite Storage

Each sodium hypochlorite storage tank will be provided with a level transmitter (A-NOCL-LIT-1101, A-NOCL-LIT-1201) used to monitor the liquid level. The level transmitter will provide high and low level alarms for the Operator and, in case of low level, will send a signal to stop the Sodium Hypochlorite Metering Pumps.

Each level transmitter will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)
- Sodium Hypochlorite Storage Tank 1 high level (A-NOCL-LIT-1101 > 8')
- Sodium Hypochlorite Storage Tank 1 low level (A-NOCL-LIT-1101 < 2')
- Sodium Hypochlorite Storage Tank 2 high level (A-NOCL-LIT-1201 > 8')
- Sodium Hypochlorite Storage Tank 2 low level (A-NOCL-LIT-1201 < 2')

STATUS INDICATIONS
- A-NOCL-LIT-1101 – Sodium Hypochlorite Storage Tank 1 level
- A-NOCL-LIT-1201 – Sodium Hypochlorite Storage Tank 2 level

4.11.2.2 Sodium Hypochlorite Metering Pumps to Well Pumps

The Sodium Hypochlorite Metering Pumps (A-NOCL-PDM-1001, A-NOCL-PDM-2001) will be used to feed sodium hypochlorite from the Sodium Hypochlorite Storage Tanks to Arcadia Well Pump 4 and Arcadia Well Pump 5. Pump A-NOCL-PDM-1001 will feed to Arcadia Well Pump 4. Pump A-NOCL-PDM-2001 will feed to Arcadia Well Pump 5. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local manual control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI shall select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided when auto is selected at the HMI. The pumps will then be controlled by a Proportional Integral controller. The setpoint for the controller is the pressure filter backwash flow demand. The controller feedback signal will be from the Backwash Supply Pump discharge flow (A-BW-FIT-1003). The output of the PI controller is the pump speed.

Remote automatic control for pump A-NOCL-PDM-1001 will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum Arcadia Well Pump 4 discharge flow from the existing PLC > 20 gpm (operator adjustable). Pump speed will be controlled by the Arcadia Well Pump 4 discharge flow pacing signal and the dosage (adjustable at the HMI) entered by the Operator.

Remote automatic control for pump A-NOCL-PDM-2001 will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum Arcadia Well Pump 5 discharge flow from the existing PLC > 20 gpm (operator adjustable). Pump speed will be controlled by the Arcadia Well Pump 5 discharge flow pacing signal and the dosage (adjustable at the HMI) entered by the Operator.

The metering pumps will have the following interlocks:

RUN PERMISSIVE

- Either Sodium Hypochlorite Storage tank level is above 2', operator adjustable (A-NOCL-LIT-1101 > 2' or A-NOCL-LIT-1201 > 2').

STOP OVERRIDE

- Both Sodium Hypochlorite Storage tanks have reached low level, operator adjustable (A-NOCL-LIT-1101 < 1' and A-NOCL-LIT-1202 < 1').

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Pump discharge flow.
-

4.11.2.3 Sodium Hypochlorite Metering Pumps to Raw Water and Contact Tank

The Sodium Hypochlorite Metering Pumps (A-NOCL-PDM-4001, A-NOCL-PDM-5001, A-NOCL-PDM-6001) will be used to feed sodium hypochlorite from the Sodium Hypochlorite Storage Tanks to the Raw Water Inlet Vault and the Contact Tank. Pump A-NOCL-PDM-4001 will feed to the Raw Water Inlet Vault. Pump A-NOCL-PDM-5001 will feed to the Contact Tank. Pump A-NOCL-PDM-6001 can feed to either the Raw Water Inlet Vault or the Contact Tank. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control for pump A-NOCL-PDM-4001 will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum Arcadia Plant Influent Flow, A-RW-FIT-1001 > 20 gpm (operator adjustable) and the Arcadia Plant Influent Chlorine Residual < 5 ppm. Pump speed will be controlled by the Arcadia Plant Influent Flow pacing signal and the dosage (adjustable at the HMI) entered by the Operator.

Remote automatic control for pump A-NOCl-PDM-6001 will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run whenever any Filter Feed Pump is running. When the first Filter Feed Pump starts, the chemical pump will start with 80% speed (operator adjustable) for the first 5 minutes and then the chemical pump control will switch to flow pacing control. Pump speed will be controlled by the combined filter effluent flow from Pressure Filter PLC flow pacing signal and the dosage calculated by a Proportional Integral controller. The setpoint for the controller will be the desired chlorine residual at the combined filter effluent flow. The controller feedback signal will be from the chlorine residual analyzer, A-ROF-AIT-1001, measuring chlorine residual downstream of the respective feed points. The output of the PI controller will be scaled for the dosage range for the feed point to provide the correct units for the calculations shown below. Transfer between manual and automatic modes of the controller will be smooth.

Pump A-NOCL-PDM-5001 will be a manual swing pump to backup either pump A-NOCL-PDM-4001 or pump A-NOCL-PDM-6001. The Operator will need to manually adjust the manual isolation valves locally to select which one he wants to replace. Then the Operator will need to select on the HMI screen which pump he has selected to be replaced by the pump A-NOCL-PDM-5001. Based on the Operator selection, the pump A-NOCL-PDM-5001 will either follow the pump A-NOCL-PDM-4001's control logic or the pump A-NOCL-PDM-6001's control logic described above.

The metering pumps will have the following interlocks:

RUN PERMISSIVE

- Either Sodium Hypochlorite Storage tank level is above 2', operator adjustable (A-NOCL-LIT-1101 > 2' or A-NOCL-LIT-1201 > 2').

STOP OVERRIDE

- Both Sodium Hypochlorite Storage tanks have reached low level, operator adjustable (A-NOCL-LIT-1101 < 1' and A-NOCL-LIT-1202 < 1').

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Pump discharge flow.

4.11.2.4 Sodium Hypochlorite Metering Pumps to Finished Water

The Sodium Hypochlorite Metering Pumps (A-NOCL-PDM-7001, A-NOCL-PDM-8001) will be used to feed sodium hypochlorite from the Sodium Hypochlorite Storage Tanks to the Finished Water. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control for pump A-NOCL-PDM-7001 will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum Decarbonator Discharge Flow, A-DC-FIT-1001 > 20 gpm (operator adjustable). Pump speed will be controlled by the Decarbonator Discharge Flow pacing signal and the dosage calculated by a Proportional Integral controller. The setpoint for the controller will be the desired chlorine residual at the reservoir inlet flow. The controller feedback signal will be from the chlorine residual analyzer, A-DC-AIT-1003, measuring chlorine residual downstream of the respective feed points. The output of the PI controller will be scaled for the dosage range for the feed point to provide the correct units for the calculations shown below. Transfer between manual and automatic modes of the controller will be bumpless.

A-NOCL-PDM-7001 and A-NOCL-PDM-8001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one shall automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

RUN PERMISSIVE

- Either Sodium Hypochlorite Storage tank level is above 2', operator adjustable (A-NOCL-LIT-1101 > 2' or A-NOCL-LIT-1201 > 2').

STOP OVERRIDE

- Both Sodium Hypochlorite Storage tanks have reached low level, operator adjustable (A-NOCL-LIT-1101 < 1' and A-NOCL-LIT-1202 < 1').

ALARMS (All alarm setpoint are operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Duty/standby.
- Pump discharge flow.

4.11.3 Sodium Bisulfite Feed System

4.11.3.1 Sodium Bisulfite Storage

The sodium bisulfite storage tank will be provided with a level transmitter (A-NHS-LIT-1001) used to monitor the liquid level. The level transmitter will provide high and low level alarms for the Operator and in case of low level sends a signal to stop the Sodium Bisulfite Metering Pumps.

Each level transmitter will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Sodium Bisulfute Storage Tank high level (A-NHS-LIT-1001 > 8')
- Sodium Bisulfite Storage Tank low level (A-NHS-LIT-1001 < 2')

STATUS INDICATIONS

- A-NHS-LIT-1001 – Sodium Bisulfite Storage Tank level

4.11.3.2 Sodium Bisulfite Metering Pumps

The Sodium Bisulfite Metering Pumps (A-NHS-PDM-1001, A-NHS-PDM-2001) will be used to feed sodium bisulfite from the Sodium Bisulfite Storage Tank to Upstream of RO Units. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum combined filter effluent flow from the Pressure Filter PLC > 20 gpm (operator adjustable). Pump speed will be controlled by combined filter effluent flow pacing signal or the LP RO Feed Pump Discharge flow, depending on the feed location and the dosage. Three modes of determining dosage will be selectable. Mode 1 will be through manual entry of the dosage at the HMI. Mode 2 will be calculation as a ratio of the pressure filter effluent chlorine residual, A-ROF-AIT-1001. The ratio for calculating the dosage will be adjustable at the HMI from 1.00-5, initially set at 1.46. The calculation will be as defined below. Mode 3 will be calculation by a PI controller having a setpoint for bisulfite residual and feedback from the bisulfite analyzer, A-ROF-AIT-1002, at the discharge common header of the

LP RO Feed Pumps. Transfer between manual and automatic modes of the controller will be bumpless.

A-NHS-PDM-1001 and A-NHS-PDM-2001 will be valved to feed either the RO Feed Tank influent or RO Feed Tank effluent. A selector will be provided at the HMI that allows the Operator to select the feed point for the pump. The PLC will assign the appropriate controls for the pump based on the selection made. If RO Feed Tank influent is selected, the flow pacing signal will be the combined filter effluent flow from the Pressure Filter PLC. If RO Feed Tank effluent is selected, the flow pacing signal will be the combined filter effluent flow from the Pressure Filter PLC minus the RO Bypass flow, A-ROF-FIT-1003.

A-NHS-PDM-1001 and A-NHS-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

RUN PERMISSIVE

- Sodium Bisulfite Storage tank level is above 2', operator adjustable (A-NHS-LIT-1001 > 2').

STOP OVERRIDE

- Sodium Bisulfite Storage tank has reached low level, operator adjustable (A-NHS-LIT-1001 < 1').

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Duty/standby.
- Pump discharge flow.
- Control mode selection.
- Injection location selection.

4.11.4 Ammonium Sulfate Feed System

4.11.4.1 Ammonium Sulfate Storage

Each ammonium sulfate storage tote will be provided with a weight indicator (A-NSO4-WIT-1101, A-NSO4-WIT-1201) used to monitor the tote weight. The weight indicator will provide low level alarms for the Operator and in case of low level sends a signal to stop the Ammonium Sulfate Metering Pumps.

Each weight indicator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Ammonium Sulfate Tote 1 low level (A-NSO4-WIT-1101 < 10%)
- Ammonium Sulfate Tote 2 low level (A-NSO4-WIT-1201 < 10%)

STATUS INDICATIONS

- A-NSO4-WIT-1101 – Ammonium Sulfate Tote 1 weight
- A-NSO4-WIT-1202 – Ammonium Sulfate Tote 2 weight

4.11.4.2 Ammonium Sulfate Storage Totes Discharge Valves

Each ammonium sulfate storage tote will be provided with a motor operated discharge valve (A-NSO4-VBM-1103, A-NSO4-VBM-1203). Local manual control of the valve will be provided through manual overrides on the valve actuator. Remote manual control will be provided through the PLC. When MANUAL is selected at the HMI, the valve will be opened/closed using the Operator commands at the HMI.

Each valve actuator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Valve fail alarm.

STATUS INDICATIONS

- Valve in local/remote.
- Manual.
- Valve open/closed.
- Valve fail.

4.11.4.3 Ammonium Sulfate Metering Pumps

The Ammonium Sulfate Metering Pumps (A-NSO4-PDM-1001, A-NSO4-PDM-2001) will be used to feed ammonium sulfate from the Ammonium Sulfate Storage Totes to the Finished Water. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum Decarbonator discharge flow, A-DC-FIT-1001 > 20 gpm (operator adjustable). Pump speed will be controlled by Decarbonator discharge flow, A-DC-FIT-1001, flow pacing signal and the dosage entered by the Operator at the HMI.

A-HSO4-PDM-1001 and A-HSO4-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

<u>RUN PERMISSIVE</u>

- Ammonium Sulfate Tote 1 weight is above 10% (A-NSO4-WIT-1101 > 10%) and the discharge valve A-NSO4-VBM-1103 is open or Ammonium Sulfate Tote 2 weight is above 10% (A-NSO4-WIT-1201 > 10%) and the discharge valve A-NSO4-VBM-1203 is open.

<u>ALARMS (All alarm setpoints will be operator adjustable)</u>

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

<u>STATUS INDICATIONS</u>

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Duty/standby.
- Pump discharge flow.
-

4.11.5 Anti-Scalant Feed System

4.11.5.1 Anti-Scalant Storage

Each anti-scalant storage tote will be provided with a weight indicator (A-AS-WIT-1101, A-AS-WIT-1201) used to monitor the tote weight. The weight indicator will provide low level alarms for the Operator and in case of low level sends a signal to stop the Anti-Scalant Metering Pumps.

Each weight indicator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Anti-Scalant Tote 1 low level (A-AS-WIT-1101 < 10%)
- Anti-Scalant Tote 2 low level (A-AS-WIT-1201 < 10%)

STATUS INDICATIONS

- A-AS-WIT-1101 – Anti-Scalant Tote 1 weight
- A-AS-WIT-1202 – Anti-Scalant Tote 2 weight

4.11.5.2 Anti-Scalant Storage Totes Discharge Valves

Each anti-scalant storage tote will be provided with a motor operated discharge valve (A-AS-VBM-1103, A-AS-VBM-1203). Local manual control of the valve will be provided through manual overrides on the valve actuator. Remote manual control will be provided through the PLC. When MANUAL is selected at the HMI, the valve will be opened/closed using the Operator commands at the HMI.

Each valve actuator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Valve fail alarm.

STATUS INDICATIONS

- Valve in local/remote.
- Manual.
- Valve open/closed.
- Valve fail.

4.11.5.3 Anti-Scalant Metering Pumps

The Anti-Scalant Metering Pumps (A-AS-PDM-1001, A-AS-PDM-2001) will be used to feed anti-scalant from the Anti-Scalant Storage Totes to Upstream of the RO Units. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on any of the LP RO Feed Pump running. Pump speed will be controlled by the combined filter effluent flow from the Pressure Filter PLC minus the RO Bypass flow, A-ROF-FIT-1003, flow pacing signal and the dosage entered by the Operator at the HMI.

A-AS-PDM-1001 and A-AS-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

RUN PERMISSIVE

- Anti-Scalant Tote 1 weight is above 10% (A-AS-WIT-1101 > 10%) and the discharge valve A-AS-VBM-1103 is open or Anti-Scalant Tote 2 weight is above 10% (A-AS-WIT-1201 > 10%) and the discharge valve A-AS-VBM-1203 is open.

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Duty/standby.
- Pump discharge flow.

4.11.6 Sodium Hydroxide Feed System

4.11.6.1 Sodium Hydroxide Storage

Each sodium hydroxide storage tank will be provided with a level transmitter (A-NAOH-LIT-1101, A-NAOH-LIT-1201) used to monitor the liquid level. The level transmitter will provide high and low level alarms for the Operator and in case of low level sends a signal to stop the Sodium Hypochlorite Metering Pumps.

Each level transmitter will have the following interlocks:

<u>ALARMS (All alarm setpoint are operator adjustable)</u>

- Sodium Hydroxide Storage Tank 1 high level (A-NAOH-LIT-1101 > 8')
- Sodium Hydroxide Storage Tank 1 low level (A-NAOH-LIT-1101 < 2')
- Sodium Hydroxide Storage Tank 2 high level (A-NAOH-LIT-1201 > 8')
- Sodium Hydroxide Storage Tank 2 low level (A-NAOH-LIT-1201 < 2')

<u>STATUS INDICATIONS</u>

- A-NAOH-LIT-1101 – Sodium Hydroxide Storage Tank 1 level
- A-NAOH-LIT-1201 – Sodium Hydroxide Storage Tank 2 level

4.11.6.2 Sodium Hydroxide Transfer Pumps

The Sodium Hydroxide Transfer Pumps (A-NAOH-PCL-1001, A-NAOH-PCL-2001) will be used to transfer sodium hydroxide from the Sodium Hydroxide Storage Tanks to the Sodium Hydroxide Dilution System. The pumps are designed to operate in local manual and remote manual modes.

Local manual control of the pump will be provided through an ON-OFF-REMOTE (O-O-R) selector switch near the pump. When the O-O-R switch is in the ON position, the pump will start. The pump will have hardwired interlocks in all control modes to start and stop based on the level control in the batch system.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF.

Each transfer pump will have the following interlocks:

<u>ALARMS (All alarm setpoints will be operator adjustable)</u>

- Pump fail.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in manual.
- Pump fail.

4.11.6.3 Sodium Hydroxide Dilution System

The Sodium Hydroxide Dilution System will be used to dilute the bulk 50% sodium hydroxide to a 25% concentration. The system is designed to automatically make up a batch of 25% sodium hydroxide solution.

The dilution system will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- System fail.

STATUS INDICATIONS

- Dilution tank batch feed rate.
- Dilution tank batch weight.
- Dilution system running.
- Dilution system fail.

4.11.6.4 Sodium Hydroxide Metering Pumps

The Sodium Hydroxide Metering Pumps (A-NAOH-PDM-1001, A-NAOH-PDM-2001) will be used to feed sodium hydroxide from the Sodium Hydroxide Dilution System to the Finished Water. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on a minimum Decarbonator discharge flow, A-DC-FIT-1001 > 20 gpm (operator adjustable), and pump speed will be controlled by the flow pacing signal and the dosage. Two modes of determining dosage will be selectable. Mode 1 will be through manual entry of the dosage at the HMI. Mode 2 will be calculation by a PI controller having a setpoint for pH and feedback from the pH analyzer, A-DC-AIT-1001, at the Decarbonator discharge header. Transfer between manual and automatic modes of the controller will be bumpless.

A-NAOH-PDM-1001 and A-NAOH-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Pump discharge flow.

4.11.6.5 Sodium Hydroxide Metering Pumps

The Sodium Hydroxide Metering Pumps (A-NAOH-PDM-3001, A-NAOH-PDM-4001) will be used to feed sodium hydroxide from the Sodium Hydroxide Dilution System to the Finished Water. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on a minimum Decarbonator discharge flow, A-DC-FIT-1001 >

20 gpm (operator adjustable), and pump speed will be controlled by the flow pacing signal and the dosage. Two modes of determining dosage will be selectable. Mode 1 will be through manual entry of the dosage at the HMI. Mode 2 will be calculation by a PI controller having a setpoint for pH and feedback from the pH analyzer, A-DC-AIT-1001, at the Decarbonator discharge header. Transfer between manual and automatic modes of the controller will be bumpless.

A-NAOH-PDM-3001 and A-NAOH-PDM-4001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Pump discharge flow.

4.11.6.6 Sodium Hydroxide CIP Transfer Pump

The Sodium Hydroxide CIP Transfer Pump (A-NAOH-PCL-3001) will be used to feed sodium hydroxide from the Sodium Hydroxide Dilution System to the CIP Neutralization Tank. The pump is designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the

HMI, the pump will start and stop based on the pH analyzer, A-CIP-AIT-2001, at the neutralization tank.

Auto start
When pH < 8

Auto stop
When pH > 8

The transfer pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)
- Pump fail

STATUS INDICATIONS
- Pump running.
- Pump in remote.
- Pump in auto.
- Pump fail.
- Pump discharge flow.

4.11.7 Sulfuric Acid Feed System

4.11.7.1 Sulfuric Acid Storage

The sulfuric acid storage tank will be provided with a level transmitter (A-HSO4-LIT-1001) used to monitor the liquid level. The level transmitter will provide high and low level alarms for the Operator and in case of low level sends a signal to stop the Sulfuric Acid Metering Pumps.

Each level transmitter will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)
- Sulfuric Acid Storage Tank high level (A-NSO4-LIT-1001 > 8')
- Sulfuric Acid Storage Tank low level (A-NSO4-LIT-1001 < 2')

STATUS INDICATIONS
A-NSO4-LIT-1001 – Sulfuric Acid Storage Tank level

4.11.7.2 Sulfuric Acid Metering Pumps

The Sulfuric Acid Metering Pumps (A-HSO4-PDM-1001, A-HSO4-PDM-2001) will be used to feed sulfuric acid from the Sulfuric Acid Storage Tank to Upstream of RO Units. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed. The dilution water solenoid valve will be opened/closed from the HMI using the Operator manual commands.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on a minimum combined filter effluent flow from the Pressure Filter PLC minus the RO Bypass flow, A-ROB-FIT-1003 > 20 gpm (operator adjustable), and pump speed will be controlled by the flow pacing signal and the dosage. Two modes of determining dosage will be selectable. Mode 1 will be through manual entry of the dosage at the HMI. Mode 2 will be calculation by a PI controller having a setpoint for pH and feedback from the pH analyzer, A-ROF-AIT-1104, at the Cartridge Filters effluent. Transfer between manual and automatic modes of the controller will be bumpless. The dilution water solenoid valve will be automatically opened / closed based on the pump running status.

The metering pumps will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.

4.11.7.3 Sulfuric Acid CIP Metering Pump

The Sulfuric Acid CIP Metering Pump (A-HSO4-PDM-3001) will be used to feed sulfuric acid from the Sulfuric Acid Storage Tank to the CIP Neutralization Tank. The pump is designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed. The dilution water solenoid valve will be opened / closed from the HMI using the Operator manual commands.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will start and stop based on the pH analyzer, A-CIP-AIT-2001, at the neutralization tank. The pump speed will be controlled by the HMI using Operator entered speed. The dilution water solenoid valve will be automatically opened / closed based on the pump running status.

Auto start
When pH > 8

Auto stop
When pH < 8

The metering pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.

4.11.8 Citric Acid Feed System

4.11.8.1 Citric Acid Storage

The citric acid storage tote will be provided with a weight indicator (A-CA-WIT-1101) used to monitor the tote weight. The weight indicator will provide low level alarms for the Operator.

The weight indicator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Citric Acid Tote low level (A-CA-WIT-1101 < 10%)

STATUS INDICATIONS

- A-CA-WIT-1101 – Citric Acid Tote weight

4.11.8.2 Citric Acid Transfer Pump

The Citric Acid Transfer Pump (A-CA-PCL-1001) will be used to feed citric acid from the Citric Acid Storage Tote to the CIP Make-Up Tanks. The pump is designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will start based on the HMI command from the Operator and shall run for X minutes (operator adjustable).

The transfer pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump fail.
- Pump discharge flow.

4.11.9 Caustic Detergent Feed System

4.11.9.1 Caustic Detergent Storage

The caustic detergent storage tote will be provided with a weight indicator (A-DET-WIT-1101) used to monitor the tote weight. The weight indicator will provide low level alarms for the Operator.

The weight indicator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Caustic Detergent Tote low level (A-DET-WIT-1101 < 10%)

STATUS INDICATIONS

- A-DET-WIT-1101 – Caustic Detergent Tote weight

4.11.9.2 Caustic Detergent Transfer Pump

The Caustic Detergent Transfer Pump (A-DET-PCL-1001) will be used to feed caustic detergent from the Caustic Detergent Storage Tote to the CIP Make-Up Tanks. The pump is designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run using the local adjustment device on the panel.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will start based on the HMI command from the Operator and will run for X minutes (operator adjustable).

The transfer pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump fail.
- Pump discharge flow.

4.11.10 Polyaluminum Chloride Feed System

4.11.10.1 Polyaluminum Chloride Storage

The polyaluminum chloride storage tote will be provided with a weight indicator (A-PACL-WIT-1101, A-AS-WIT-1201) used to monitor the tote weight. The weight indicator will provide low level alarms for the Operator and in case of low level sends a signal to stop the Polyaluminum Chloride Metering Pumps.

Each weight indicator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Polyaluminum Chloride Tote low level (A-PACL-WIT-1101 < 10%)

STATUS INDICATIONS

- A-PACL-WIT-1101 – Polyaluminum Chloride Tote weight

4.11.10.2 Polyaluminum Chloride Metering Pumps

The Polyaluminum Chloride Metering Pumps (A-PACL-PDM-1001, A-PACL-PDM-2001) will be used to feed polyaluminum chloride from the Polyaluminum Chloride Storage Tote to the Backwash Recovery System, upstream of the Package Treatment Unit. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum backwash recovery pump discharge flow, A-WW-FIT-1001, > 20 gpm (operator adjustable). Pump speed will be controlled by the backwash recovery pump discharge flow, A-WW-FIT-1001, flow pacing signal and the dosage entered by the Operator on the HMI. Transfer between manual and automatic modes of the controller will be bumpless.

A-PACL-PDM-1001 and A-PACL-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

low level alarms for the Operator and in case of low level sends a signal to stop the Polyaluminum Chloride Metering Pumps.

Each weight indicator will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Polyaluminum Chloride Tote low level (A-PACL-WIT-1101 < 10%)

STATUS INDICATIONS

- A-PACL-WIT-1101 – Polyaluminum Chloride Tote weight

4.11.10.2 Polyaluminum Chloride Metering Pumps

The Polyaluminum Chloride Metering Pumps (A-PACL-PDM-1001, A-PACL-PDM-2001) will be used to feed polyaluminum chloride from the Polyaluminum Chloride Storage Tote to the Backwash Recovery System, upstream of the Package Treatment Unit. The pumps are designed to operate in local manual, remote manual and remote auto modes.

Local control of the metering pump will be provided through an ON-OFF-REMOTE (O-O-R) switch on the metering pump control panel. When the O-O-R switch is in the ON position the pump will run and speed will be controlled using the local adjustment device on the panel. Stroke length control will be adjusted manually at the pump only.

Remote manual control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position and MANUAL is selected at the HMI, the pump ON/OFF will be controlled from the HMI using Operator manual commands and the speed will be manually adjusted from the HMI. A single AUTO/MANUAL selector at the HMI will select the mode of control for ON/OFF, and speed.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on minimum backwash recovery pump discharge flow, A-WW-FIT-1001, > 20 gpm (operator adjustable). Pump speed will be controlled by the backwash recovery pump discharge flow, A-WW-FIT-1001, flow pacing signal and the dosage entered by the Operator on the HMI. Transfer between manual and automatic modes of the controller will be bumpless.

A-PACL-PDM-1001 and A-PACL-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

Local control of the metering pumps will be provided through an ON-OFF-REMOTE switch. When the switch is in the ON position the pump will run. Selection of LOCAL or REMOTE stroke speed control will be provided on the pump. When LOCAL stroke speed control is selected, stroke speed will be controlled by the adjustment device on the pump.

Remote manual control will be provided through the PLC. When REMOTE is selected at the pump and MANUAL is selected at the HMI, pump start/stop will be through manual controls at the HMI and stroke speed will be manually adjusted from the HMI.

Remote automatic control will be provided through the PLC. When the O-O-R selector switch on the metering pump control panel is in the REMOTE position, and AUTO is selected at the HMI, the pump will run based on a minimum Decarbonator discharge flow, A-DC-FIT-1001 > 20 gpm (operator adjustable), and pump speed will be controlled by the flow pacing signal and the dosage. Two modes of determining dosage will be selectable. Mode 1 will be through manual entry of the dosage at the HMI. Mode 2 will be calculation by a PI controller having a setpoint for fluoride and feedback from the fluoride analyzer, A-DC-AIT-1002, at the Decarbonator effluent. Transfer between manual and automatic modes of the controller will be bumpless.

A-NAF-PDM-1001 and A-NAF-PDM-2001 will be designed for duty/standby operation. The Operator will be able to select either pump as the duty pump while the other one will automatically default as standby. The duty and standby pumps will be automatically rotated whenever the duty pump stops. The standby pump will automatically start to replace the failed duty pump.

The metering pumps will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Pump fail from metering pump control panel, includes drive failure and shutdown on high discharge pressure.

STATUS INDICATIONS

- Pump running.
- Pump in remote.
- Pump in auto.
- Pump speed.
- Pump fail.
- Pump discharge flow.

4.12 Finished Water Reservoir

4.12.1 Finished Water Reservoir General Monitoring

The free chlorine, pH, and temperature will be monitored going to the 350' zone and the 250' zone with four analyzers, finished water 350' zone free chlorine analyzer (A-FS-AIT-1001), finished water 350' zone pH and temperature analyzer (A-FS-AIT-1002), finished water 250' zone free chlorine analyzer (A-FS-AIT-1003), and finished water 250' zone pH and temperature analyzer (A-FS-AIT-1004). These instruments will be depicted on the associated Finished Water Reservoir display.

The Finished Water Reservoir instruments have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- 350' zone free chlorine is low (A-FS-AIT-1001 < 5 ppm).
- 350' zone pH is high (A-FS-AIT-1002 pH > 9).
- 350' zone pH is low (A-FS-AIT-1002 pH < 6).
- 350' zone temperature is high (A-FS-AIT-1002 temperature > 150 F).
- 250' zone free chlorine is low (A-FS-AIT-1003 < 5 ppm).
- 350' zone pH is high (A-FS-AIT-1004 pH > 9).
- 350' zone pH is low (A-FS-AIT-1004 pH < 6).
- 350' zone temperature is high (A-FS-AIT-1004 temperature > 150 F).

STATUS INDICATIONS

- A-FS-AIT-1001 – Finished water 350' zone free chlorine analyzer.
- A-FS-AIT-1002 – Finished water 350' zone pH and temperature analyzer.
- A-FS-AIT-1003 – Finished water 250' zone free chlorine analyzer.
- A-FS-AIT-1004 – Finished water 250' zone pH and temperature analyzer.

4.12.2 Finished Water Reservoir Detention Basin Sump Pump

When the finished water reservoir overflows the water will go to the Detention Basin with a sump pump, finished water reservoir detention sump pump (A-OF-PSS-1001), to pump water to the storm drain. The sump pump will be depicted on the associated Finished Water Reservoir display. The reservoir does not overflow under normal operations.

The sump pump will operate with local controls only, which will be provided through the local control panel. In auto mode the sump pump automatically turns on and off based on the level switches.

The detention basin sump pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Sump pump fail.

STATUS INDICATIONS

- Pump running.

finished water 350' zone pH and temperature analyzer (A-FS-AIT-1002), finished water 250' zone free chlorine analyzer (A-FS-AIT-1003), and finished water 250' zone pH and temperature analyzer (A-FS-AIT-1004). These instruments will be depicted on the associated Finished Water Reservoir display.

The Finished Water Reservoir instruments have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- 350' zone free chlorine is low (A-FS-AIT-1001 < 5 ppm).
- 350' zone pH is high (A-FS-AIT-1002 pH > 9).
- 350' zone pH is low (A-FS-AIT-1002 pH < 6).
- 350' zone temperature is high (A-FS-AIT-1002 temperature > 150 F).
- 250' zone free chlorine is low (A-FS-AIT-1003 < 5 ppm).
- 350' zone pH is high (A-FS-AIT-1004 pH > 9).
- 350' zone pH is low (A-FS-AIT-1004 pH < 6).
- 350' zone temperature is high (A-FS-AIT-1004 temperature > 150 F).

STATUS INDICATIONS

- A-FS-AIT-1001 – Finished water 350' zone free chlorine analyzer.
- A-FS-AIT-1002 – Finished water 350' zone pH and temperature analyzer.
- A-FS-AIT-1003 – Finished water 250' zone free chlorine analyzer.
- A-FS-AIT-1004 – Finished water 250' zone pH and temperature analyzer.

4.12.2 Finished Water Reservoir Detention Basin Sump Pump

When the finished water reservoir overflows the water will go to the Detention Basin with a sump pump, finished water reservoir detention sump pump (A-OF-PSS-1001), to pump water to the storm drain. The sump pump will be depicted on the associated Finished Water Reservoir display. The reservoir does not overflow under normal operations.

The sump pump will operate with local controls only, which will be provided through the local control panel. In auto mode the sump pump automatically turns on and off based on the level switches.

The detention basin sump pump will have the following interlocks:

ALARMS (All alarm setpoints will be operator adjustable)

- Sump pump fail.

STATUS INDICATIONS

- Pump running.

4.13 Solids Disposal

Solids disposal is associated with the plate settler of the packaged treatment unit. The solids discharge valve will open intermittently to release solids from the hopper into the pipe that leads to the sewer.

4.14 Drainage System

There will be no stormwater retention basin on site, but there will be two oil/grit separators. Refer to Chapter 3.4 for details.

4.15 Electrical

4.15.1 General

This section discusses electrical power distribution systems and the normal operation of electrical equipment for the Arcadia site.

4.15.2 Electric Power Distribution

The existing utility feed from LADWP at 34.5 kV to the existing substation will be utilized for the addition of the new facility loads. The existing transformer will need to be replaced with two larger transformers as required by LADWP to accommodate the additional connected load for the new Filter and RO facilities. A new utility disconnect will be installed on the primary of the two new transformers. The secondary voltage on both new transformers will be 480VAC. One transformer will feed a new 2500A, service entrance rated switchboard with utility metering section. The other transformer will feed a new 1600A, service entrance rated switchboard with utility metering section. The new 2500A switchboard will service the RO facility, while the new 1600A switchboard will feed a new MCC-D, existing MCC-F, existing MSB-AD, a new MCC-G, a new MCC-H, and a new power panel PP-FL.

The design of the new RO facility requires demolition of the existing Regeneration Building which houses MCC-D. As MCC-D will be relocated a new MCC-D will be installed outdoors and will feed the existing reservoir aerators as the existing MCC-D does currently. New cables will be installed from new MCC-D to the aerators to avoid splicing the cables. In addition, a new MCC-H will be installed in the electrical room being constructed near the RO skids in the RO Building. This new MCC will feed the AFDs for the High Pressure RO Pumps. The AFDs for the High Pressure RO Pumps will be located in the electrical room with MCC-H along with a dry-type transformer and panelboard for single phase loads, a RIO cabinet and HMI.

The design of the new facility does not significantly impact MCC-F. A new feeder will be installed from the new MSB to MCC-F.

New MCC-G will be installed in the Electrical Building being constructed near the Filter Complex. MCC-G will feed AFDs for Contact Tank Pumps, Backwash Supply Pumps and Low Pressure RO Feed Pumps. The AFDs will be located in the Electrical Building with MCC-G along with a dry-type transformer and panelboards for single phase loads, a RIO cabinet and

HMI. The distribution equipment associated with MCC-G will also feed the chemical feed pumps.

The existing facility engine-generator will be replaced with a new generator, capable of powering the new softening plant. The engine-generator will be installed west of the existing LADWP substation, with sufficient space between the two for LADWP to access the substation. The new generator will tie into both the new 2500A and 2000A switchboards via two new automatic transfer switches.

4.15.3 Normal Operation

During normal operation, the low voltage distribution system will be in service providing 480/208/120VAC power to the components it serves.

5.0 Startup and Shutdown

5.1 Normal Startup

The normal plant operation startup assumes that all the tanks have been filled with water either from the previous plant operation or by the Operator through manual operation.

1. The Operator will manually select the number of RO units to be on-line from the HMI screen. A RO Unit Capacity Table (Table 5-1) will be available on the HMI screen. This will inform the Operator of the amount of RO production based on the number of RO units in operation. The Operator will have 3 selections for each RO unit: On-line, Off-line, and Standby. The Operator will put an RO unit in "On-line" mode for production. The RO unit will not automatically start when the RO unit is in "On-line" mode and the Operator will be required to manually press the "Start" command button on the HMI to startup the RO unit as described below.

   If the Operator needs to perform CIP or other maintenance on the RO unit, he/she will put the RO unit in "Off-line" mode.

   If an RO unit is in "Stand-by" mode, it will automatically start to replace any tripped RO unit.

Table 5-1. RO Unit Capacity Table

No. of Skids On-Line	Permeate (MGD)	Bypass (MGD)	Total WTP Production
1	2.3	0.6	2.9
2	4.7	1.2	5.9
3	7.0	1.8	8.8

2. The Operator will manually select which Well Pumps are to be used to provide feed water to the RO units on the HMI by placing the selected Well Pumps in "Auto" mode on the HMI. A Well Pump Production Table (Table 5-2) will be available on the HMI screen; this will inform the Operator of the capacity of each Well Pump.

Table 5-2. Well Pump Production Table

Facility	Production Capacity	
	MGD	Gpm
Charnock Well 13 (constant flow)	1.728	1200
Charnock Well 15 (constant flow)	1.728	1200
Charnock Well 19 (variable flow)	1.44 - 2.16	1000 – 1500
Charnock Well 16 (constant flow)	3.168	2200
Charnock Well 18 (constant flow)	2.16	1500
Santa Monica Well 3 (constant flow)	1.12	780
Santa Monica Well 4 (constant flow)	1.17	810
Arcadia Well 4 (constant flow)	0.35	240

Arcadia Well 5 (constant flow)	0.37	260
MWD water line (variable flow)	0 - 2	0 - 1389

The Operator will be required to manually start and stop the Arcadia Wells 4 & 5 and Santa Monica Wells 3 & 4 if they decide to use these wells to provide feed water to the RO units.

3. The Operator will manually select which booster pumps at Charnock are to be used to provide feed water to the Arcadia WTP by placing the selected booster pumps in "Auto" mode on the HMI. A Booster Pump Production Table will be available on the HMI screen to inform the Operator of the capacity of each booster pump.

Charnock Booster Pump Production Table

Facility	Production Capacity	
	MGD	gpm
Booster Pump 1 (constant flow)	2.3	1600
Booster Pump 2 (constant flow)	1.87	1300
Booster Pump 3 (variable flow)	1.73 - 2.88	1200 - 2000
Booster Pump 4 (variable flow)	2.25 - 3.74	1560 - 2600
Booster Pump 5 (constant flow)	4.32	3000

The Plant PLC will provide a **Total Available Flow from Charnock Booster Pumps** for all the Charnock Boosters Pumps that are in "Auto" mode.

4. All of the pressure filter cells will default to "Auto" mode unless the Operator decides to manually select certain pressure filter cells to be in "Manual" mode for manual backwash or other maintenance purposes.

5. The Operator will put the remainder of the Arcadia equipment in "Auto" mode for normal plant startup.

6. The Operator will manually press the "Start" command on the HMI screen to bring the on-line RO units into service one at a time.

7. Once the RO units are running, the Plant PLC will automatically start the LP RO Feed Pumps to maintain the Cartridge Filter inlet pressure (Operator adjustable) for the HP RO Feed Pumps.

8. Once the RO units are running, the duty Decarbonator and blowers will start.

9. When the permeate valve of the running RO unit opens, the RO Bypass Flow Control Valve shall modulate to maintain an Operator adjustable start up flow split between the

RO Bypass and the feed water to the RO unit (initially set at 25% bypassing and 75% through the RO).

10. Once the LP RO Feed Pumps are running and the RO Feed Tank water level drops below a preset level setpoint, the Filter Feed Pumps will come on automatically. The Filter Feed Pumps will automatically adjust the pump speed to maintain the required flow for the operating RO units and to keep the RO Feed Tank level within an operating range.

11. Once the Filter Feed Pumps are running, the pressure filter effluent valves (A-FLT-VBF-1103, 1203, 2103, 2203, 3103, 3203, 4103, 4203, 5103, 5203, 6103, and 6203) for all the filter cells that are on-line and in "Auto" mode will automatically modulate to maintain the Filter Feed Pumps discharge header pressure and to provide even flow for all on-line filter cells.

12. Once the Filter Feed Pumps are running and the Contact Tank water level drops below a preset level setpoint, the Arcadia PLC will send a request signal to the Charnock PLC to turn on the Charnock Booster Pumps that are in "Auto" mode. The operating Charnock Booster Pumps will either vary the pump speed for the VFD pumps or turn on and off for the constant speed pumps to maintain a constant flow to Arcadia WTP and to maintain the Contact Tank water level within an operating range. The control flow setpoint for the Charnock Booster Pumps will be the calculated **Total Available Charnock Plant Flow,** with a maximum value at the **Required Arcadia Plant Production Flow**.

    Charnock PLC will start the booster pumps up one at a time with the smallest size pump first and the VFD pump last.

13. If the Charnock Variable Speed Booster Pump(s) are running at 100% and the available flow from Charnock to Arcadia WTP is less than the required flow for the RO units, the MWD 24" water line valve will automatically modulate to provide the required additional flow and to maintain the water level in the Contact Tank within the operating range. If the Arcadia Contact Tank water level is above the operating range, the MWD 24" water line valve will close to reduce the Arcadia Plant Inlet Flow before the Charnock Variable Speed Booster Pumps will lower the pump speed.

14. Refer to the Charnock Operations Plan for maintaining the required flow from the booster pumps.

15. The chemical systems will automatically start based on the Arcadia Plant flow.

5.2 *Normal Plant Operation Shutdown Procedures*

1. The Operator will manually press the "Stop" command on the HMI to shut down the running RO units.

If the Operator wants to shut down one running RO unit and leave the remaining units in operation, the Operator will manually press the "Stop" command on the HMI to stop the selected running RO unit. The Plant PLC will automatically adjust the Plant Flow to leave the remaining RO units running.

2. When all of the running RO units are stopped, the RO PLC will remove the Feed Water Request signal to the Arcadia plant PLC, which will stop all of the running LP RO Feed Pumps, Well Pumps, booster pumps, and all feed pumps. The Arcadia Plant PLC will also close the MWD water line valve.

3. Once the Plant Flow drops below a preset flow setpoint, all of the running chemical systems will automatically stop.

5.3 Draining of Underground Tanks

The following procedures will be used for draining the underground storage tanks for maintenance or inspection.

5.3.1 Contact Tank

The Contact Tank will contain a fixed sump pump for drainage of the final tank volume below the operation low-level of the Filter Feed Pumps. Flow from the Filter Feed Pumps will be delivered to the Pressure Filters for treatment until the pumps stop on low level. Flow from the sump pump will be delivered to the storm drain. Prior to draindown, the Contact Tank should be isolated at the upstream manual valve (A-RW-VBF-1002) in the Raw Water Inlet Vault. Drainage from the Contact Tank will contain chlorine and may require dechlorination prior to draining the tank.

5.3.2 Backwash Holding Tank

The Backwash Holding Tank will normally be fed a proportion of the filtered water from the Pressure Filter discharge header via a flow control valve (A-BW-VBF-1001). The backwash supply pipe connection to the filtered water discharge header will need to be isolated prior to draindown of the tank. The Backwash Holding Tank will contain a fixed sump pump for drainage of the final tank volume below the operation low-level of the Backwash Supply Pumps. Flow from the Backwash Supply Pumps will be delivered to the Pressure Filters for backwashing or can be diverted to drain to the storm drain, until the pumps stop on low level. Flow from the sump pump will be delivered to the storm drain. Drainage from the Backwash Holding Tank will contain chlorine and may require dechlorination before draining the tank.

5.3.3 RO Feed Tank

The RO Feed Tank will contain a fixed sump pump for drainage of the final tank volume below the operation low-level of the LP RO Feed Pumps. Flow from the LP RO Feed Pumps will be delivered to the RO System for treatment until the pumps stop on low level. To prevent potential cross-contamination, the sump pump will not be plumbed directly to the storm drain. A quick-connect coupling will provided at the top of the tank for pump-over into the storm drain via storm drain manhole (SDMH) 3 or SDMH 4. Prior to draindown, the RO Feed Tank will need to be isolated from the Pressure Filters / the filtered water discharge header. Drainage from the RO Feed Tank will be free of chlorine.

5.3.4 Washwater Equalization Tank

The Washwater Equalization Tank will be drained to the Package Treatment Unit using the submersible Washwater Recovery Pumps. If required, the Package Treatment Unit can be drained by returning the settled flows to the head of the Plant, and then via the solids drain connection to the sewer. Prior to draining the Washwater Equalization Tank, Pressure Filter backwashing will need to be inhibited. The tank will also need to be isolated from the drain line from the Cartridge Filters at motorized valve A-DRN-VBF-1002, and the RO Off-spec Permeate Return from the RO skids at manual valves A-RO-VBF-1122, 2114, 3114, 4114 respectively.

5.3.5 Decarbonator Effluent Tank

During normal operation, the Decarbonator Effluent Tank will pass treated water to the reservoir by gravity. However, in order to maintain a residence time and allow entrained air bubbles from the decarbonation process to escape, the tank has a minimum operating level and will not completely drain to the reservoir. The tank will be emptied to the storm drain by opening a manual drain valve (A-DRN-VBF-1006) on a pipe connection to new SDMH 1. Prior to draindown, the Decarbonator Effluent Tank will need to be isolated from the RO skids and the RO Bypass Pipeline at motorized valves A-RO-VBF-1107, 2107, 3107 and 4107 and manual valve A-ROB-VBF-1001 respectively. Drainage from the Decarbonator Effluent Tank will have been stabilized and will be free of chlorine.

6.0 Abnormal Operation

This chapter outlines procedures for operating conditions that are not routine or not considered normal.

6.1 Increased Chlorine Demand

6.1.1 Feed Water Chlorine Demand

If the chlorine demand of the feed water entering the Contact Tank increases, the chlorine dose to water leaving the Charnock site, the dose applied to the feed water, and the dose applied to each well feeding in upstream of the Arcadia WTP can be increased so that the blended water in the Contact Tank has sufficient chlorine for manganese oxidation. Sample tap A-RW-VBM-1003 can be used to determine the chlorine residual of water entering the Arcadia WTP.

To check the concentration of chlorine in the Contact Tank, manual samples can be taken from the tank, either from the manual sample tap that is upstream of the Contact Tank (A-RW-VBM-1004), or the turbidimeter (A-RW-AIT-1001) drain that is downstream of the Contact Tank.

6.1.2 Contact Tank Chlorine Demand

If the chlorine demand at the Contact Tank is higher than usual or increasing over time, the Operator should check to see if: 1) the water from Charnock and upstream wells is being dosed with enough chlorine, and 2) sodium bisulfite (SB) is being overfed upstream of the RO Feed Tank. SB is a dechlorinating agent, and a portion of flow containing SB is recycled if the Cartridge Filters are wasted to the Washwater Equalization Tank.

The SB feed point dose is set to be slightly greater than 1.5 times the chlorine residual of the Pressure Filter outlet (A-ROF-AIT-1001), and automatically adjusted if chlorine is detected at the chlorine analyzer (A-ROF-AIT-1002) upstream of the RO Feed Tank. SB is used at the Arcadia WTP to protect the RO membranes from free chlorine. The slight excess of the stoichiometric requirement of SB is used at the Arcadia site because chloraminated water from MWD could be used to balance the feed flow to the plant, and this can create lags in chemical dosing or analyzer responses. Therefore as a precaution, the SB dose should be set to slightly higher than 1.5 times the actual stoichiometric requirement (e.g. 1.7 times). The Operator should check that the SB feed is adequately quenching the chlorine residual, but not at an excessive dose rate.

6.1.3 Finished Water Chlorine Demand

If the chlorine demand of the finished water is elevated or increasing, it could be a result of an overfeed of the SB system. Refer to Section 6.1.2 above for information about checking the SB dose.

6.2 *Increased Pressure Filter Backwash Frequency*

If the required backwash frequency of the Pressure Filters increases, the filter run time will decrease as a result. This can be due to several causes:

1. Has the feed water quality changed? Are more particles entering the filters? Are more particles being recycled from the plate settlers in the Package Treatment Unit (PTU)? These causes would be linked to an increased pressure differential during the filter run. Checking this requires sampling and comparison to previous sample results. Also, the Operator should check that the back wash system is working properly, and that the chemical dosing (e.g., PACl) is set at the correct dose. Jar testing may be needed to verify the coagulant dose for the PTU.

2. Is there sufficient chlorine to maintain oxidized conditions through the filters? If not, the chlorine dosing at the Charnock site, the Wells, or upstream of the Contact Tank should be adjusted. This issue would result in higher iron and/or manganese in the effluent, which would require that the filters be backwashed more frequently.

3. Is the backwashing procedure optimized? Are the air and water flow rates at the correct levels? Is there even flow distribution within the filter cells? Is the duration of backwashing correct?

If the filters are being backwashed because of the iron and/or manganese level in the finished water, then the upstream chemistry (i.e., oxidation in the Contact Tank) should be checked. Note that the addition of more chlorine is not always the optimum solution.

In addition, the greensand media may require reactivation. Procedures for reactivation are discussed later in this chapter.

6.3 *Increased Iron/Manganese in Pressure Filter Effluent*

Iron and manganese are removed at the Arcadia site by oxidation, which begins in the wells and through the Contact Tank, followed by physical removal by filtration and adsorption on the Pressure Filters. As the filters operate, iron and manganese (but usually manganese first) will break through the filters and eventually exceed an allowable level (i.e. 0.005 mg/L manganese + iron). When this occurs, the filter will normally be backwashed, and the filter returned to operation to achieve acceptable iron/manganese removal. During the first 15 to 25 minutes following a backwash, turbidity in the filter effluent may be elevated as the filter is "ripening" with deposited particles. The filter effluent during this period is wasted either to the Contact Tank or the Washwater Equalization Tank, a backwashing step referred to as "filter-to-waste" (FTW).

When the total concentration of iron and manganese in the filter effluent exceeds the allowable limit (which was 0.005 mg/L of manganese plus iron during the pilot trial of 2008), backwashing the filter would be the first operational procedure to try. If the water quality after backwashing is not acceptable, the backwashing procedure should be investigated. This includes checking the air and water flow rates, and backwash duration. If possible, a visual inspection of the filter vessel to identify any possible cause of uneven flow distribution during backwashing should be made.

If the filter run time (FRT) is decreasing (which also means that the frequency of backwashing is increasing) over time, the oxidation chemistry upstream should be investigated. During the pilot study, a 24 hour backwash frequency was needed to achieve acceptable water quality for the downstream RO System. The upstream oxidation chemistry can be modified by adjusting either the chlorine dose applied at the Charnock site and the wells, or the chlorine dose applied upstream of the Contact Tank or Pressure Filters.

If backwashing and upstream chemistry appear to be working properly, the Operators should consider a reactivation of the greensand media. This is typically necessary only every 5 to 10 years; however, as a troubleshooting measure, it can be performed to see if iron and manganese removal improves subsequently. The activation procedures are discussed later in this chapter.

6.4 Elevated Fouling Rate or Cleaning Frequency of RO

Fouling of the RO is generally caused by high iron and/or manganese in the RO feed water or microbial growth. An elevated fouling rate will cause the feed pressure to increase, and require more frequent cleans using the Clean-in-Place (CIP) System.

The concentrations of iron and manganese should be checked in the RO Feed Tank. If they are elevated (i.e., >0.005 mg/L iron + manganese), then the operation of the Pressure Filters should be checked.

Heterotrophic plate count (HPC) samples should be collected from the RO Feed Tank to see if there is elevated microbial growth, which can result in RO fouling. Normal operation is to dose SB upstream of the RO Feed Tank because it provides more time for dechlorination upstream of the RO membranes. If there is evidence of microbial growth, the RO Feed Tank can be disinfected by switching the SB feed point from upstream of the tank to downstream of the tank. This will allow the chlorine residual (about 1.0 mg/L) in the filtered water from the Pressure Filters to disinfect the RO Feed Tank.

Occasional disinfection (e.g. quarterly) of the RO Feed Tank in this way is recommended as a preventative measure in any case.

6.5 High RO Permeate Conductivity

Water that passes through the RO membrane is called permeate, and it should have a very low conductivity (i.e., < 50 μS/cm). The SCADA system will track the conductivity of each stage for each RO skid, and if it is elevated, the following should be checked:

1. Identify which skid or stage of RO has elevated conductivity.
2. Check to see if there is a leak around connection o-rings for the RO membranes inside the vessel.

3. If the system is connected properly, the RO membrane could be damaged, thus allowing more passage of water quality characteristics (e.g. hardness, metals, radionuclides). New RO membranes can be installed and the used membranes could be tested by the Manufacturer to determine the cause of increased salt passage.

6.6 Low Finished Water Alkalinity

Alkalinity in the Arcadia WTP finished water is dependent upon the amount of bypass around the RO system, the Decarbonator performance, and the downstream sodium hydroxide (NaOH) dosing.

There is a high concentration of alkalinity (approximately 325 mg/L as $CaCO_3$) in the feed water to the Arcadia WTP. The RO System removes alkalinity, which leaves a very soft (acidic) permeate. The Bypass Flow will contain the feed water level of alkalinity. RO permeate and Bypass Flow are blended upstream of the Decarbonators. The Decarbonators are used to reduce excessive levels of carbon dioxide (CO_2) from the blended permeate, which would create a high chemical demand for NaOH if left in solution. The Decarbonator design is based on removing CO_2 to about 12 mg/L. The final pH and alkalinity are then adjusted with NaOH.

If the alkalinity of the finished water is low, it could be a result of a well combination that results in a feed alkalinity that is lower than the design figure of 325 mg/L as $CaCO_3$, or that the Decarbonator is removing more CO_2 than planned, or that the Bypass Flow is low (possibly due to the need to treat a higher percentage of the water through the RO for contaminant removal).

To increase the Finished Water alkalinity, a portion of the permeate/Bypass Flow can bypass the Decarbonator and go directly to the Decarbonator Effluent Tank. This will require a manual valve adjustment (A-DC-VBF-1004). Another option is to shutdown the blower for one of the Decarbonators.

There is a NaOH feed point upstream of the Decarbonators as well as downstream of the Decarbonators. The upstream feed point was planned for use if the Decarbonators could not be installed (due to an air quality permit moratorium in 2009). This upstream NaOH feed point can be used to add NaOH upstream of the Decarbonators. It will react with CO_2 and create alkalinity that is not removed by the Decarbonators. The downstream NaOH system would still be needed to adjust the final pH of the water.

6.7 High Finished Water Conductivity

If the Finished Water conductivity level is elevated or on a rising trend, the Operator should check the performance of the RO System, the Bypass Flow, and the chemical feed systems. The RO System might not be lowering the conductivity to an acceptable level, due to leaks or damaged membranes. The Bypass Flow might be too high, resulting in higher Finished Water hardness and elevated concentrations of contaminants that might be present (e.g., uranium, MTBE, TBA, etc.). The chemicals added to the Finished Water also add to the conductivity. Too much chemical could result in higher Finished Water conductivity.

6.8 Variability in Sodium Bisulfite Dosing

The SB dosing location is just upstream of the RO Feed Tank. A second, optional feed point is downstream of the RO Feed Tank; however the upstream dosing point is used to allow more reaction time for dechlorination upstream of the RO membranes.

If there is a lot of variability in the SB dosing level, the Operator should monitor the chlorine levels upstream of the dosing point to see if they are fluctuating significantly. If so, the cause of the chlorine fluctuation should be investigated. As discussed in the 'Increased Chlorine Demand' section of this chapter, the SB dose should be set at above the stoichiometric level to account for some variability in chlorine residuals, as well as the possible addition of MWD water to balance feed flows.

6.9 Activation of Greensand Filter Media

The greensand layer in the Pressure Filers has a manganese dioxide coating that may require re-activation periodically (e.g. every 5 to 10 years) to maintain satisfactory performance for iron and manganese removal. Likewise, when greensand is new and installed into a filter, the activation (sometimes called regeneration) procedure must be performed.

Activation is accomplished by soaking (for a minimum of 4 hours) the media in an oxidized solution. This can be of either free chlorine or potassium permanganate. During the pilot study carried out in 2008, free chlorine was used for the activation of the pilot filter greensand media, and the system performed well. One benefit of free chlorine is that it can be neutralized and disposed of easily, whereas potassium permanganate will contain manganese solids when it is neutralized.

Check with the supplier of the greensand to verify proper regeneration procedures, but an example is shown below for reference.

Each filter cell contains 18 inches of greensand. The volume of greensand is approximately 342 cubic feet. For example, the Inversand Company, which supplies greensand, recommends a chlorine solution of 50 gallons of 6% bleach for every 100 cubic feet of media, or 20 gallons of 15% bleach for every 100 cubic feet of media. This equates to approximately 171 gallons of 6% bleach or 69 gallons of 15% bleach.

Backwash and then shutdown the filter cell that will be activated or reactivated. The vessel should be nearly full of water. Open the hatch on the pressure vessel cell and pour in the chemical requirement of chlorine solution into the water above the media or pump hypochlorite through the hatch using temporary piping and pump. Next, open the effluent valve to allow the chlorinated water to slowly move through the filter media. When a chlorine residual is detected in the effluent, close the valve and let the cell soak for at least 4 hours. Backwash the filter cell. The highly chlorinated water will enter the Washwater Equalization Tank. The chlorinated water can be neutralized in the Washwater Equalization Tank by dumping sodium bisulfite and running the submersible mixers. Neutralized waste can be pumped up to the Package Treatment Unit, from where the effluent will be fed back to the Contact tank.

If the chlorinated washwater is recycled to the head of the Plant for treatment through the Plant without neutralizing, the chemical dosing within the Plant (i.e. chlorine feed upstream of the Pressure Filters and SB upstream of the RO Feed Tank) will be affected until it has passed through the system.

6.10 Loss of Pressure Filter Media

It is not uncommon to observe losses of filter media over time as the system operates. The losses are typically in the backwash flow. A filter inspection should be conducted:

1. If media loss is occurring. This may be detected during tank drain-down of the Washwater Equalization Tank. If media loss occurs, the backwash rate and air flow rate should be checked and adjusted to minimize media carryover.
2. After first six months of operation, a service company can conduct inspections to determine the media depth.
3. Every 2 to 5 years if filter operation appears to be normal.

6.11 Standby Power Facilities

A possible abnormal operation for the Arcadia electrical system is upon loss of utility power. Under this occurrence, the Automatic Transfer Switches will detect the loss of utility power, signal the generator to start, and transfer Plant load to the generator. When utility power is available, the Automatic Transfer Switches will transfer Plant load back to the utility service and signal the generator to shutdown.

6.12 Optimizing PACl Dosing for Washwater Treatment

If the turbidity of the washwater recovered from the PTU is high (e.g., > 2 NTU), the Operator should adjust the coagulant dosage. The coagulant is polyaluminum chloride (PACl), and the adjustment may be higher or lower than the current dosing level.

A jar test can be used to identify the optimum PACl dosage. Water from the Washwater Equalization Tank should be collected and poured into the jars for the test. Usually, there are 2-liter jars for jar tests. These are then mixed to replicate rapid mixing (15 seconds at the maximum stirrer speed) followed by flocculation (5 minutes and ranging from between 15 and 60 rpm). A jar test (possibly more than one) should first be performed to try to mimic what is happening in the full-scale plate settler system. For example, mixer speeds should be adjusted so that the water quality at the applied PACl dose at the end of the jar test matches the water quality of the PTU effluent. A settling time of 8.3 minutes (based on a 0.3 gpm/sf loading rate and 10 cm settling height in the jar relative to the sample extraction point) should be allowed in the jars to replicate the plate settler sedimentation process.

Once the mixer settings for speed are known for the system, the PACl dose can be adjusted to identify the optimum dose for achieving the lowest settled water turbidity. The full-scale PACl dosing system can then be adjusted.

7.0 Process and Water Quality Monitoring

This Chapter outlines the various types of monitoring to be conducted by the operations staff. Note that much of the monitoring is for operations and process control; the compliance point for finished water quality for the facility is downstream of the 5 MG reservoir.

7.1 Operating and Monitoring Records

Operating and monitoring records are necessary to document treatment settings and performance, such that future evaluations and decisions can be based on historical operating data. Most operating data is collected automatically via the SCADA system, and reports are generated electronically. There are also some manual records that are required.

Operations data that are automatically collected are listed in Table 7-1.

Table 7-1. Automated On-Line Sampling at the Arcadia WTP

Parameter	Units	Location
FEED WATER		
Flow	gpm	A-RW-FIT-1001
Chlorine Residual	mg/L	A-RW-AIT-1003
PRESSURE FILTER INFLUENT FLOW		
Turbidity	NTU	A-RW-AIT-1001
Chlorine Residual	mg/L	A-RW-AIT-1002
PRESSURE FILTER EFFLUENT		
Turbidity (for each of 12 cells)	NTU	A-PF-AIT-1104, A-PF-AIT-1204, A-PF-AIT-2104, A-PF-AIT-2204, A-PF-AIT-3104, A-PF-AIT-3204, A-PF-AIT-4104, A-PF-AIT-4204, A-PF-AIT-5104, A-PF-AIT-5204, A-PF-AIT-6104, A-PF-AIT-6204
Flow from each cell	gpm	A-PF-FIT-1105, A-PF-FIT-1205, A-PF-FIT-2105, A-PF-FIT-2205, A-PF-FIT-3105, A-PF-FIT-3205, A-PF-FIT-4105, A-PF-FIT-4205, A-PF-FIT-5105, A-PF-FIT-5205, A-PF-FIT-6105, A-PF-FIT-6205
Differential Pressure on each cell	psi	A-PF-DPIT-1103, A-PF-DPIT-1203, A-PF-DPIT-2103, A-PF-DPIT-2203, A-PF-DPIT-3103, A-PF-DPIT-3203, A-PF-DPIT-4103, A-PF-DPIT-4203, A-PF-DPIT-5103, A-PF-DPIT-5203, A-PF-DPIT-6103, A-PF-DPIT-6203
RO FEED TANK INFLUENT		

Parameter	Units	Location
Chlorine residual	mg/L	A-ROF-AIT-1001, A-ROF-AIT-1002
RO BYPASS		
Flow	gpm	A-ROB-FIT-1003
CARTRIDGE FILTER INFLUENT		
Turbidity	NTU	A-ROF-AIT-1101
Differential Pressure on each vessel	psi	A-ROF-PDIT-1001
RO UNITS INFLUENT		
ORP	mV	A-ROF-AIT-1102
pH/temperature	--/oC	A-ROF-AIT-1104
Conductivity	Umho/cm	A-ROF-AIT-1105
Turbidity	NTU	A-ROF-AIT-1106
Chlorine Residual	mg/L	A-ROF-AIT-1103
Inlet Pressure (common)	psi	A-ROF-PIT-1001
RO UNITS		
Conductivity	Umho/cm	A-RO-AIT-1101, A-RO-AIT-1103, A-RO-AIT-1104, A-RO-AIT-1102, A-RO-AIT-2101, A-RO-AIT-2103, A-RO-AIT-2104, A-RO-AIT-2102, A-RO-AIT-3101, A-RO-AIT-3103, A-RO-AIT-3104, A-RO-AIT-3102, A-RO-AIT-4101, A-RO-AIT-4103, A-RO-AIT-4104, A-RO-AIT-4102
Flow (permeate)	gpm	A-RO-FIT-1100, A-RO-FIT-2100, A-RO-FIT-3100, A-RO-FIT-4100
Flow (concentrate)	gpm	A-RO-FIT-1104, A-RO-FIT-2104, A-RO-FIT-3104, A-RO-FIT-4104
DECARBONATOR EFFLUENT		
Flow	gpm	A-DC-FIT-1001
pH/temperature	--/oC	A-DC-AIT-1001
Fluoride	mg/L	A-DC-AIT-1002
Turbidity	NTU	A-DC-AIT-1004
Conductivity	Umho/cm	A-DC-AIT-1005
Chlorine Residual	mg/L	A-DC-AIT-1003
FINISHED WATER		
Chlorine Residual	mg/L	A-FS-AIT-1003, A-FS-AIT-1001
pH/temperature	--/oC	A-FS-AIT-1004, A-FS-AIT-1002

Parameter	Units	Location
BACKWASH FLOWS		
Pressure Vessel Backwash Flow	gpm	A-BW-FIT-1003
Plate Settler Influent Flow	gpm	A-WW-FIT-1001
Plate Settler Solids Flow	gpm	A-WW-FIT-1006
Turbidity (recycled flow)	gpm	A-WW-AIT 1001

Other manual operation tasks at the Arcadia WTP will include:

1. Draining of the main process tanks for cleaning, inspection, or maintenance of equipment.
2. Draining and disposal of rainwater and chemical spillages at the chemical containment areas (Chemical Storage Area, CIP Area, Fluoride Building blind sump and PACl containment).
3. Clearing and disposal of debris and oil accumulated in the Storm Water Interceptors.

An operations log book should document that these procedures have been performed, including the date, time, duration of the procedure, and outcomes.

7.2 *Water Quality Monitoring*

Water quality monitoring is necessary to track the performance of the Pressure Filter and RO systems at the Arcadia WTP. Table 7-2 outlines the recommended process monitoring for the facility. The SCADA system will be used to store on-line monitoring data; however, site field samples, such as manual chlorine, pH, or turbidity measurements, should be documented in a field data book at the site.

7.2.1 *Contaminant Monitoring*

Table 7-2 displays the anticipated initial sampling frequency for contaminants at the Charnock and Arcadia facilities. The frequency and location of sampling may change over time as the plant operates, so requirements should be checked with the water quality supervisor for the City.

Note that 'In-house' refers to the City's laboratory being used to monitor for some of the contaminants in Table 7-2. 'Contract' refers to a contract laboratory for sampling of these contaminants; they may require the use of the City's sampling bottles for analysis. The City should check with the Contract laboratory and plan ahead so that enough sample bottles are available, and that the proper chain of custody forms are completed with each sample.

Table 7-2. Anticipated Initial Sampling Frequency for Contaminants at the Charnock and Arcadia Facilities

Parameter and Sampling Location	Regulatory or Process	Frequency	Laboratory / Turn-Around
MTBE			
Wells 13, 15, 19	Reg	Quarterly (1)	In-House / Standard
Wells 16, 18	Reg	Quarterly (1)	In-House / Standard
Combined influent	Process	As needed	Contract / As needed
Post lead GAC vessels	Process	Monthly/Weekly (2)	Contract / 7-day
Post lag GAC vessels	Process	Monthly	Contract / 7-day
Treated Charnock Water	Process	Monthly/Weekly (2)	Contract / 7-day
RO influent	Process	As needed	In-House / Standard
RO permeate	Process	As needed	In-House / Standard
Finished water	Reg	Weekly	In-House / Standard
TBA			
Wells 13, 15, 19	Reg	Quarterly (1)	Contract / 7day
Wells 16, 18	Reg	Quarterly (1)	Contract / 7-day
Combined influent	Process	As needed	Contract / As needed
Post lead GAC vessels	Process	Monthly/Weekly (2)	Contract / 7-day
Post lag GAC vessels	Process	Monthly	Contract / 7-day
Treated Charnock Water	Process	Monthly/Weekly (2)	Contract / 7-day
RO influent	Process	As needed	Contract / Standard
RO permeate	Process	As needed	Contract / Standard
Finished water	Reg	Monthly/Weekly (2)	Contract / 7-day
TDS (3)			
Wells 13, 15, 19, 16, 18	Process	Quarterly (1)	In-House / Standard
Santa Monica Wells	Process	Quarterly (1)	In-House / Standard
Arcadia Wells	Process	Quarterly (1)	In-House / Standard
RO influent	Process	Monthly	On-line / immediate
RO permeate	Process	Monthly	On-line / immediate
Finished water	Process	Weekly	On-line / immediate
Uranium			
Wells 13, 15, 19, 16, 18	Reg	Quarterly or less (4)	Contract/ Standard
RO influent	Process	As needed	Contract/ As needed
RO permeate	Process	As needed	Contract/ As needed
Finished water	Reg	Monthly	Contract/ Standard

Parameter and Sampling Location	Regulatory or Process	Frequency	Laboratory / Turn-Around
Iron and Manganese			
Wells 13, 15, 19, 16, 18	Process	Quarterly (1)	In-House / Standard
Santa Monica Wells	Process	As needed	In-House / Standard
Arcadia Wells	Process	As needed	In-House / Standard
Charnock Pressure Filter Influent	Process	As needed	Field Kit /As Needed
Charnock Pressure Filter Effluent	Process	As needed	Field Kit /As Needed
Arcadia Pressure Filter Influent	Process	As needed	Field Kit /As Needed
Arcadia Pressure Filter Effluent	Process	As needed	Field Kit /As Needed
RO influent	Process	As needed	Field Kit /As Needed
Finished water	Reg	Monthly	In-House / Standard
TCE (and 1,1-DCE)			
Wells 13, 15, 19, 16, 18	Reg	Quarterly (1)	In-House / Standard
Santa Monica Wells	Reg	Monthly (1)	In-House / Standard
5 MG Reservoir Inlet	Process	Weekly	In-House / Standard
Finished water	Reg	Weekly	In-House / Standard

1. Monitoring increases to Monthly for those parameters that exceed an MCL. Monitoring is only done on wells that are in service during scheduled sampling events.
2. Frequency will be Monthly until the first detection at any well, weekly thereafter for as long as contaminant is detected in any Charnock well.
3. Conductivity measurements will be used as a surrogate for TDS.
4. Initial monitoring for four quarters for compliance with the Radionuclides Rule will be performed upon start-up of the Charnock Wells. Thereafter, ongoing monitoring will be performed as specified by Title 22 Section 64442 (i.e. Ave>MCL=quarterly monitoring).

Occasionally, filter water quality profiles should be performed to observe the performance of the Pressure Filters for iron and manganese removal. This filter profile involves measuring the total iron and manganese (and sometimes the dissolved species, if the City is trouble-shooting the system for poor iron and manganese removal) in the feed and filter effluent over an entire filter run time. An example would be to collect the raw and filtered samples at time zero after the initiation of a filter run, followed by measurements every 10 minutes until 30 minutes into the filter run, followed by measurements every 2 or so hours. Measurements should be continued until the iron and manganese concentrations have increased to unacceptable levels (e.g. <0.0.005 mg/L total iron plus manganese). These data should be documented in a log book or computer file to show filter performance over time. If the filers are performing well, and iron and manganese removal is satisfactory with filter run times being acceptable as well (i.e. > 24 hours), then filter profiles do not need to be performed.

The main contaminants of concern are shown in Table 7-2, but monitoring for the other water quality contaminants (e.g. metals, volatile organics, etc.) will continue on the regulatory monitoring schedule as prescribed by DPH. The City's laboratory staff will track the sampling requirements for these constituents.

7.2.2 Continuous (On-Line) Monitoring

The on-line instruments for the Arcadia facility include:

- Feed water: chlorine residual (A-RW-AIT-1003)
- Feed water to Pressure Filters: turbidity (A-RW-AIT-1001) and chlorine (A-RW-AIT-1002)
- Pressure Filter effluent: turbidity (A-PF-AIT-1104, A-PF-AIT-1204, A-PF-AIT-2104, A-PF-AIT-2204, A-PF-AIT-3104, A-PF-AIT-3204, A-PF-AIT-4104, A-PF-AIT-4204, A-PF-AIT-5104, A-PF-AIT-5204, A-PF-AIT-6104, A-PF-AIT-6204)
- Pressure Filter effluent: chlorine (A-ROF-AIT-1001)
- RO Feed Tank: chlorine residual (A-ROF-AIT-1002)
- Cartridge Filter influent: turbidity (A-ROF-AIT-1101)
- RO feed water: ORP (A-ROF-AIT-1102), pH/temperature (A-ROF-AIT-1104), conductivity (A-ROF-AIT-1105), turbidity (A-ROF-AIT-1106), and chlorine (A-ROF-AIT-1103)
- RO treated water: conductivity from each skid (A-RO-AIT-1102, A-RO-AIT-2102, A-RO-AIT-3102, and A-RO-AIT-4102)
- CIP System: pH (A-CIP-AIT-1001)
- Washwater recycle flow: turbidity (A-WW-AIT-1001)
- Decarbonator effluent: pH/temperature (A-DC-AIT-1001), fluoride (A-DC-AIT-1002), turbidity (A-DC-AIT-1004), conductivity (A-DC-AIT-1005), and chlorine (A-DC-AIT-1003).
- Treated water leaving site: free chlorine (A-FS-AIT-1003 and A-FS-AIT-1001) and pH/temperature (A-FS-AIT-1004 and A-FS-AIT-1002)

Data from each should be stored via the SCADA system, such that it can be retrieved to view and trend the data, as desired.

Of the on-line monitors, one is directly linked to regulatory monitoring: Pressure Filter effluent chlorine residual (A-ROF-AIT-1001). This monitors the chlorine residual that is used to assess the disinfection that is required (see later section in this chapter).

7.2.3 Bench or Field Sample Collection and Monitoring

Table 7-2 includes some bench or field sampling and monitoring for iron and manganese. It will be necessary to document the performance of the Pressure Filters for iron and manganese removal. During start-up and trouble-shooting, it may be necessary to monitor the total iron and manganese (and possibly the dissolved species as well) in the feed and filtered water over an entire filter run (e.g. every two hours over a 24 hour period) to confirm filter performance. Once the filter run time which creates satisfactory water quality over the entire filter run is known, operations staff can set the equipment to operate with this backwash frequency.

Other bench or field tests include pH, turbidity, chlorine residual and total chlorine residual.

7.2.4 Disinfectant Residual and CT

The biological GAC at the Charnock Wellfield location will require a 4.0 log virus inactivation to be achieved downstream of the GAC contactors. The design includes chlorination in the Charnock Filtered Water Tank, 3.4 miles of pipeline between the Charnock and Arcadia sites, the Arcadia WTP Contact Tank, Pressure Filters at the Arcadia site, and chloramination in the existing 5 MG reservoir at Arcadia.

The level of disinfection is determined by the 'CT,' which is calculated by multiplying the chlorine concentration, C, by the contact time, T. The contact time must be adjusted for mixing with the use of a baffling factor, which is the ratio of contact time for 10 percent of the water passing to the theoretical contact time (i.e. T_{10}/T_{theo}). The baffling factor for a pipeline is 1.0, thus offering the most efficient disinfection contactor arrangement for determining CT. Based on the virus inactivation table of the Surface Water Treatment Rule, the required CT will be 4 mg-min/L for a water at 15 °C with pH between 6 and 9.

The determination of CT will be through the Pressure Filters at the Arcadia WTP. The target dose of 1.0 mg/L in the filter effluent combined with the 8.1 minute effective contact time (which accounts for 0.7 baffling factor for the water above the media and the 50% water volume within the media bed) provides a CT of 8.1 mg-min/L, which is over two times the required amount of CT.

Tracking CT involves continuous monitoring of the chlorine residual (A-FLT-AIT-1001) and temperature upstream of the RO (A-ROF-AIT-1104), and weekly grab samples to verify the pH is between 6 and 9.

7.2.5 Calibration/ Verification Procedures

This procedure should be used to verify that the chemical feed pump is drawing the proper amount of chemical. The calibration column should be used with the following procedure:

1. Check that calibration column is empty and without scale or debris. Remove, clean, and reinstall if necessary.
2. Turn OFF only the pump that is being checked. The other pumps supplying chemicals can remain in operation.
3. Open the isolation valve to the calibration column for the pump being checked.
4. Allow the calibration column to fill with the chemical, but do not over fill.
5. Once the column is full close the skid isolation valve.
6. Note the "start" level of the chemical in the calibration column and begin timing as the pump to be tested is turned on.

7. Stop timing and check the level in the calibration column (the longer the time, the more accurate the reading will be).
8. Allow the remaining chemical to be pumped from the column.
9. Open the skid isolation valve and close the calibration column isolation valve.
10. Continue with normal operation.
11. To verify the chemical feed rate divide the amount of chemical by the elapsed time, e.g. if the calibration column is delineated into millilitres (ml) and 250 ml were pumped from the column in 30 seconds, the chemical feed rate would be 250ml/30 seconds = 8.3 ml/s. To convert units 8.3 ml/s*60*60/(1000*3.785) = 8 gallons per hour (gph).
12. Compare the calculated gph to the programmed feed rate for the pump and the feed rate indicated by the chemical flow meters.

8.0 Preventative Maintenance Program

Operating staff should consult the equipment manuals provided by the equipment supplier for preventative maintenance recommendations for each piece of equipment.

Standby Diesel Generator – TBD
Low Voltage Motor Control Centers – TBD
Control System and Instrumentation – Beavens Systems Inc
Chemical Feed Equipment – Chem Flow
Dry Chemical Feed Equipment (Sodium Fluoride) – Automated Ingredient Systems
Submersible Mixers – JCI
Static Mixers – Mixtech
Pressure Filter Equipment – Westech
Packaged Washwater Treatment Unit – Meurer Research Inc.
RO System – Biwater AEWT
Decarbonators – TBD
Carbon Absorption – TBD
Sulfuric Acid and Hydroxide Tanks – RECO USA
FRP Tanks – Belding Tank Technologiers Inc
Low Pressure RO Feed Pumps – Lee Mathews Equipment Inc
Backwash Supply Pumps – Lee Mathews Equipment Inc
Filter Feed Pumps – Lee Mathews Equipment Inc
Washwater Recovery System Feed Pumps – Lee Mathews Equipment Inc
Reservoir Overflow Detention Basin Sump Pump – Lee Mathews Equipment Inc
Contact Tank, Backwash Supply Tank, RO Feed Tank Sump Pumps – Lee Mathews Equipment Inc
Raw Water Inlet Vault Sump Pumps – TBD
Chemical Storage Area Portable Sump Pump - TBD
Sodium Hypochlorite System – TBD
Sodium Bisulfite System – TBD
Ammonium Sulfate System – TBD
Sodium Hydroxide Chemical & Dilution System – TBD
Sulfuric Acid System – TBD
Polyaluminum Chloride System – TBD

9.0 Safety

There are many elements to a safety program for a water treatment system. This section highlights those safety areas related to process equipment and procedures.

9.1 General Guidelines

The WTP is designed with safety in mind, however mechanical dangers, hazards and chemical exposure exist that may cause injuries or death if proper precautions are not taken while working on or around the WTP equipment. Only trained and experienced maintenance and operations personnel who are familiar with the WTP equipment should be allowed to operate and maintain the facility.

The following are some of the many precautions that should be taken when working within the WTP facility:

- The WTP can be a wet environment and care should be taken to avoid slips. Ensure handrails are used. Post warning signs whenever such conditions are first noticed and resolve them at the earliest opportunity.

- The WTP employs several chemicals that can be hazardous and Operators should review MSDS's to ensure the proper precautions are taken. Rope off and contain any spills and follow the City's chemical spill procedure. Immediately notify your Supervisor should a spill pose personnel and/or environmental hazards. All chemicals are stored with secondary containment.

- The City's Electrical Safety Procedure should be followed when working around the WTP equipment and components. Prior to working on WTP equipment never assume that the tagging procedure has been properly conducted: perform your own checks and test.

- Some WTP systems operate with high pressure air, water, and oil sub-systems. Never open a vent or drain valve or open a flange connection unless it is proven that the pressure source has been shutdown and the pressure has dissipated.

- Several WTP components and tanks are designated as Confined Spaces. Ensure that you get a Confined Space Permit and follow proper Confined Space Procedures prior to, and during, maintenance.

- Notify the plant Supervisor should you notice any potential safety hazards in or around the WTP.

- For emergency showers and eyewash stations to be effective, the American National Standards Institute (ANSI) Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-2004) recommends that the affected body part must be flushed immediately and thoroughly for at least 15 minutes using a large supply of clean fluid under low pressure. Water does not neutralize contaminants -- it only dilutes and washes them away. This fact is why large amounts of water are needed.

  However, other references recommend a minimum 20-minute flushing period if the nature of the contaminant is not known. The flushing or rinsing time can be modified if the identity and properties of the chemical are known. For example:

  - a minimum 5-minute flushing time is recommended for mildly irritating chemicals,
  - at least 20 minutes for moderate-to-severe irritants,
  - 20 minutes for non-penetrating corrosives, and
  - at least 60 minutes for penetrating corrosives.

  Review the MSDS before you enter the particular WTP hazardous chemical area for emergency shower and eyewash requirements to determine wash time periods.

10.0 Staffing Plan

Staff for both the Charnock and Arcadia facilities will be primarily be based at the Arcadia WTP. Gary Richinick, Supervisor, resides on the property of the Arcadia WTP, and provides a rapid response to any alarms. John Watts also resides on the property and provides a rapid response to operational needs.

The table on the following page outlines the staff for the treatment system.

City of Santa Monica
Water Production and Treatment Operations Staff

	Position	Treatment Grade	Distribution Grade	Hours	Home Phone	Cell Phone	Distance from WTP
Cardenas, Myriam	Assistant Manager	T4 #12794	D5 #14585	M-Th 7am-5:30 pm	(310) 543-5226	(310) 621-8835	17 mi
Richinick, Gary	Supervisor	T4 #22490	D5 #9352	Tu-F 7am-5:30 pm	(310) 979-4554	(213) 709-1888	.1 mi
Arroyo, Abel	Operator	T3 #24569	D2 #34287	Various	(661) 723-6651	(661) 433-9169	65 mi
Bussart, Randy	Operator	T3 #27880	D4 #18896	Various	None	(707) 761-0187	5 mi
Milton, Eddie	Operator	T3 #24816	D4 #18896	Various	(323) 934-0349	(323) 934-0349	7 mi
Noriega, Abel	Operator	T2 #22479	D2 #27487	M-Th 7am-5:30 pm	(661) 267-2336	(661) 435-7164	60 mi
Paxman, Gary	Operator	T3 #15582	D4 #3135	Various	(805) 526-0131	(805) 526-0131	31 mi
Watts, John	Operator	T4 #17232	D5 #6303	Sa-Tu 7am-5:30 pm	(424) 832-3316	(424) 832-3316	.1 mi

revised 11/24/09

11.0 Emergency Procedures and Contacts

11.1 Emergency Procedures

11.1.1 Disinfection

A disinfection emergency would be either a failure to meet disinfection requirements through the pressure filters with a chlorine residual of 1.0 mg/L, or too low of a residual leaving the WTP.

Disinfection in the pressure filters is needed to achieve 4.0 log virus inactivation, as prescribed by DPH due to microbial populations being present in the GAC vessels at the Charnock facility. To correct this problem, additional chlorine feed can be applied upstream of the pressure vessels, to the water leaving the Charnock facility, to any wells entering the system (Santa Monica or Arcadia wells), and to the influent of the contact tank at the Arcadia WTP.

To ensure adequate disinfection prior to distribution, additional chlorine can be added upstream of the 5 mg reservoir, and this will automatically trigger a higher ammonia dose for conversion to chloramines, and the finished water chloramine concentration would be higher than the normal 2 to 2.5 mg/L. The MCL for chloramines is 4.0 mg/L so the residual can not be higher than 4.0 mg/L. As a temporary measure, this higher chloramine residual in the 5 mg reservoir and entering distribution could be used until the primary disinfection point is returned to service. For chloramines, the CT requirement is 1,491 mg-min/L for temperatures greater than 10 °C, and 994 for temperatures greater than 15°C.

Table 11-1 shows that if the temperature is greater than 15 °C, the plant could still produce 8.8 mgd, but the chloramine residual would need to be 4.0 mg/L. To maintain a more normal finished water chloramine concentration, the plant production could be reduced to 5.4 mgd, and the finished water chloramine concentration would need to be > 2.5 mg/L.

Table 11-1
Available CT in the 5 mg Reservoir if Disinfection in the Pressure Filters Fails

Flow (mgd)	Chloramine Residual (mg/L) to meet CT Levels:	
	994 mg-min/L >15 °C	1,491 mg-min/L >10 °C
3.3 mgd (654 min in reservoir)	1.5	2.3
3.6 mgd (597 min in reservoir)	1.7	2.5
5.4 mgd (398 min in reservoir)	2.5	3.8
6.6 mgd (327 min in reservoir)	3.1	>4 – not possible
8.8 mgd (245 min in reservoir)	4.0	>4 – not possible

* Based on a baffling factor of 0.3 in the existing 5 mg reservoir, which is baffled and equipped with surface aerators.

11.1.2 Power Outages

TBD

11.1.3 Earthquakes

TBD

11.1.4 Chemical Spill

TBD

11.1.5 Fire

TBD

11.2 Emergency Contacts

The following page contains the emergency contacts for the City of Santa Monica.

State of California—Health and Human Services Agency

California Department of Public Health

CDPH

MARK B HORTON, MD, MSPH
Director

ARNOLD SCHWARZENEGGER
Governor

WATER QUALITY EMERGENCY NOTIFICATION PLAN

Name of Utility: City of Santa Monica/ Water Resources

Physical Location/Address: 1212 5th St., Santa Monica, CA 90404

The following persons have been designated to implement the plan upon notification by the State Department of Public Health that an imminent danger to the health of the water users exists:

	Water Utility: Contact Name & Title	Email Address	Telephone Day	Telephone Evening	Telephone Cell
1.	Myriam Cardenas/ Acting Water Prod. & Treatment Superintendent	myriam.cardenas@smgov.net	310 826-6712 310 434-2659	310 543-5225	310 621-8835
2.	Gary Richinick/ Acting Water Treatment Plant Supervisor	gary.richinick@smgov.net	310 434-2660	310 979-4554	213 709-1888
3.	Jeffrey Moss/ Water Chemist	jeffrey.moss@smgov.net	310 434-2658	661 250-7564	818 426-5804

The implementation of the plan will be carried out with the following State and County Health Department personnel:

	State & County Health Departments: Contact Name & Title	Telephone Day	Telephone Evening
1.	Stefan Cajina, P.E., District Engineer California Department of Public Health	(213) 580-3127 Fax (213) 580-5711	H (323) 259-5069 M (213) 210-6810
2.	Grazyna Newton, P.E., Associate Sanitary Engineer Sutida Bergquist, P.E., Associate Sanitary Engineer James Ko, P.E., Associate Sanitary Engineer Milagros Alora, Sanitary Engineer Jim Jablonski, P.E., Associate Sanitary Engineer California Department of Public Health	(213) 580-5734 (213) 580-3126 (213) 977-6808 (213) 580-5726 (213) 580-5709	(818) 349-7960 (562) 493-2175 (626) 447-9477 (818) 993-9351 (949) 786-0733
3.	Alfonso Medina, Director Mihue Shur, Chief of Small Water Systems Program Bureau of Environmental Protection County Environmental Health Department Local Primacy Agency 5050 Commerce Drive Baldwin Park, CA 91706-1423	(626) 430-5280 (626) 430-5420	Emergency Operator (213) 974-1234

4. **If the above personnel cannot be reached, contact:**

Office of Emergency Services Warning Center (24 hrs) (800) 852-7550 or (916) 845-8911
When reporting a water quality emergency to the Warning Center, please ask for the California Department of Public Health – Drinking Water Program Duty Officer

NOTIFICATION PLAN

Attach a written description of the method or combination of methods to be used (radio, television, door-to-door, sound truck, etc.) to notify customers in an emergency. For each section of your plan give an estimate of the time required, necessary personnel, estimated coverage, etc. Consideration must be given to special organizations (such as schools), non-English speaking groups, and outlying water users. Ensure that the notification procedures you describe are practical and that you will be able to actually implement them in the event of an emergency. Examples of notification plans are attached for large, medium and small communities.

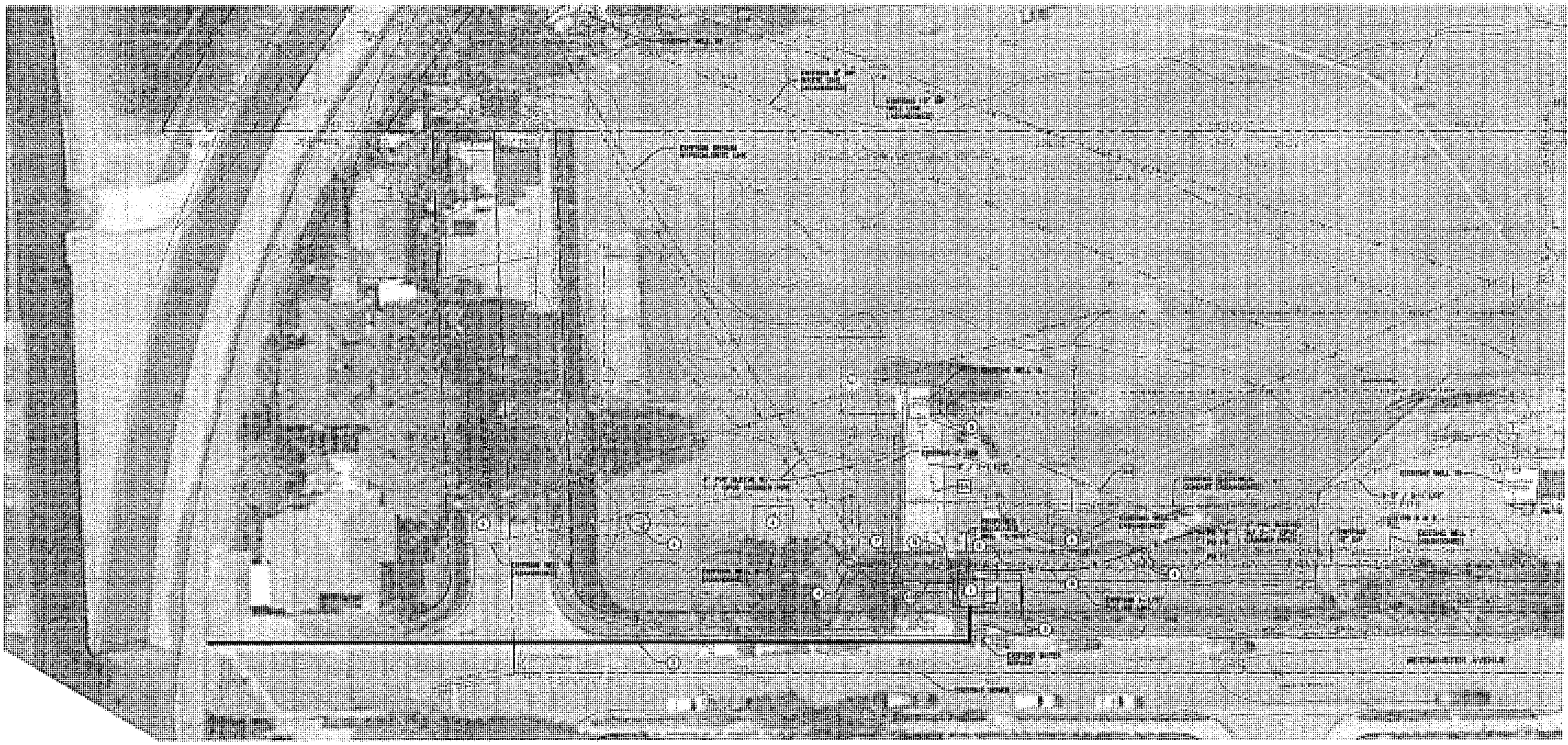
Report prepared by:

Signature and Title

Date

Appendix T

Charnock Well #20 Construction Data



CONSTRUCTION NOTES

1. PROPOSED WELL RELOCATION SITE. EXTRACT WELL 15, INSPECT COMPONENTS, REPLACE COMPONENTS AS REQUIRED WITH CITY STAFF AND INSTALL PUMP AT NEW LOCATION. SEE SHEET ___.
2. TEMPORARY PUMP DISCHARGE PIPE – PROVIDE VEHICLE ACCESS OVER TOP OF PIPE DURING PUMP TESTING – PROVIDE TEMPORARY CONNECTION PER DETAIL ___ HEREON
3. RELOCATE 2" WATER SERVICE – SEE DETAIL ___ SHEET ––.
4. DESTROYED WELLS
5. WELL SITE TO BE DESTROYED– SEE SPECIFICATIONS
6. LOCATE 10" DI WATER PIPE FROM WELL 15. CUT PIPE, INSTALL ELBOWS WITH THRUST BLOCKS AS REQUIRED, AND CONNECT TO DISCHARGE AT NEW WELL 15 LOCATION.
7. LOCATE <size> CHEMICAL FEED LINE TO WELL 8. DRAIN THE LINE BACK TO CUT PIPE FEED STATION.
8. INSTALL CONDUIT EQUAL TO EXISTING CONDUIT 8A. DISCONNECT CABLE AT EXISTING WELL 15 AND REROUTE TO NEW WELL 15.
9. INSTALL CONDUIT EQUAL TO EXISTING CONDUIT 9A. DISCONNECT CABLE AT EXISTING WELL 15 AND REROUTE TO NEW WELL 15.
10. REROUTE CHEMICAL FEED LINES PER DETAIL ___ SHEET ___.

LEGEND

————	PROPOSED WATERLINE
— W —	EXISTING WATERLINE
— CHW —	CHEMICAL WATERLINE
— AW —	ABANDONED WATERLINE
— E —	EXISTING ELECTRICAL
— AE —	ABANDONED ELECTRICAL

N

SCALE: 1"=20'

0 20 40 60

City of Santa Monica
Department of Public Works
1437 4th Street, Suite 300 Santa Monica, CA 90401
TEL. (310)458-8721 FAX. (310)393-4425
e-mail : smengineering@smgov.net

NO	DATE	BY	DESCRIPTION	APPROVED
			REVISIONS	

CONSULTANT

REVIEWED: DATE: ___ 20__
REVIEWED: DATE: ___ 20__
REVIEWED: DATE: ___ 20__
CITY CLIENTS

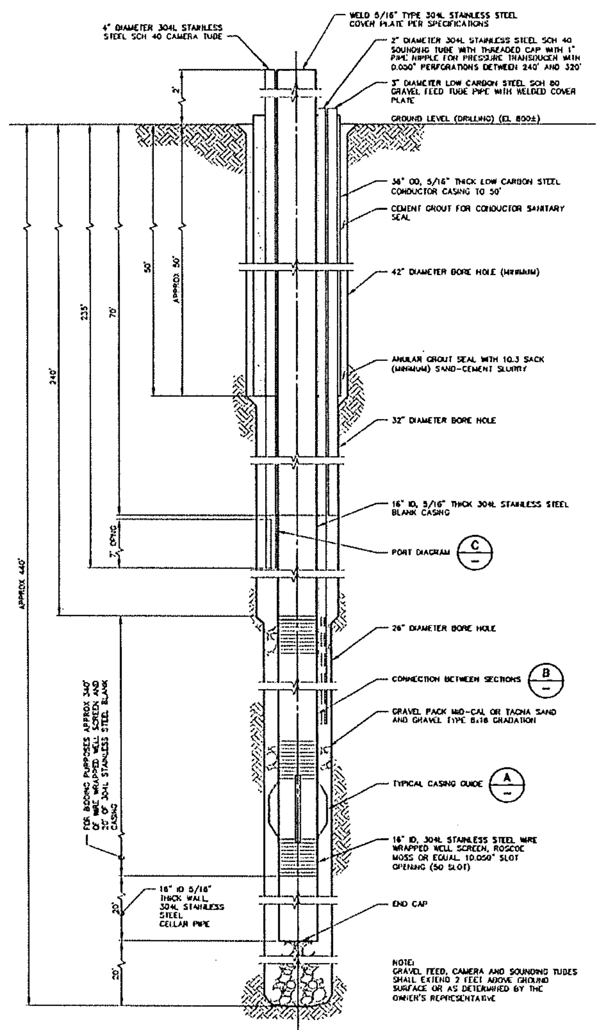
REFERENCE:
DATE: ___ 20__
SUBMITTED BY:
COMPUTER FILE NAME:
SP-FILE NO.:
PROJECT DIRECTOR
APPROVED BY: DATE: ___ 20__
CITY ENGINEER
ENGINEERING

Penfield & Smith
Engineering · Surveying · Planning · Construction Management ·
1327 Del Norte Road, Suite 200, Camarillo, CA 93010
Phone: (805) 981-0706 Fax: (805) 981-0251

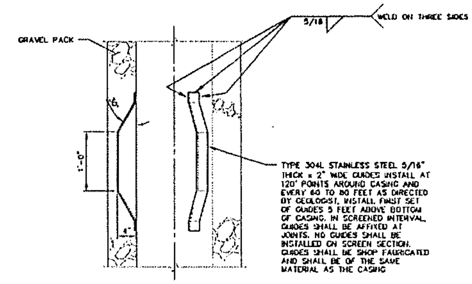
RCS

PROJECT TITLE: WINDWARD SCHOOL RELOCATION OF CITY OF SANTA MONICA WELL 15
JURISDICTION: CITY OF SANTA MONICA
DWG NO: 20
DWG DESC: PLATE 1 - SITE PLAN & DETAILS
FILE: CHARNOCK

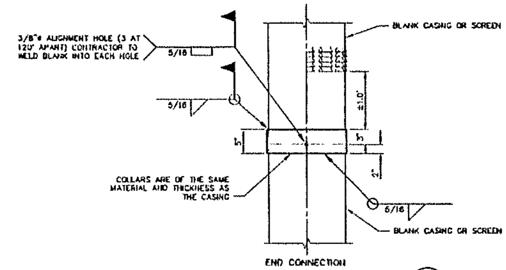
DESIGNED BY: XXX.XX
DRAWN BY:
CHECKED BY: XXXXXXX
CONSULTANT JOB/SHEET NO
DRAWING NO: XXXX
SHT X of X SHTS



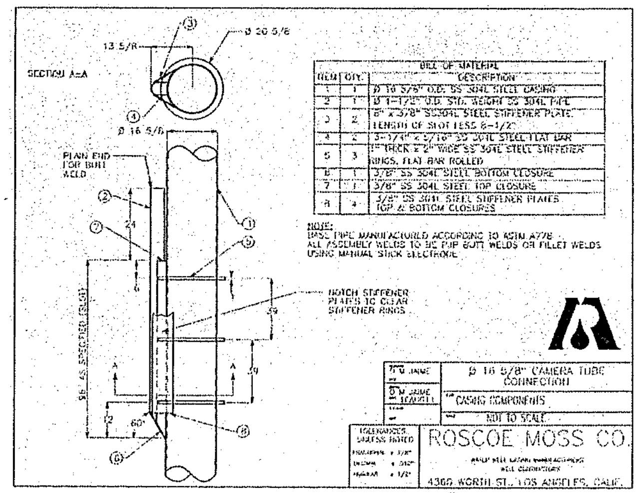
WELL DETAIL
SCALE: NTS



PORT DIAGRAM DETAIL (A)
SCALE: NTS

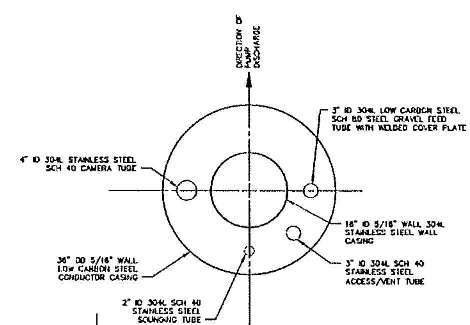


CONNECTION DETAIL (B)
SCALE: NTS



ITEM	QTY.	DESCRIPTION
1	1	Ø 16 5/8" O.D. SS 304L STEEL CASING
2	1	Ø 1-1/2" O.D. STD. WEIGHT SS 304L PIPE
3	2	8" x 3/8" SS304L STEEL STIFFENER PLATE, LENGTH OF SLOT LESS 8-1/2"
4	2	3-1/4" x 5/16" SS 304L STEEL FLAT BAR
5	3	1" THICK x 2" WIDE SS 304L STEEL STIFFENER RINGS, FLAT BAR ROLLED
6	1	3/8" SS 304L STEEL BOTTOM CLOSURE
7	1	3/8" SS 304L STEEL TOP CLOSURE
8	4	3/8" SS 304L STEEL STIFFENER PLATES TOP & BOTTOM CLOSURES

PORT DIAGRAM DETAIL (C)
SCALE: NTS



NOTE: FINAL LOCATION FOR GRAVEL FEED, SOUNDING, AND CAMERA TUBES SHALL BE DETERMINED IN THE FIELD BY OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION OF CASING

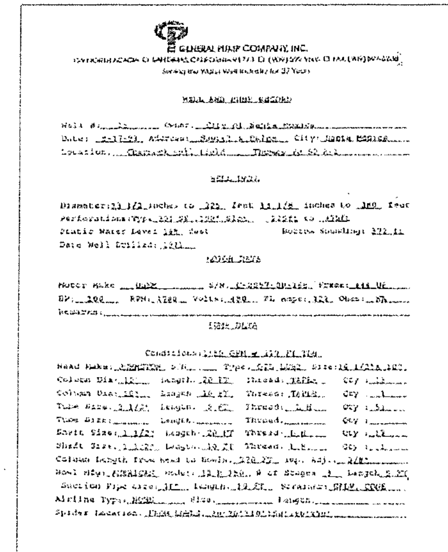
TYPICAL PLAN
SCALE: NTS

Penfield & Smith
Engineering · Surveying · Planning · Construction Management
1327 Del Norte Road, Suite 200, Camarillo, CA 93010
Phone: (805) 981-0706 Fax: (805) 981-0251

RCS

City of Santa Monica
Department of Public Works
1437 4th Street, Suite 300 Santa Monica, CA 90401
TEL. (310)458-8721 FAX. (310)393-4425
e-mail : smengineering@smgov.net

PROJECT TITLE: WINDWARD SCHOOL RELOCATION OF CITY OF SANTA MONICA WELL 15
JURISDICTION: CITY OF SANTA MONICA
DWG DESC: PLATE 2 - WELL DETAILS
FIELD: CHARNOCK
DRAWING NO: XXXX
SHT X OF X SHTS


GENERAL PUMP COMPANY, INC.

WELL AND PUMP RECORD

Well #: [illegible] Owner: City of Santa Monica
Date: [illegible] Address: [illegible] City: Santa Monica
Location: [illegible]

WELL DATA

Diameter: [illegible] inches to [illegible] feet [illegible] inches to [illegible] feet
Perforations (Type: [illegible]
Static Water Level [illegible] feet Bottom Sounding: [illegible]
Date Well Drilled: [illegible]

MOTOR DATA

Motor Make [illegible] S/N: [illegible] Frame: [illegible]
HP: 200 RPM: 1780 Volts: 480 FL amps: [illegible] Other: [illegible]
Remarks:

PUMP DATA

Conditions: [illegible]
Head Make: [illegible] S/N: [illegible] Type: [illegible] Size: [illegible]
Column Dia: [illegible] Length: [illegible] Thread: [illegible] Qty: [illegible]
Column Dia: [illegible] Length: [illegible] Thread: [illegible] Qty: [illegible]
Tube Size: [illegible] Length: [illegible] Thread: [illegible] Qty: [illegible]
Tube Size: Length: Thread: Qty:
Shaft Size: [illegible] Length: [illegible] Thread: [illegible] Qty: [illegible]
Shaft Size: [illegible] Length: [illegible] Thread: [illegible] Qty: [illegible]
Column Length from Head to Bowls: [illegible] Imp. Adj.: [illegible]
Bowl Mfg: [illegible] Model: [illegible] # of Stages [illegible] Length: [illegible]
Suction Pipe Size: [illegible] Length: [illegible] Strainer: [illegible]
Airline Type: [illegible] Size: Length:
Spider Location: [illegible]

WELL SITE RELOCATION (D)
SCALE: NTS

WATER SERVICE RELOCATION (E)
SCALE: NTS

CHEMICAL FEEDLINE REROUTE (F)
SCALE: NTS

WELL PUMP DATA (G)
SCALE: NTS

Penfield & Smith
Engineering · Surveying · Planning · Construction Management
1327 Del Norte Road, Suite 200, Camarillo, CA 93010
Phone: (805) 981-0706 Fax: (805) 981-0251

RCS

City of Santa Monica
Department of Public Works
1437 4th Street, Suite 300 Santa Monica, CA 90401
TEL. (310)458-8721 FAX. (310)393-4425
e-mail smengineering@smgov.net

REVISIONS — NO. DATE BY DESCRIPTION APPROVED

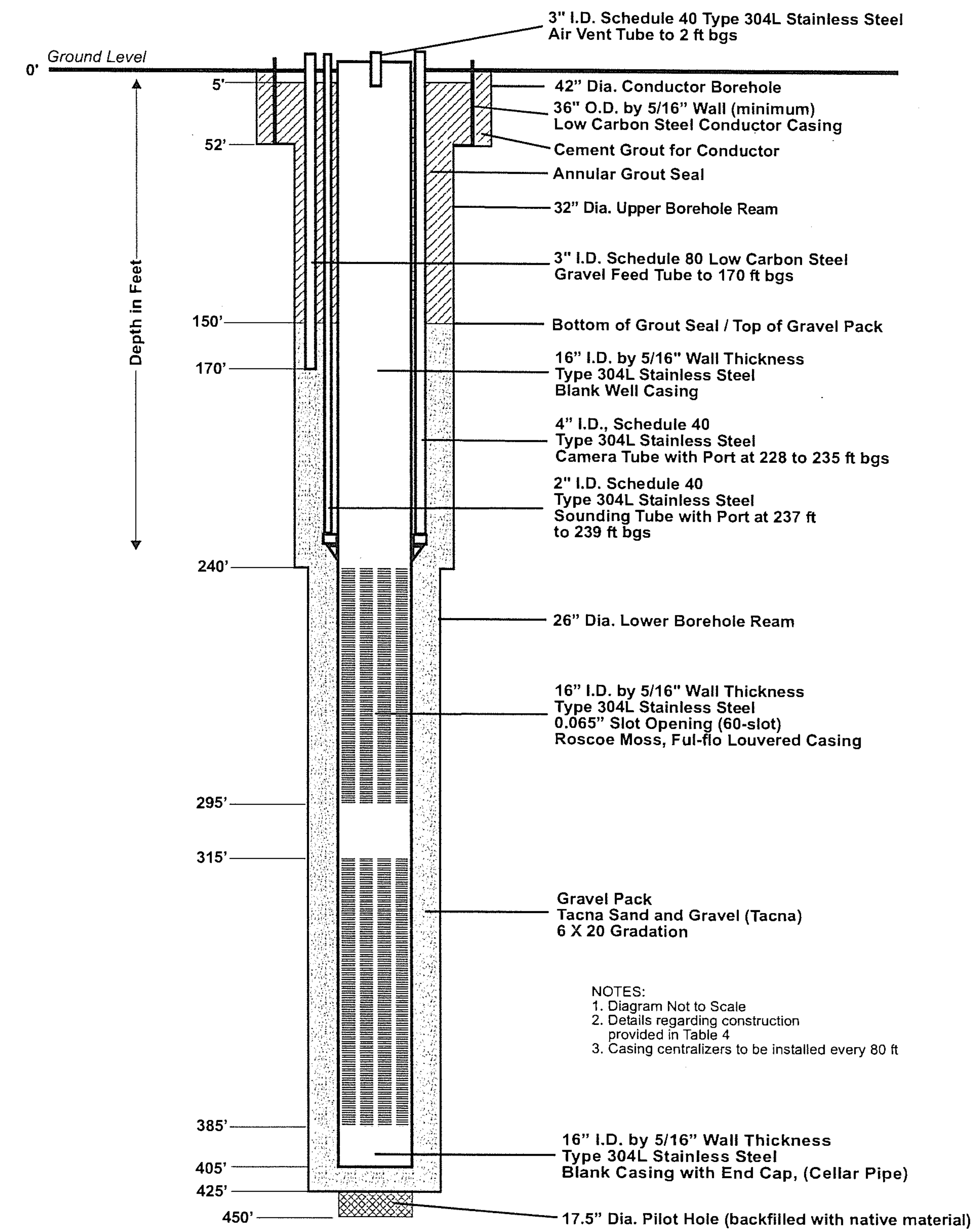
CONSULTANT

CITY CLIENTS — REVIEWED: DATE: ___ 20__ / REVIEWED: DATE: ___ 20__ / REVIEWED: DATE: ___ 20__

ENGINEERING — REFERENCE: DATE: ___ 20__ SUBMITTED BY: COMPUTER FILE NAME: SP-FILE NO: PROJECT DIRECTOR APPROVED BY: DATE: ___ 20__ CITY ENGINEER

PROJECT TITLE: WINDWARD SCHOOL RELOCATION OF CITY OF SANTA MONICA WELL 15
JURISDICTION: CITY OF SANTA MONICA
DWG NO:
DWG DESC: PLATE 2 - WELL DETAILS
FIELD: CHARNOCK

DESIGNED BY: XXXXXX
DRAWN BY:
CHECKED BY: XXXXXXXX
CONSULTANT JOB/SHEET NO:
DRAWING NO: XXXX
SHT X OF X SHTS



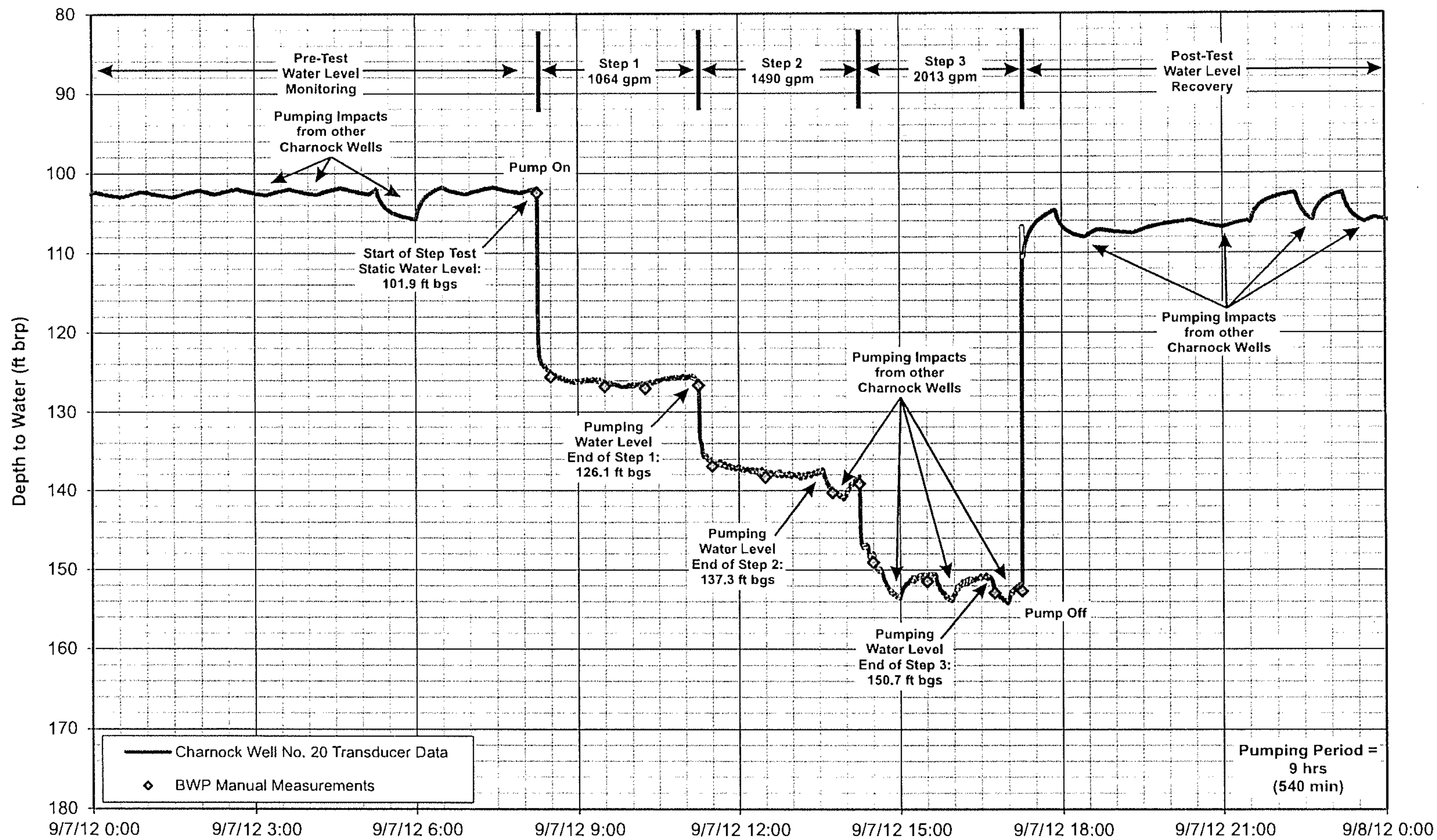
RCS
RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS
12750 Ventura Blvd., Suite 202
Studio City, CA 91604
Studio City Phone (818) 506-0418
Napa Phone (707) 963-3914
Fax (818) 506-1343

FIGURE 2
FINAL WELL DESIGN DIAGRAM
CHARNOCK WELL NO. 20

Job No. 462-LAS02A — July 2012

TABLE 1 STEP DRAWDOWN TEST DATA CHARNOCK WELL NO. 20				
STEP RATE NO.	**AVERAGE PUMPING RATE(1) (Q, in gpm)**	**PUMPING WATER LEVEL (ft bgs)(2)**	**WATER LEVEL DRAWDOWN (s, in ft)(3)**	**SPECIFIC CAPACITY (Q/s, in gpm/ft of drawdown)**
1	1064	126.1	24.2	43.9
2	1490	137.3	35.4	42.1
3	2013	150.7	48.8	41.3

(1) Pumping rates averaged and are based on totalizer readings taken by pump operator.
(2) Based on a static water level of 101.9 ft bgs (below ground surface).
Test Date = September 7, 2012
Duration of each step rate = 3 hours
(3) Based on transducer measurements.



Note: Major divisions on the X-axis represent 3 hours;
Minor divisions represent 30 minutes.

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS
12750 Ventura Blvd., Suite 202
Studio City, CA 91604
Studio City Phone (818) 506-0418
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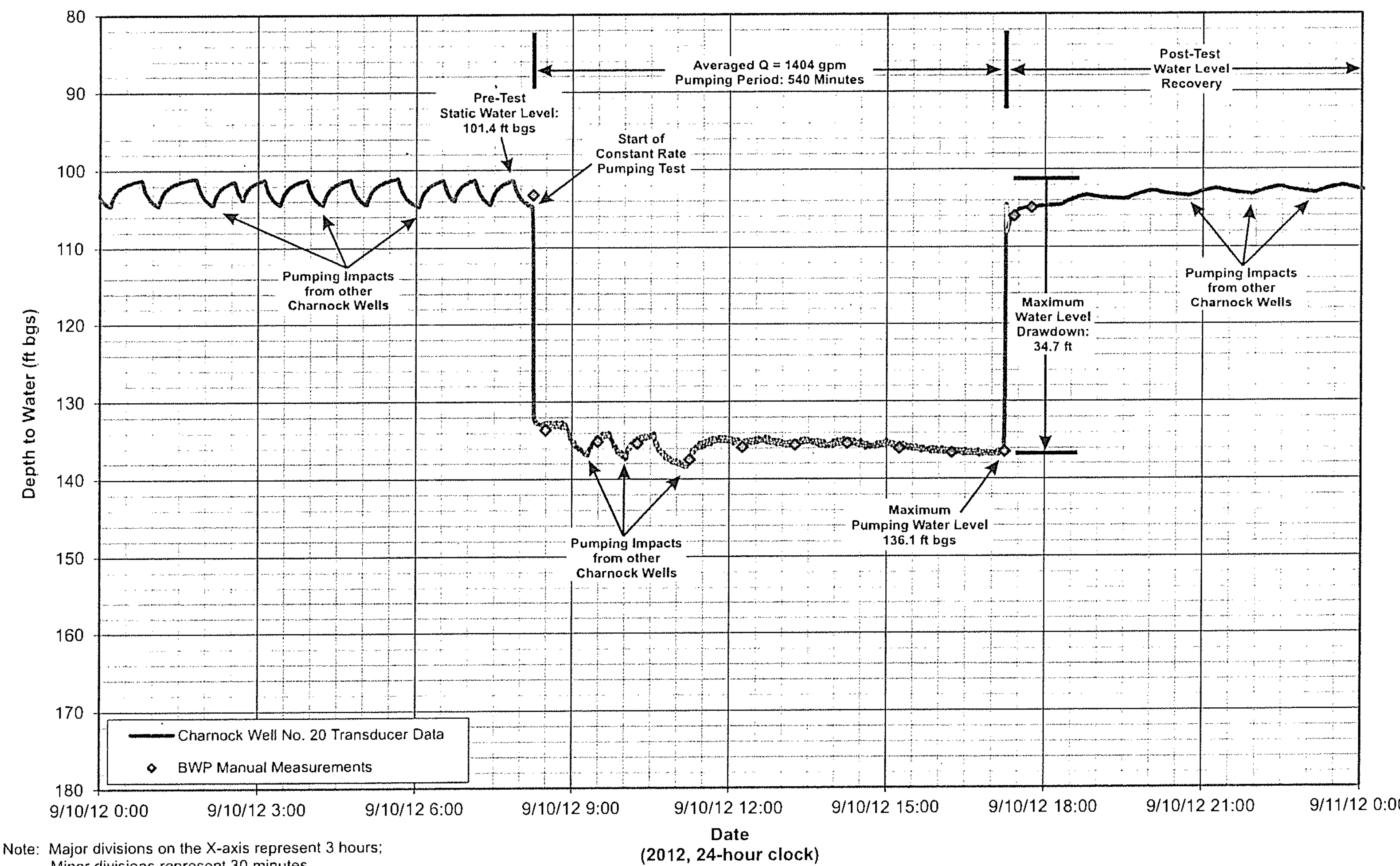
Fax (818) 506-1343

Figure 3
Water Levels During Step Drawdown Test
Charnock Well No. 20

Job No. 462-LAS02A **September 2012**



Note: Major divisions on the X-axis represent 3 hours;
Minor divisions represent 30 minutes.

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CONSULTING GROUNDWATER GEOLOGISTS
12750 Ventura Blvd., Suite 202
Studio City, CA 91604
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Fax (818) 506-1343

Figure 4
Water Levels During Constant Rate Pumping Test
Charnock Well No. 20

Job No. 462-LAS02A

September 2012

TABLE 2
RECOMMENDED PUMPING RATE AND PERMANENT PUMP DEPTH SETTING
CHARNOCK WELL NO. 20

A.	**Current Static Water Level Depth (ft bgs) [1].**	101
B.	**Current Estimated Specific Capacity at 1,400 gpm (gpm/ft ddn) [2].**	40.4
C.	**Recommended Maximum Pumping Rate (gpm).**	1400
D.	**Projected Drawdown (in ft) at Design Rate of 1,400 gpm = (C/B).**	35
E.	**Projected Pumping Water Level Depth (ft bgs) at the Design Rate = (A+D).**	136
F.	**Estimated Decline in Water Levels (in ft) due to a 20% Decline in Specific Capacity (to 32.3 gpm/ft ddn during a future pumping period of 24 hours).**	6
G.	**Estimated Drawdown Interference from Other Wells (in ft)**	4
H.	**Estimated Future Static Water Level Decline (in ft) due to Potential Long-Term Drought Conditions.[3]**	70
I.	**Estimated Future Pumping Water Level Depth (ft brp) Following Decline in Specific Capacity, Future Static Water Level Decline, and Drawdown Interference from Other Wells = (E+F+G+H).**	216
J.	**Recommended Maximum Depth (ft bgs) for Pump Intake.[4]**	220

Notes:
1) bgs = below ground surface
2) Based on the recent, September 10, 2012, 9-hour constant rate pumping test in this well at an average flow rate of 1404 gpm. The depth for the pump intake represents a setting which considers long-term drought, a 20% decline in the current specific capacity of the well, and drawdown interference from other wells.
3) Should future static water level decline greater than 70 ft over time, then the pump intake can be lowered to a depth of 305 ft bgs, within a blank section of casing from 295 ft to 315 ft bgs.
4) The recommended maximum pump intake depth is at a depth of 220 ft bgs. This places the pump within a blank section of casing; this depth is above the sounding tube port that enters the well casing at a depth of 228 ft bgs.

BC Laboratories, Inc.
Environmental Testing Laboratory Since 1949

Date of Report: 10/03/2012

Kevin Newlen

Bakersfield Well & Pump
7212 Fruitvale Ave
Bakersfield, CA 93308

Project:	BWP - Full Title 22
BC Work Order:	1217054
Invoice ID:	B131114

Enclosed are the results of analyses for samples received by the laboratory on 9/10/2012. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Contact Person: Kerrie Vaughan
Client Services

Authorized Signature

Certifications: CA ELAP #1186; NV #CA00014

BC Laboratories, Inc.

Environmental Testing Laboratory Since 1949

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BC Laboratories, Inc.
Environmental Testing Laboratory Since 1949

Chain of Custody Form

Report To: Client: Bakersfield Well and Pump	Project #:
Attn: Kevin Newlan	Project Name: Charnock Well 20
Street Address: 7212 Fruitvale	Global ID #:
City, State, Zip: Bakersfield, CA 93308	Sampler(s): Wick
Phone: (661) 747-0520	
Email Address: knewlan@bwpumps.com	
Work Order# 12-17054	

Analysis Requested

Sample #	Description	Date Sampled	Date Sampled	Complete Title 22	Analytical Suite	Soil	Sludge	Drinking Water	Ground water	Waste Water	Other	Notes
1	Charnock well 20 Final Wellblend	9/10/12	11:45	X	X				X			*see bottle order for list of constituents

Comments: Field: Turbidity = 0.67 NTU T = 22.6°C EC = 1210 µS pH = 7.7

Are there any tests with holding times less than or equal to 48 hours? ☐ Yes ☐ No

CHK BY [initials] DISTRIBUTION [illegible] SUB-OUT ☐

SHORT HOLDING TIME: Cr+6 NO2 NO3 OP SS DO Cl2 BOD MBAS COLI

Billing ☒ Same as above
Client:
Address:
City: State: Zip:
Attn:
PO#:

EDF Required? ☐ Yes ☐ No
Send Copy to State of CA? ☐ Yes ☐ No

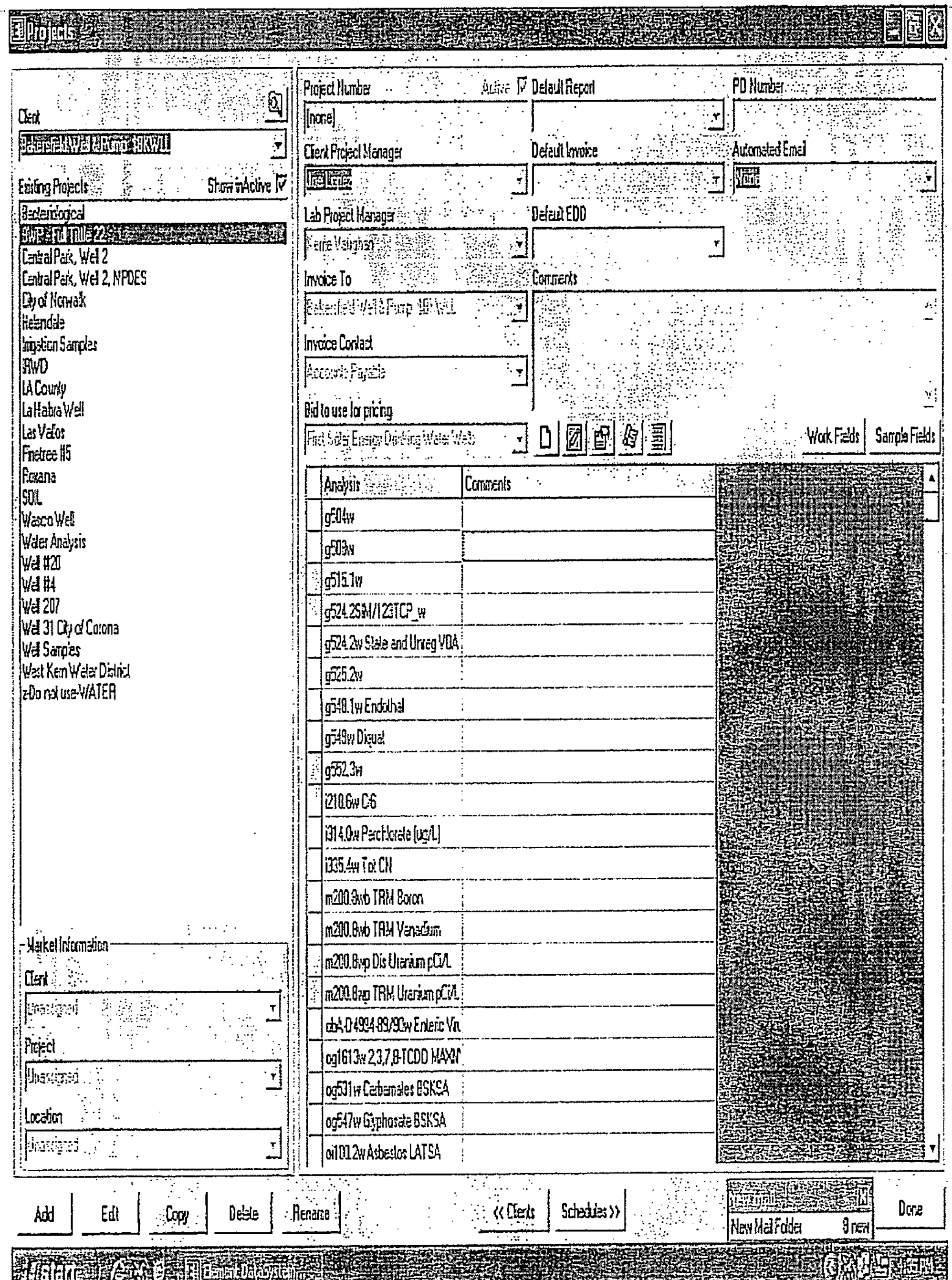
Sample Disposal: ☐ Return to Client ☐ Disposal by lab ☐ Archive Months

Special Reporting: ☐ QC ☐ EDF ☐ Raw Data

Relinquished By	Date	Time	Received By	Date	Time
1. [signature]	9/10/12	13:05	1. [signature]	9/10/12	13:10
2. [signature]	9/10/12	15:04	2. [signature]	9/10/12	15:04
3.			3.		

BC Laboratories, Inc. – 4100 Atlas Court Bakersfield, Ca. 93308 661.327-4911 Fax: 661.327-1918 Page ____ of ____

12-17054



Bromate, Chlorite, Gross Alpha, Gross Beta, Radium 226, Radium 228, Strontium-90, Tritium, GMPI

BC Laboratories, Inc.

Environmental Testing Laboratory Since 1949

BC LABORATORIES INC. COOLER RECEIPT FORM Rev. No. 13 08/17/12 Page 1 Of 1

Submission #: 12-17054

SHIPPING INFORMATION

Federal Express ☐ UPS ☐ Hand Delivery ☒
BC Lab Field Service ☐ Other ☐ (Specify)

SHIPPING CONTAINER

Ice Chest ☒ None ☐
Box ☐ Other ☐ (Specify)

Refrigerant: Ice ☒ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals: Ice Chest ☐ Intact? Yes ☐ No ☐ | Containers ☐ Intact? Yes ☐ No ☐ | None ☒ Comments:

All samples received? Yes ☒ No ☐ All samples containers intact? Yes ☒ No ☐ Description(s) match COC? Yes ☒ No ☐

COC Received ☒ YES ☐ NO

Emissivity: 0.95 Container: Pipe Thermometer ID: 207, 96/0/2-189
Temperature: (A) 18.7 °C / (C) 18.9 °C

Date/Time 9/10/12
Analyst Init MAM 15:04

SAMPLE CONTAINERS	1	2	3	4	5	6	7	8	9	10
QT GENERAL MINERAL/ GENERAL PHYSICAL	CDEF									
PT PE UNPRESERVED	G									
QT INORGANIC CHEMICAL METALS	HIJK									
PT INORGANIC CHEMICAL METALS	L									
PT CYANIDE	M									
PT NITROGEN FORMS										
PT TOTAL SULFIDE										
2oz. NITRATE / NITRITE										
PT TOTAL ORGANIC CARBON										
PT TOX										
PT CHEMICAL OXYGEN DEMAND										
PtA PHENOLICS										
40ml VOA VIAL TRAVEL BLANK										
40ml VOA VIAL	A 3	( )	( )	( )	( )	( )	( )	( )	( )	( )
QT EPA 413.1, 413.2, 418.1										
PT ODOR	N									
RADIOLOGICAL										
BACTERIOLOGICAL										
40 ml VOA VIAL- 504	B(3)									
QT EPA 508/~~608/8080~~	O									
QT EPA 515.1/~~8150~~	P									
QT EPA 525	Q									
QT EPA 525 TRAVEL BLANK										
100ml EPA 547	R									
100ml EPA 531.1	S									
QT EPA 548	T									
QT EPA 549	U									
~~QT EPA 632~~ HAA 5	V									
QT EPA 8015M										
QT AMBER	WX									
4 OZ. ~~JAR~~ Amber	Y									
32 OZ. JAR										
SOIL SLEEVE										
PCB VIAL										
PLASTIC BAG										
FERROUS IRON										
ENCORE										
SMART KIT										

Comments:
Sample Numbering Completed By: KTP Date/Time: 9/10/12 1635
A = Actual / C = Corrected

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** Project: Project Number: Project Manager:	10/03/2012 11:20 BWP - Full Title 22 Charnock Well 20 Kevin Newlen

Laboratory / Client Sample Cross Reference

Laboratory	Client Sample Information			
1217054-01	**COC Number:**	---	**Receive Date:**	09/10/2012 15:04
	Project Number:	---	**Sampling Date:**	09/10/2012 11:45
	Sampling Location:	---	**Sample Depth:**	---
	Sampling Point:	Charnock Well 20 Final Well Blend	**Lab Matrix:**	Water
	Sampled By:	---	**Sample Type:**	Groundwater

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

EDB/DBCP Analysis (EPA Method 504.1)

BCL Sample ID: 1217054-01	Client Sample Name: Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
1,2-Dibromo-3-chloropropane	<0.010	ug/L	0.010	EPA-504.1		V11	1
Ethylene dibromide	<0.010	ug/L	0.010	EPA-504.1			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-504.1	09/17/12	09/17/12 19:31	VH1	GC-4	0.935	BVI1190

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Bakersfield Well & Pump		**Reported:**	10/03/2012 11:20
7212 Fruitvale Ave		Project:	BWP - Full Title 22
Bakersfield, CA 93308		Project Number:	Charnock Well 20
		Project Manager:	Kevin Newlen

Organochlorine Pesticides and PCB's (EPA Method 508)

BCL Sample ID: 1217054-01 **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Aldrin	<0.0050	ug/L	0.0050	EPA-508			1
alpha-BHC	<0.0050	ug/L	0.0050	EPA-508			1
beta-BHC	<0.0050	ug/L	0.0050	EPA-508			1
delta-BHC	<0.0050	ug/L	0.0050	EPA-508			1
gamma-BHC (Lindane)	<0.0050	ug/L	0.0050	EPA-508			1
Chlordane (Technical)	<0.10	ug/L	0.10	EPA-508			1
4,4'-DDD	<0.0050	ug/L	0.0050	EPA-508			1
4,4'-DDE	<0.0050	ug/L	0.0050	EPA-508			1
4,4'-DDT	<0.0050	ug/L	0.0050	EPA-508			1
Dieldrin	<0.0050	ug/L	0.0050	EPA-508			1
Endosulfan I	<0.0050	ug/L	0.0050	EPA-508			1
Endosulfan II	<0.0050	ug/L	0.0050	EPA-508			1
Endosulfan sulfate	<0.0050	ug/L	0.0050	EPA-508			1
Endrin	<0.0050	ug/L	0.0050	EPA-508			1
Endrin aldehyde	<0.010	ug/L	0.010	EPA-508			1
Heptachlor	<0.0050	ug/L	0.0050	EPA-508			1
Heptachlor epoxide	<0.0050	ug/L	0.0050	EPA-508			1
Methoxychlor	<0.0050	ug/L	0.0050	EPA-508			1
Toxaphene	<1.0	ug/L	1.0	EPA-508			1
PCB-1016	<0.20	ug/L	0.20	EPA-508			1
PCB-1221	<0.20	ug/L	0.20	EPA-508			1
PCB-1232	<0.20	ug/L	0.20	EPA-508			1
PCB-1242	<0.20	ug/L	0.20	EPA-508			1
PCB-1248	<0.20	ug/L	0.20	EPA-508			1
PCB-1254	<0.20	ug/L	0.20	EPA-508			1
PCB-1260	<0.20	ug/L	0.20	EPA-508			1
Total PCB's (Summation)	<0.20	ug/L	0.20	EPA-508			1
TCMX (Surrogate)	125	%	50 - 130 (LCL - UCL)	EPA-508			1
Dibutyl chlorendate (Surrogate)	116	%	50 - 140 (LCL - UCL)	EPA-508			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-508	09/13/12	09/24/12 17:19	VH1	GC-1	1	BVI1822

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** Project: Project Number: Project Manager:	10/03/2012 11:20 BWP - Full Title 22 Charnock Well 20 Kevin Newlen

Organic Analysis (EPA Method 515.1)

BCL Sample ID:	1217054-01	Client Sample Name:	Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Bentazon	<0.80	ug/L	0.80	EPA-515.1			1
2,4-D	<0.40	ug/L	0.40	EPA-515.1			1
2,4-DB	<3.0	ug/L	3.0	EPA-515.1			1
Dalapon	<5.0	ug/L	5.0	EPA-515.1			1
Dicamba	<0.080	ug/L	0.080	EPA-515.1			1
Dichloroprop	<0.50	ug/L	0.50	EPA-515.1			1
Dinoseb	<0.20	ug/L	0.20	EPA-515.1			1
MCPA	<10	ug/L	10	EPA-515.1		V11	1
MCPP	<10	ug/L	10	EPA-515.1			1
2,4,5-T	<0.090	ug/L	0.090	EPA-515.1			1
2,4,5-TP (Silvex)	<0.070	ug/L	0.070	EPA-515.1			1
2,4-Dichlorophenylacetic acid (Surrogate)	52.0	%	43 - 136 (LCL - UCL)	EPA-515.1			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-515.1	09/14/12	09/27/12 23:07	mk1	GC-8	1	BVI1851

BC Laboratories, Inc.
Environmental Testing Laboratory Since 1949

Bakersfield Well & Pump	**Reported:** 10/03/2012 11:20
7212 Fruitvale Ave	Project: BWP - Full Title 22
Bakersfield, CA 93308	Project Number: Charnock Well 20
	Project Manager: Kevin Newlen

Volatile Organic Analysis (EPA Method 524.2)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Benzene	<0.50	ug/L	0.50	EPA-524.2			1
Bromobenzene	<0.50	ug/L	0.50	EPA-524.2			1
Bromochloromethane	<0.50	ug/L	0.50	EPA-524.2			1
Bromodichloromethane	<0.50	ug/L	0.50	EPA-524.2			1
Bromoform	<0.50	ug/L	0.50	EPA-524.2			1
Bromomethane	<1.0	ug/L	1.0	EPA-524.2		V11	1
n-Butylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
sec-Butylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
tert-Butylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
Carbon tetrachloride	<0.50	ug/L	0.50	EPA-524.2			1
Chlorobenzene	<0.50	ug/L	0.50	EPA-524.2			1
Chloroethane	<0.50	ug/L	0.50	EPA-524.2			1
Chloroform	<0.50	ug/L	0.50	EPA-524.2			1
Chloromethane	<0.50	ug/L	0.50	EPA-524.2		V11	1
2-Chlorotoluene	<0.50	ug/L	0.50	EPA-524.2			1
4-Chlorotoluene	<0.50	ug/L	0.50	EPA-524.2			1
Dibromochloromethane	<0.50	ug/L	0.50	EPA-524.2			1
Dibromomethane	<0.50	ug/L	0.50	EPA-524.2			1
1,2-Dichlorobenzene	<0.50	ug/L	0.50	EPA-524.2			1
1,3-Dichlorobenzene	<0.50	ug/L	0.50	EPA-524.2			1
1,4-Dichlorobenzene	<0.50	ug/L	0.50	EPA-524.2			1
Dichlorodifluoromethane	<0.50	ug/L	0.50	EPA-524.2		V11	1
1,1-Dichloroethane	<0.50	ug/L	0.50	EPA-524.2			1
1,2-Dichloroethane	<0.50	ug/L	0.50	EPA-524.2			1
1,1-Dichloroethene	<0.50	ug/L	0.50	EPA-524.2			1
cis-1,2-Dichloroethene	<0.50	ug/L	0.50	EPA-524.2			1
trans-1,2-Dichloroethene	<0.50	ug/L	0.50	EPA-524.2			1
1,2-Dichloropropane	<0.50	ug/L	0.50	EPA-524.2			1
1,3-Dichloropropane	<0.50	ug/L	0.50	EPA-524.2			1
2,2-Dichloropropane	<0.50	ug/L	0.50	EPA-524.2		V11	1
1,1-Dichloropropene	<0.50	ug/L	0.50	EPA-524.2			1
Total 1,3-Dichloropropene	<0.50	ug/L	0.50	EPA-524.2			1
Ethylbenzene	<0.50	ug/L	0.50	EPA-524.2			1

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** Project: Project Number: Project Manager:	10/03/2012 11:20 BWP - Full Title 22 Charnock Well 20 Kevin Newlen

Volatile Organic Analysis (EPA Method 524.2)

BCL Sample ID: 1217054-01	**Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Hexachlorobutadiene	<0.50	ug/L	0.50	EPA-524.2			1
Isopropylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
p-Isopropyltoluene	<0.50	ug/L	0.50	EPA-524.2			1
Methylene chloride	<0.50	ug/L	0.50	EPA-524.2			1
Methyl t-butyl ether	**0.91**	**ug/L**	**0.50**	**EPA-524.2**			1
Naphthalene	<0.50	ug/L	0.50	EPA-524.2			1
n-Propylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
Styrene	<0.50	ug/L	0.50	EPA-524.2			1
1,1,1,2-Tetrachloroethane	<0.50	ug/L	0.50	EPA-524.2			1
1,1,2,2-Tetrachloroethane	<0.50	ug/L	0.50	EPA-524.2			1
Tetrachloroethene	<0.50	ug/L	0.50	EPA-524.2			1
Toluene	<0.50	ug/L	0.50	EPA-524.2			1
1,2,3-Trichlorobenzene	<0.50	ug/L	0.50	EPA-524.2			1
1,2,4-Trichlorobenzene	<0.50	ug/L	0.50	EPA-524.2			1
1,1,1-Trichloroethane	<0.50	ug/L	0.50	EPA-524.2			1
1,1,2-Trichloroethane	<0.50	ug/L	0.50	EPA-524.2			1
Trichloroethene	<0.50	ug/L	0.50	EPA-524.2			1
Trichlorofluoromethane	<0.50	ug/L	0.50	EPA-524.2			1
1,2,3-Trichloropropane	<1.0	ug/L	1.0	EPA-524.2			1
1,2,4-Trimethylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
1,3,5-Trimethylbenzene	<0.50	ug/L	0.50	EPA-524.2			1
Vinyl chloride	<0.50	ug/L	0.50	EPA-524.2			1
Total Xylenes	<1.0	ug/L	1.0	EPA-524.2			1
Total Trihalomethanes	<2.0	ug/L	2.0	EPA-524.2			1
t-Amyl Methyl ether	<0.50	ug/L	0.50	EPA-524.2			1
t-Butyl alcohol	<10	ug/L	10	EPA-524.2			1
2-Chloroethyl vinyl ether	<10	ug/L	10	EPA-524.2			1
Ethyl t-butyl ether	<0.50	ug/L	0.50	EPA-524.2			1
1,2-Dichloroethane-d4 (Surrogate)	106	%	75 - 125 (LCL - UCL)	EPA-524.2			1
Toluene-d8 (Surrogate)	102	%	80 - 120 (LCL - UCL)	EPA-524.2			1
4-Bromofluorobenzene (Surrogate)	101	%	80 - 120 (LCL - UCL)	EPA-524.2			1

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

Volatile Organic Analysis (EPA Method 524.2)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-524.2	09/13/12	09/13/12 18:31	kea	HPCHEM	1	BVI0893

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Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

DHS Low Level 1,2,3-TCP by SIM GC/MS

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
1,2,3-Trichloropropane	<0.0050	ug/L	0.0050	DHS-1,2,3-TCP			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	DHS-1,2,3-TCP	09/14/12	09/14/12 14:47	jmc	MS-V6	1	BVI1032

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

Organic Analysis by Liquid Solids Extraction (EPA Method 525.2)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Chamock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Acenaphthylene	<0.10	ug/L	0.10	EPA-525.2			1
Alachlor	<0.20	ug/L	0.20	EPA-525.2			1
Anthracene	<0.10	ug/L	0.10	EPA-525.2			1
Atraton	<0.50	ug/L	0.50	EPA-525.2			1
Atrazine	<0.30	ug/L	0.30	EPA-525.2			1
Benzo[a]anthracene	<0.20	ug/L	0.20	EPA-525.2			1
Benzo[b]fluoranthene	<0.30	ug/L	0.30	EPA-525.2			1
Benzo[k]fluoranthene	<0.30	ug/L	0.30	EPA-525.2			1
Benzo[a]pyrene	<0.10	ug/L	0.10	EPA-525.2			1
Benzo[g,h,i]perylene	<0.30	ug/L	0.30	EPA-525.2			1
Benzyl butyl phthalate	<4.0	ug/L	4.0	EPA-525.2			1
delta-BHC	<0.20	ug/L	0.20	EPA-525.2			1
gamma-BHC (Lindane)	<0.10	ug/L	0.10	EPA-525.2			1
bis(2-Ethylhexyl)phthalate	<3.0	ug/L	3.0	EPA-525.2			1
Bromacil	<0.50	ug/L	0.50	EPA-525.2			1
Chrysene	<0.30	ug/L	0.30	EPA-525.2			1
Diazinon	<0.20	ug/L	0.20	EPA-525.2			1
Dibenzo[a,h]anthracene	<0.30	ug/L	0.30	EPA-525.2			1
Di(2-ethylhexyl)adipate	<1.0	ug/L	1.0	EPA-525.2			1
Dimethoate	<2.0	ug/L	2.0	EPA-525.2			1
Dimethyl phthalate	<1.0	ug/L	1.0	EPA-525.2			1
Di-n-butyl phthalate	<1.0	ug/L	1.0	EPA-525.2			1
Fluorene	<0.20	ug/L	0.20	EPA-525.2			1
Hexachlorobenzene	<0.10	ug/L	0.10	EPA-525.2			1
Hexachlorocyclopentadiene	<1.0	ug/L	1.0	EPA-525.2			1
Indeno[1,2,3-cd]pyrene	<0.30	ug/L	0.30	EPA-525.2			1
Methoxychlor	<0.30	ug/L	0.30	EPA-525.2			1
Metolachlor	<0.50	ug/L	0.50	EPA-525.2			1
Metribuzin	<0.50	ug/L	0.50	EPA-525.2			1
Molinate	<0.50	ug/L	0.50	EPA-525.2			1
Phenanthrene	<0.10	ug/L	0.10	EPA-525.2			1
Prometon	<0.50	ug/L	0.50	EPA-525.2			1
Prometryn	<0.50	ug/L	0.50	EPA-525.2			1

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

Organic Analysis by Liquid Solids Extraction (EPA Method 525.2)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Pyrene	<0.10	ug/L	0.10	EPA-525.2			1
Secbumeton	<0.50	ug/L	0.50	EPA-525.2			1
Simazine	<0.30	ug/L	0.30	EPA-525.2			1
Terbutryn	<0.50	ug/L	0.50	EPA-525.2			1
Thiobencarb	<0.50	ug/L	0.50	EPA-525.2			1
Perylene-d12 (Surrogate)	128	%	60 - 130 (LCL - UCL)	EPA-525.2			1
1,3-Dimethyl-2-nitrobenzene (Surrogate)	94.5	%	62 - 130 (LCL - UCL)	EPA-525.2			1
Triphenylphosphate (Surrogate)	116	%	70 - 130 (LCL - UCL)	EPA-525.2			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-525.2	09/12/12	09/21/12 20:53	spb	MS-B3	1	BVI1465

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

Organic Analysis for Endothal (EPA Method 548.1)

BCL Sample ID:	1217054-01	**Client Sample Name:**	Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Endothal	<20	ug/L	20	EPA-548.1			1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-548.1	09/11/12	09/20/12 22:34	spb	MS-B3	1	BVI0904

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** Project: Project Number: Project Manager:	10/03/2012 11:20 BWP - Full Title 22 Charnock Well 20 Kevin Newlen

Organic Analysis for Herbicides (EPA Method 549)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Diquat	<4.0	ug/L	4.0	EPA-549.2		V11	1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-549.2	09/17/12	09/19/12 16:25	MK1	LC-14	1	BVI1423

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Bakersfield Well & Pump		**Reported:**	10/03/2012 11:20
7212 Fruitvale Ave		Project:	BWP - Full Title 22
Bakersfield, CA 93308		Project Number:	Charnock Well 20
		Project Manager:	Kevin Newlen

Halogenated Acetic Acids (Method EPA-552.3)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Dibromoacetic acid	<1.0	ug/L	1.0	EPA-552.3			1
Dichloroacetic acid	<1.0	ug/L	1.0	EPA-552.3			1
Monobromoacetic acid	<1.0	ug/L	1.0	EPA-552.3			1
Monochloroacetic acid	<1.0	ug/L	1.0	EPA-552.3			1
Trichloroacetic acid	<1.0	ug/L	1.0	EPA-552.3			1
Total HAA's (Summation)	<1.0	ug/L	1.0	EPA-552.3			1
2,3-Dibromopropionic acid (Surrogate)	23.8	%	70 - 130 (LCL - UCL)	EPA-552.3		S09	1

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-552.3	09/12/12	10/01/12 11:05	RDS	GC-3	1	BVI1396

Bakersfield Well & Pump
7212 Fruitvale Ave
Bakersfield, CA 93308

Reported: 10/03/2012 11:20
Project: BWP - Full Title 22
Project Number: Charnock Well 20
Project Manager: Kevin Newlen

Water Analysis (General Chemistry)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Dissolved Calcium	120	mg/L	0.10	EPA-200.7			1
Total Recoverable Calcium	130	mg/L	0.10	EPA-200.7			2
Dissolved Magnesium	48	mg/L	0.050	EPA-200.7			1
Total Recoverable Magnesium	50	mg/L	0.050	EPA-200.7			2
Dissolved Sodium	73	mg/L	0.50	EPA-200.7			1
Total Recoverable Sodium	77	mg/L	0.50	EPA-200.7			2
Dissolved Potassium	2.2	mg/L	1.0	EPA-200.7			1
Total Recoverable Potassium	2.5	mg/L	1.0	EPA-200.7			2
Bicarbonate	400	mg/L	10	SM-2320B			3
Carbonate	<5.0	mg/L	5.0	SM-2320B			3
Hydroxide	<2.8	mg/L	2.8	SM-2320B			3
Alkalinity as CaCO3	330	mg/L	4.1	Calc			4
Chloride	68	mg/L	0.50	EPA-300.0			5
Fluoride	0.36	mg/L	0.050	EPA-300.0			5
Nitrate as NO3	<0.44	mg/L	0.44	EPA-300.0			5
Sulfate	260	mg/L	1.0	EPA-300.0			5
Dissolved Total Cations	13	meq/L	0.10	Calc			4
Total Cations	14	meq/L	0.10	Calc			6
Total Anions	14	meq/L	0.10	Calc			4
Dissolved Hardness as CaCO3	500	mg/L	0.50	Calc			4
Hardness as CaCO3	520	mg/L	0.50	Calc			6
pH	7.63	pH Units	0.05	EPA-150.1		S05	7
Electrical Conductivity @ 25 C	1230	umhos/cm	1.00	SM-2510B			8
Total Dissolved Solids @ 180 C	840	mg/L	50	SM-2540C			9
Color	2.0	Color Units	1.0	SM-2120B			10
Odor	No Obs Odor	Odor Units	1.0	SM-2150B			11
Turbidity	5.0	NT Units	0.10	EPA-180.1			12
MBAS	<0.20	mg/L	0.20	SM-5540C		A01	13
Total Cyanide	<0.0050	mg/L	0.0050	EPA-335.4			14
Nitrite as N	<50	ug/L	50	EPA-353.2			15
Perchlorate	<4.0	ug/L	4.0	EPA-314.0			16

Bakersfield Well & Pump	**Reported:** 10/03/2012 11:20
7212 Fruitvale Ave	Project: BWP - Full Title 22
Bakersfield, CA 93308	Project Number: Charnock Well 20
	Project Manager: Kevin Newlen

Water Analysis (General Chemistry)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-200.7	09/11/12	09/12/12 14:03	JRG	PE-OP2	1	BVI0823
2	EPA-200.7	09/14/12	09/14/12 16:21	JRG	PE-OP2	1	BVI1042
3	SM-2320B	09/11/12	09/11/12 15:49	RML	MET-1	2	BVI0697
4	Calc	09/12/12	09/24/12 14:50	MSA	Calc	1	BVI0846
5	EPA-300.0	09/10/12	09/10/12 21:58	LD1	IC2	1	BVI0706
6	Calc	09/12/12	09/24/12 14:49	MSA	Calc	1	BVI0846
7	EPA-150.1	09/11/12	09/11/12 15:49	RML	MET-1	1	BVI0697
8	SM-2510B	09/11/12	09/11/12 15:49	RML	MET-1	1	BVI0697
9	SM-2540C	09/11/12	09/11/12 08:10	NW1	MANUAL	5	BVI0649
10	SM-2120B	09/12/12	09/12/12 09:45	RML	MANUAL	1	BVI0986
11	SM-2150B	09/12/12	09/12/12 09:45	RML	MANUAL	1	BVI0987
12	EPA-180.1	09/12/12	09/12/12 09:45	RML	MANUAL	1	BVI0990
13	SM-5540C	09/12/12	09/12/12 08:45	JMN	SPEC05	2	BVI1290
14	EPA-335.4	09/12/12	09/12/12 13:48	TDC	KONE-1	1	BVI0807
15	EPA-353.2	09/11/12	09/11/12 08:18	TDC	KONE-1	1	BVI0718
16	EPA-314.0	09/20/12	09/21/12 01:58	LS1	IC6	1	BVI0988

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Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	**Reported:** 10/03/2012 11:20 Project: BWP - Full Title 22 Project Number: Charnock Well 20 Project Manager: Kevin Newlen

Water Analysis (Metals)

BCL Sample ID: 1217054-01 | **Client Sample Name:** Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Dissolved Aluminum	<50	ug/L	50	EPA-200.7			1
Dissolved Antimony	<2.0	ug/L	2.0	EPA-200.8			2
Dissolved Arsenic	**2.5**	**ug/L**	**2.0**	**EPA-200.8**			2
Hexavalent Chromium	<0.20	ug/L	0.20	EPA-218.6			3
Dissolved Barium	**38**	**ug/L**	**10**	**EPA-200.7**			1
Dissolved Beryllium	<1.0	ug/L	1.0	EPA-200.8			2
Dissolved Cadmium	<1.0	ug/L	1.0	EPA-200.8			2
Dissolved Chromium	<10	ug/L	10	EPA-200.7			1
Dissolved Copper	<10	ug/L	10	EPA-200.7			1
Dissolved Iron	<50	ug/L	50	EPA-200.7			1
Dissolved Lead	<1.0	ug/L	1.0	EPA-200.8			2
Dissolved Manganese	**36**	**ug/L**	**10**	**EPA-200.7**			1
Dissolved Mercury	<0.20	ug/L	0.20	EPA-200.8			2
Dissolved Nickel	<10	ug/L	10	EPA-200.7			1
Dissolved Selenium	<2.0	ug/L	2.0	EPA-200.8			2
Dissolved Silver	<10	ug/L	10	EPA-200.7			1
Dissolved Thallium	<1.0	ug/L	1.0	EPA-200.8			2
Dissolved Uranium	**6.5**	**pCi/L**	**0.67**	**EPA-200.8**			2
Dissolved Zinc	<10	ug/L	10	EPA-200.7			1
Total Recoverable Aluminum	<50	ug/L	50	EPA-200.7			4
Total Recoverable Antimony	<2.0	ug/L	2.0	EPA-200.8			5
Total Recoverable Arsenic	**3.6**	**ug/L**	**2.0**	**EPA-200.8**			6
Total Recoverable Barium	**43**	**ug/L**	**10**	**EPA-200.7**			4
Total Recoverable Beryllium	<2.0	ug/L	2.0	EPA-200.8		A10	7
Total Recoverable Boron	**170**	**ug/L**	**40**	**EPA-200.8**		A10	7
Total Recoverable Cadmium	<1.0	ug/L	1.0	EPA-200.8			6
Total Recoverable Chromium	<10	ug/L	10	EPA-200.7			4
Total Recoverable Copper	<10	ug/L	10	EPA-200.7			4
Total Recoverable Iron	**510**	**ug/L**	**50**	**EPA-200.7**			4
Total Recoverable Lead	<1.0	ug/L	1.0	EPA-200.8			6
Total Recoverable Manganese	**38**	**ug/L**	**10**	**EPA-200.7**			4
Total Recoverable Mercury	<0.20	ug/L	0.20	EPA-200.8			6
Total Recoverable Nickel	<10	ug/L	10	EPA-200.7			4

Bakersfield Well & Pump 7212 Fruitvale Ave Bakersfield, CA 93308	Reported: Project: Project Number: Project Manager:	10/03/2012 11:20 BWP - Full Title 22 Charnock Well 20 Kevin Newlen

Water Analysis (Metals)

BCL Sample ID:	1217054-01	Client Sample Name:	Charnock Well 20 Final Well Blend, 9/10/2012 11:45:00AM

Constituent	Result	Units	PQL	Method	MB Bias	Lab Quals	Run #
Total Recoverable Selenium	<2.0	ug/L	2.0	EPA-200.8			6
Total Recoverable Silver	<10	ug/L	10	EPA-200.7			4
Total Recoverable Uranium	**6.6**	**pCi/L**	**0.67**	**EPA-200.8**			6
Total Recoverable Thallium	<1.0	ug/L	1.0	EPA-200.8			6
Total Recoverable Vanadium	<3.0	ug/L	3.0	EPA-200.8			6
Total Recoverable Zinc	<50	ug/L	50	EPA-200.7			4

Run #	Method	Prep Date	Run Date/Time	Analyst	Instrument	Dilution	QC Batch ID
1	EPA-200.7	09/11/12	09/12/12 14:03	JRG	PE-OP2	1	BVI0823
2	EPA-200.8	09/11/12	09/14/12 14:34	SRM	PE-EL2	1	BVI0682
3	EPA-218.6	09/10/12	09/10/12 23:53	LS1	IC-4	1	BVI0636
4	EPA-200.7	09/14/12	09/14/12 16:21	JRG	PE-OP2	1	BVI1042
5	EPA-200.8	09/17/12	09/18/12 12:23	SRM	PE-EL2	1	BVI1181
6	EPA-200.8	09/17/12	09/17/12 16:18	SRM	PE-EL2	1	BVI1181
7	EPA-200.8	09/17/12	09/18/12 16:47	SRM	PE-EL2	2	BVI1181

BSK Associates
Engineers & Laboratories

A2I0986
09/26/2012

Kerrie Vaughan
BC Laboratories
4100 Atlas Court
Bakersfield, CA 93308

Dear Kerrie Vaughan,

Thank you for selecting BSK Associates for your analytical testing needs. We have prepared this report in response to your request for analytical services. Enclosed are the results of analyses for samples received by the laboratory on 09/12/2012 15:00.

If additional clarification of any information is required, please contact your Client Services Representative, Michelle Harmstead at (800) 877-8310 or (559) 497-2888.

BSK ASSOCIATES

Michelle Harmstead

Michelle Harmstead
Project Manager

BSK Associates Engineers & Laboratories

09/26/2012

Case Narrative

Work Order Information

Client Name:	BC Laboratories	**Submitted by:**	Client
Client Code:	BCLab4911	**Shipped by:**	Peninsula Messenger Service (PMS)
Work Order:	A2I0986	**COC Number:**	
Project:	General: Project Manager-Kerrie Vaughan	**TAT:**	10
Client Project:	1217054	**PO #:**	

Sample Receipt Conditions

Cooler: **Default Cooler** **Temp. °C:** 2.0

Containers Intact
COC/Labels Agree
Received On Wet Ice
Sample(s) arrived at lab on same day sampled.
Packing Material - Other
Sample(s) were received in temperature range.
Sample(s) preserved after receipt at lab.
Initial receipt at BSK-FAL

Report Manager	Report Format
Kerrie Vaughan	Final.rpt

1414 Stanislaus Street Fresno, CA 93706 (559) 497-2888 FAX (559) 485-6935 www.bsklabs.com
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BSK Associates Engineers & Laboratories

Certificate of Analysis

Kerrie Vaughan
BC Laboratories
4100 Atlas Court
Bakersfield, CA 93308

Report Issue Date: 9/26/2012 13:18
Received Date: 09/12/2012
Received Time: 15:00

Lab Sample ID: A2I0986-01
Sample Date: 09/10/2012 11:45
Sample Type: Grab

Client Project: 1217054
Sampled by: Client
Matrix: Water

Sample Description: 1217054-01

General Chemistry

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Bromate	EPA 317.0	ND	0.0010	mg/L	1	A210382	09/14/12	09/14/12	
Chlorite	EPA 300.1	ND	0.010	mg/L	2	A210622	09/21/12	09/21/12	DL01
Surrogate: Dichloroacetate	EPA 300.1	108 %	*Acceptable range: 90-115 %*						

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Carbamates by HPLC									
3-Hydroxycarbofuran	EPA 531.1	ND	3.0	ug/L	1	A210668	09/21/12	09/21/12	
Aldicarb	EPA 531.1	ND	3.0	ug/L	1	A210668	09/21/12	09/21/12	
Aldicarb Sulfone	EPA 531.1	ND	2.0	ug/L	1	A210668	09/21/12	09/21/12	
Aldicarb Sulfoxide	EPA 531.1	ND	3.0	ug/L	1	A210668	09/21/12	09/21/12	
Carbaryl	EPA 531.1	ND	5.0	ug/L	1	A210668	09/21/12	09/21/12	
Carbofuran	EPA 531.1	ND	5.0	ug/L	1	A210668	09/21/12	09/21/12	
Methomyl	EPA 531.1	ND	2.0	ug/L	1	A210668	09/21/12	09/21/12	
Oxamyl	EPA 531.1	ND	20	ug/L	1	A210668	09/21/12	09/21/12	
Glyphosate by HPLC									
Glyphosate	EPA 547	ND	25	ug/L	1	A210608	09/20/12	09/20/12	
Surrogate: AMPA	EPA 547	91 %	*Acceptable range: 70-130 %*						

A2I0986 FINAL 09262012 1318

BSK Associates
Engineers & Laboratories

General Chemistry Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual	
Batch: A210382				Analyst: DFS		Prepared: 9/14/2012						
Blank (A210382-BLK1) EPA 317.0 - Quality Control												
Bromate	ND	0.0010	mg/L							09/14/12		
Blank Spike (A210382-BS1) EPA 317.0 - Quality Control												
Bromate	0.0097	0.0010	mg/L	0.010		97	85-115			09/14/12		
Blank Spike Dup (A210382-BSD1) EPA 317.0 - Quality Control												
Bromate	0.010	0.0010	mg/L	0.010		100	85-115	3	10	09/14/12		
Matrix Spike (A210382-MS1) EPA 317.0 - Quality Control						Source: A2I0465-01						
Bromate	0.0090	0.0010	mg/L	0.010	ND	90	75-125			09/14/12		
Matrix Spike (A210382-MS2) EPA 317.0 - Quality Control						Source: A2I1003-01						
Bromate	0.012	0.0010	mg/L	0.010	ND	123	75-125			09/14/12		
Matrix Spike Dup (A210382-MSD1) EPA 317.0 - Quality Control						Source: A2I0465-01						
Bromate	0.0097	0.0010	mg/L	0.010	ND	97	75-125	7	10	09/14/12		
Matrix Spike Dup (A210382-MSD2) EPA 317.0 - Quality Control						Source: A2I1003-01						
Bromate	0.011	0.0010	mg/L	0.010	ND	110	75-125	11	10	09/14/12	MS05	
Batch: A210622				Analyst: LJL		Prepared: 9/21/2012						
Blank (A210622-BLK1) EPA 300.1 - Quality Control												
Chlorite	ND	0.0050	mg/L							09/21/12		
Surrogate: Dichloroacetate	*0.586*			*0.50*		*117*	*90-115*			09/21/12	*X01*	*High*
Blank Spike (A210622-BS1) EPA 300.1 - Quality Control												
Chlorite	0.22	0.0050	mg/L	0.20		109	85-115			09/21/12		
Surrogate: Dichloroacetate	*0.526*			*0.50*		*105*	*90-115*			09/21/12		
Blank Spike Dup (A210622-BSD1) EPA 300.1 - Quality Control												
Chlorite	0.21	0.0050	mg/L	0.20		107	85-115	1	10	09/21/12		
Surrogate: Dichloroacetate	*0.522*			*0.50*		*104*	*90-115*			09/21/12		
Matrix Spike (A210622-MS1) EPA 300.1 - Quality Control						Source: A2I0986-01						
Chlorite	0.25	0.0050	mg/L	0.40	ND	62	75-125			09/21/12	MS02	*Low*
Surrogate: Dichloroacetate	*1.94*			*2.0*		*97*	*90-115*			09/21/12		
Matrix Spike (A210622-MS2) EPA 300.1 - Quality Control						Source: A2I1268-05						
Chlorite	0.30	0.0050	mg/L	0.40	ND	74	75-125			09/22/12	MS02	*Low*
Surrogate: Dichloroacetate	*2.08*			*2.0*		*104*	*90-115*			09/22/12		
Matrix Spike Dup (A210622-MSD1) EPA 300.1 - Quality Control						Source: A2I0986-01						
Chlorite	0.25	0.0050	mg/L	0.40	ND	62	75-125	1	10	09/21/12	MS02	*Low*
Surrogate: Dichloroacetate	*2.02*			*2.0*		*101*	*90-115*			09/21/12		

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BSK Associates Engineers & Laboratories

General Chemistry Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A210622				Analyst: LJL		Prepared: 9/22/2012					
Matrix Spike Dup (A210622-MSD2)	EPA 300.1 - Quality Control					Source: A2I1268-05					
Chlorite	0.32	0.0050	mg/L	0.40	ND	80	75-125	8	10	09/22/12	
Surrogate: Dichloroacetate	*2.39*			*2.0*		*120*	*90-115*			*09/22/12*	*SR07*

1414 Stanislaus Street Fresno, CA 93706 (559) 497-2888 FAX (559) 485-6935 www.bsklabs.com
An Employee-Owned Company | Analytical Testing | Construction Observation
Environmental Engineering | Geotechnical Engineering | Materials Testing

BSK Associates Engineers & Laboratories

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A210608				Analyst: XHX		Prepared: 9/20/2012					
Blank (A210608-BLK1) EPA 547 - Quality Control											
Glyphosate	ND	25	ug/L							09/20/12	
Surrogate: AMPA	*94*			*100*		*93*	*70-130*			09/20/12	
Blank Spike (A210608-BS1) EPA 547 - Quality Control											
Glyphosate	130	25	ug/L	120		101	70-130			09/20/12	
Surrogate: AMPA	*120*			*120*		*97*	*70-130*			09/20/12	
Blank Spike Dup (A210608-BSD1) EPA 547 - Quality Control											
Glyphosate	130	25	ug/L	120		100	70-130	1	30	09/20/12	
Surrogate: AMPA	*120*			*120*		*97*	*70-130*			09/20/12	
Matrix Spike (A210608-MS1) EPA 547 - Quality Control						Source: A2I0718-01					
Glyphosate	120	25	ug/L	120	ND	98	70-130			09/20/12	
Surrogate: AMPA	*120*			*120*		*99*	*70-130*			09/20/12	
Matrix Spike Dup (A210608-MSD1) EPA 547 - Quality Control						Source: A2I0718-01					
Glyphosate	130	25	ug/L	120	ND	103	70-130	5	30	09/20/12	
Surrogate: AMPA	*130*			*120*		*102*	*70-130*			09/20/12	
Batch: A210668				Analyst: XHX		Prepared: 9/21/2012					
Blank (A210668-BLK1) EPA 531.1 - Quality Control											
3-Hydroxycarbofuran	ND	3.0	ug/L							09/21/12	
Aldicarb	ND	3.0	ug/L							09/21/12	
Aldicarb Sulfone	ND	2.0	ug/L							09/21/12	
Aldicarb Sulfoxide	ND	3.0	ug/L							09/21/12	
Carbaryl	ND	5.0	ug/L							09/21/12	
Carbofuran	ND	5.0	ug/L							09/21/12	
Methomyl	ND	2.0	ug/L							09/21/12	
Oxamyl	ND	20	ug/L							09/21/12	
Blank Spike (A210668-BS1) EPA 531.1 - Quality Control											
3-Hydroxycarbofuran	30	3.0	ug/L	30		100	80-120			09/21/12	
Aldicarb	30	3.0	ug/L	30		100	80-120			09/21/12	
Aldicarb Sulfone	30	2.0	ug/L	30		100	80-120			09/21/12	
Aldicarb Sulfoxide	30	3.0	ug/L	30		100	80-120			09/21/12	
Carbaryl	30	5.0	ug/L	30		101	80-120			09/21/12	
Carbofuran	30	5.0	ug/L	30		101	80-120			09/21/12	
Methomyl	30	2.0	ug/L	30		101	80-120			09/21/12	
Oxamyl	30	20	ug/L	30		100	80-120			09/21/12	
Blank Spike Dup (A210668-BSD1) EPA 531.1 - Quality Control											
3-Hydroxycarbofuran	30	3.0	ug/L	30		99	80-120	2	20	09/21/12	
Aldicarb	29	3.0	ug/L	30		98	80-120	2	20	09/21/12	
Aldicarb Sulfone	30	2.0	ug/L	30		98	80-120	2	20	09/21/12	
Aldicarb Sulfoxide	29	3.0	ug/L	30		98	80-120	2	20	09/21/12	

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BSK Associates
Engineers & Laboratories

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Batch: A210668				Analyst: XHX		Prepared: 9/21/2012					
Blank Spike Dup (A210668-BSD1)	EPA 531.1 - Quality Control										
Carbaryl	30	5.0	ug/L	30		99	80-120	2	20	09/21/12	
Carbofuran	30	5.0	ug/L	30		100	80-120	2	20	09/21/12	
Methomyl	30	2.0	ug/L	30		99	80-120	2	20	09/21/12	
Oxamyl	30	20	ug/L	30		99	80-120	0	20	09/21/12	
Matrix Spike (A210668-MS1)	EPA 531.1 - Quality Control					Source: A2I0986-01					
3-Hydroxycarbofuran	30	3.0	ug/L	30	ND	100	65-135			09/21/12	
Aldicarb	30	3.0	ug/L	30	ND	99	65-135			09/21/12	
Aldicarb Sulfone	29	2.0	ug/L	30	ND	98	65-135			09/21/12	
Aldicarb Sulfoxide	30	3.0	ug/L	30	ND	99	65-135			09/21/12	
Carbaryl	30	5.0	ug/L	30	ND	99	65-135			09/21/12	
Carbofuran	30	5.0	ug/L	30	ND	99	65-135			09/21/12	
Methomyl	30	2.0	ug/L	30	ND	98	65-135			09/21/12	
Oxamyl	30	20	ug/L	30	ND	99	65-135			09/21/12	

BSK Associates
Engineers & Laboratories

Certificate of Analysis

09/26/2012

Notes:

- The Chain of Custody document and Sample Integrity Sheet are part of the analytical report.
- Any remaining sample(s) for testing will be disposed of one month from the final report date unless other arrangements are made in advance.
- Sample(s) received, prepared, and analyzed within the method specified criteria unless otherwise noted within this report.
- The results relate only to the samples analyzed in accordance with test(s) requested by the client on the Chain of Custody document. Any analytical quality control exceptions to method criteria that are to be considered when evaluating these results have been flagged and are defined in the data qualifiers section.
- All results are expressed on wet weight basis unless otherwise specified.
- All positive results for EPA Methods 504.1, 502.2, and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed.
- Results contained in this analytical report must be reproduced in its entirety.
- Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.
- BSK Analytical Laboratories certifies that the test results contained in this report meet all requirements of the NELAC Standards for applicable certified drinking water chemistry analyses unless qualified or noted in the Case Narrative.
- Analytical data contained in this report may be used for regulatory purposes to meet the requirements of the Federal or State drinking water, wastewater, and hazardous waste programs.
- J-value is equivalent to DNQ (Detected, not quantified) which is a trace value. A trace value is an analyte detected between the MDL and the laboratory reporting limit. This result is of an unknown data quality and is only qualitative (estimated). Baseline noise, calibration curve extrapolation below the lowest calibrator, method blank detections, and integration artifacts can all produce apparent DNQ values, which contribute to the un-reliability of these values.
- (1) - Residual chlorine and pH analysis have a 15 minute holding time for both drinking and waste water samples as defined by the EPA and 40 CFR 136. Waste water and ground water (monitoring well) samples must be field filtered to meet the 15 minute holding time for dissolved metals.
- * - This is not a NELAP accredited analyte.
- Summations of analytes (i.e. Total Trihalomethanes) may appear to add individual amounts incorrectly, due to rounding of analyte values occurring before or after the total value is calculated, as well as rounding of the total value.
- (2) The digestion used to produce this result deviated from EPA 200.2 by excluding hydrochloric acid in order to produce acceptable recoveries for affected metals.
- (2C) Result reported from secondary analytical column.
- RL Multiplier is the factor used to adjust the reporting limit (RL) due to variations in sample preparation procedures and dilutions required for matrix interferences.

Certifications:

State of California - CDPH - ELAP	1180
State of California - CDPH - SAC ELAP	2435
State of California - CDPH - NELAP	04227CA
State of Nevada - NDEP	CA000792009A
State of Hawaii - DOH	04227CA

Please refer to our website for a copy of our Accredited Fields of Testing for each certificattion.

Definitions and Flags for Data Qualifiers

mg/L:	Milligrams/Liter (ppm)	M:	Method Detection Limit	MDA95:	Min. Detected Activity
mg/Kg:	Milligrams/Kilogram (ppm)	RL:	Reporting Limit	MPN:	Most Probable Number
µg/L:	Micrograms/Liter (ppb)		:DL x Dilution	CFU:	Colony Forming Unit
µg/Kg:	Micrograms/Kilogram (ppb)	ND:	None Detected at RL	Absent:	Less than 1 CFU/100mLs
%:	Percent Recovered (surrogates)	pCi/L:	Picocuries per Liter	Present:	1 or more CFU/100mLs
		NR:	Non-Reportable	RL Mult:	RL Multiplier

X01 Surrogate recovery was above acceptance limits. No target analytes were detected.

SR07 Surrogate recovery is above acceptance limits. All spiked analytes are within range.

Certificate of Analysis

09/26/2012

MS05	MS/MSD RPD exceeded the method acceptance limit. Recovery met acceptance criteria.
MS02	Matrix spike recovery was low; the associated blank spike recovery was acceptable.
DL01	Sample required dilution due to matrix or high concentration of non-target analyte.

A2I0986

BC Laboratories

BCLab4911

09122012

Turnaround: Standard
Due Date: 9/26/2012

Printed: 9/26/2012 10:30:36 AM

4100 Atlas Court Bakersfield, CA 93308 (661) 327-4911 FAX (661) 327-1918 www.bclabs.com

SUBCONTRACT ORDER
BC Laboratories
1217054

20

SENDING LABORATORY:
BC Laboratories
4100 Atlas Court
Bakersfield, CA 93308
Phone: 661-327-4911
FAX: 661-327-1918
Project Manager: Kerrie Vaughan

RECEIVING LABORATORY: BSKSA
BSK Analytical Labs
1414 Stanislaus Street
Fresno, CA 93706
Phone: (800) 877-8310
FAX: (559) 485-6935

A2I0986 09/12/2012
BCLab4911 10

Analysis	Due	Expires	Comments
Sample ID: 1217054-01 **Water**	**Sampled:**	**09/10/12 11:45**	
EPA 531.1 - Carbamate & Urea Pesticides	09/24/12 17:00	10/08/12 11:45	
EPA 547 - Glyphosate	09/24/12 17:00	09/24/12 11:45	
EPA 300.0 - Bromate	09/24/12 17:00	10/08/12 11:45	
EPA 300.1 - Chlorite	09/24/12 17:00	09/24/12 11:45	
Containers supplied:			

Released By	Date	Received By	Date
[signature]	9/12/12	[signature]	9-12-12
[signature]	9-12-12		

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A2I0986 09/12/2012
BCLab4911 10

Sample Integrity Pg. 1 of 2

Date Received 9/12 L

Section 1- Receiving Information

Sample Transport: ONTRAC UPS (PMS) Walk-In BSK-Courier GSO Fed Exp. Other: ______

Samples arrived at lab on same day sampled: Yes ____ No ✓ Has Chilling Process Begun: Yes ✓ No____

Coolers/Ice Chests Description/Temperature(s): (If more than 5 received, list information in comment section)

1) 2.0 2) ____ 3) ____ 4) ____ 5) ____

Was Temperature In Range: (Y) N N/A Received On Ice: (Wet) Blue Received Ambient: Y (N)

Describe type of packing materials: Bubble Wrap Foam Packing Peanuts Paper Other: ______

Initial Receipt: BSK-Visalia BSK-Bakersfield BSK-SAC (BSK-FAL)

Were ice chest custody seals present? Y (N) Intact: Y (N)

Section 2- COC Info.	Completed Yes	Completed No	Info From Container		Completed Yes	Completed No	Info From Container
Was COC Received				Analysis Requested			
Date Sampled				Hold times less than 72hr			
Time Sampled				Client Name			
Sample ID				Address			
Special Storage/Handling Ins.				Telephone #			

Section 3- Bottles / Analysis	Yes	No	N/A	Comment
Did all bottles arrive unbroken and intact?				
Were bottle custody seals present?				
Were bottle custody seals intact?				
Did all bottle labels agree with COC?				
Were correct containers used for the tests requested?				
Were correct preservations used for the tests requested?				
Was a sufficient amount of sample sent for tests indicated?				
Were bubbles present in VOA Vials? (**Volatile Methods Only**)				
Were Ascorbic Acid Bottles received with the VOAs?				

Section 4- Comments / Discrepancies

Sample(s) Split/(Preserve) (Yes) No Container: 250 A NBSK Preservation: EPA Dt/Time/Init 9-13-12 9:18 JJD

Container: ______ Preservation: ______ Dt/Time/Init ______

Was Client Service Rep. notified of discrepancies: Yes No (N/A) CSR: Notified By/Time:

Explanations / Comments

Report Comment Entered:

Labeled by: JJD @ 9:18 Labels checked by: [illegible] @ 1025 RUSH Paged by: ______ @ ______

(4/11)

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BCLab4911 10

Sample Integrity Pg 2 of 2

BSK Bottles (Yes) / No

250ml (A) 500ml (B) 1Liter (C) Amber Glass (AG)

Container(s) Received	\						
Bacti $Na_2S_2O_3$							
None (p) White Cap							
None (p) Blue Cap w/NH4 + Buffer							
HNO_3 (p) Red Cap							
H_2SO_4 (p) Yellow Cap							
NaOH (p) Green Cap							
EDA (p) Brown Cap/Label							
Other:							
Dissolved Oxygen 300ml (g)							
250ml (AG) None							
250ml (AG) H_2SO_4 COD Yellow Label							
250ml (AG) $Na_2S_2O_3$ 515,547 Blue Label	\						
250ml (AG) $Na_2S_2O_3$+ MCAA 531.1 Orange Label	\						
250ml (AG) NH_4Cl 552 Purple Label							
250ml (AG) EDA DBPs Brown Label	↓ |						
250ml (AG) Other							
500ml (AG) None							
500ml (AG) H_2SO_4 Yellow Label							
1 Liter (AG) None							
1 Liter (AG) H_2SO_4 O&G / TPH-Diesel Yellow Label							
1 Liter (AG) $Na_2S_2O_3$ 548 / 525 / 521 Blue Label							
1 Liter (P) $Na_2S_2O_3$+ H_2SO_4 549							
1 Liter (AG) NaOH+ZnAc Sulfide							
						9/17	
40ml VOA Vial Clear – HCL							
40ml VOA Vial Clear – Buffer pH 4						S	
40ml VOA Vial Clear – None							
40ml VOA Vial Amber – $Na_2S_2O_3$							
40ml VOA Vial Clear - $Na_2S_2O_3$ 504, 505							
40ml VOA Vial Clear – H_3PO_4							
Other:							
½ Gallon (p)							
Asbestos 1Liter Plastic/Foil							
Radon 200ml Clear (g)							
Low Level Hg/Metals Double Baggie							
Bioassay Jug							
Ampule							
PT Sample Bottle							
250 Clear Glass Jar							
500 Clear Glass Jar							
1 Liter Clear Glass Jar							
Plastic Bag							
Soil Tube Brass / Steel / Plastic							
Tedlar Bags							

(4/11)

LA Testing
520 Mission Street South Pasadena, CA 91030
Phone/Fax: (323) 254-9960 / (323) 254-9982
http://www.latesting.com / pasadenalab@latesting.com

LA Testing Order ID: 321215401
Customer ID: BCLA50
Customer PO:
Project ID:

Attn: Kerri Vaughn
BC Laboratories, Inc.
4100 ATLAS COURT
Bakersfield, CA 93308

Phone: (661) 327-4911
Fax: (661) 327-1918
Collected: 09/10/2012
Received: 09/12/2012
Analyzed: 09/26/2012

Proj: 1217054

Test Report: Determination of Asbestos Structures >10µm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

Sample ID Client / EMSL	Sample Filtration Date/Time	Original Sample Vol. Filtered (ml)	Effective Filter Area (mm²)	Area Analyzed (mm²)	ASBESTOS: Asbestos Types	Fibers Detected	Analytical Sensitivity	Concentration	Confidence Limits
							MFL (million fibers per liter)		
1217054-01 321215401-0001	9/12/2012 11:20 AM	30	1288	0.2261	None Detected	ND	0.19	<0.19	0.00 - 0.70

Analyst(s)
Sherrie Ahmad (1)

Jerry Drapala Ph.D, Laboratory Manager
or Other Approved Signatory

Any questions please contact Jerry Drapala.

Initial report from: 09/26/2012 10:27:28

Sample collection and containers provided by the client, acceptable bottle blank level is defined as ≤0.01MFL>10um. ND=None Detected. This report relates only to those items tested. This report may not be reproduced, except in full, without written permission by LA Testing. Samples received in good condition unless otherwise noted.

Samples analyzed by LA Testing South Pasadena, CA CA ELAP 2283

Maxxam

Success Through Science

Your Project #: 1217054
Your C.O.C. #: na

Attention: Kerrie Vaughan
BC Laboratories
4100 Atlas Crt
Bakersfield, CA
USA 93308

Report Date: 2012/09/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2E1625
Received: 2012/09/14, 12:05

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
2,3,7,8-TCDD in Water (1613B)	1	2012/09/12	2012/09/21	BRL SOP-00410	EPA 1613B mod.

Remarks:

The lab certifies that the test results meet all requirements of NELAC, where applicable.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

U = Undetected at the limit of quantitation.
J = Estimated concentration between the EDL & RDL.
B = Blank Contamination.
Q = One or more quality control criteria failed.

Encryption Key

Ivana Vukovic
24 Sep 2012 16:20:10 -04:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ivana Vukovic, Env Project Manager
Email: IVukovic@maxxam.ca
Phone# (905) 817-5700

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics Inc. is a NELAC accredited laboratory. Certificate # CANA001. Use of the NELAC logo however does not insure that Maxxam is accredited for all of the methods indicated. This certificate shall not be reproduced except in full, without the written approval of Maxxam Analytics Inc. Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section.

Total cover pages: 1

Maxxam

Success Through Science

Maxxam Job #: B2E1625
Report Date: 2012/09/24

BC Laboratories
Client Project #: 1217054

DIOXINS AND FURANS BY HRMS (WATER)

Maxxam ID		OV5417						
Sampling Date		2012/09/10 11:45						
COC Number		na			TOXIC EQUIVALENCY		# of	
	Units	1217054-01	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDD *	pg/L	1.3 U	1.3	10	1.00	1.30		2979713
TOTAL TOXIC EQUIVALENCY	pg/L					1.30		
Surrogate Recovery (%)								
37CL4 2378 Tetra CDD	%	84						2979713
C13-2378 TetraCDD	%	93						2979713

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin
TEF = Toxic Equivalency Factor. TEQ = Toxic Equivalency Quotient.
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization. Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

Maxxam

Success Through Science

Maxxam Job #: B2E1625
Report Date: 2012/09/24

BC Laboratories
Client Project #: 1217054

Test Summary

Maxxam ID OV5417
Sample ID 1217054-01
Matrix Water

Collected 2012/09/10
Shipped
Received 2012/09/14

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
2,3,7,8-TCDD in Water (1613B)	HRMS/MS	2979713	2012/09/12	2012/09/21	Angel Guerrero

Maxxam

Success Through Science

Maxxam Job #: B2E1625
Report Date: 2012/09/24

BC Laboratories
Client Project #: 1217054

Package 1	5.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free 800-563-6266 Fax (905) 817-5777 www.maxxam.ca

4100 Atlas Court Bakersfield, CA 93308 (661) 327-4911 FAX (661) 327-1918 www.bclabs.com

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BC Laboratories
Attention: Kerrie Vaughan
Client Project #: 1217054
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: GB2E1625

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
2979713 AGU	Spiked Blank	37CL4 2378 Tetra CDD	2012/09/21		79	%	40 - 130
		C13-2378 TetraCDD	2012/09/21		89	%	24 - 164
		2,3,7,8-Tetra CDD	2012/09/21		85	%	67 - 158
	Method Blank	37CL4 2378 Tetra CDD	2012/09/21		61	%	40 - 130
		C13-2378 TetraCDD	2012/09/21		69	%	24 - 164
		2,3,7,8-Tetra CDD	2012/09/21	1.9 U, EDL=1.9		pg/L	

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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Validation Signature Page

Maxxam Job #: B2E1625

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Kay Shaw

Kay Shaw, C. Chem, Scientific Specialist, HRMS Services

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Greensburg, PA 15601
(724)850-5600

September 27, 2012

Ms. Kerrie Vaughan
BC Laboratories
4100 Atlas Ct.
Bakersfield, CA 93308

RE: Project: 1217054
Pace Project No.: 3077453

Dear Ms. Vaughan:

Enclosed are the analytical results for sample(s) received by the laboratory on September 17, 2012. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Carin Ferris

carin.ferris@pacelabs.com
Project Manager

Enclosures

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CERTIFICATIONS

Project: 1217054
Pace Project No.: 3077453

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4 Greensburg, PA 15601
ACLASS DOD-ELAP Accreditation #: ADE-1544
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California/TNI Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Guam/PADEP Certification
Hawaii/PADEP Certification
Idaho Certification
Illinois/PADEP Certification
Indiana/PADEP Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana/TNI Certification #: LA080002
Louisiana/TNI Certification #: 4086
Maine Certification #: PA0091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nevada Certification
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188
Utah/TNI Certification #: ANTE
Virgin Island/PADEP Certification
Virginia Certification #: 00112
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia Certification #: 143
Wisconsin/PADEP Certification
Wyoming Certification #: 8TMS-Q

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SAMPLE SUMMARY

Project: 1217054
Pace Project No.: 3077453

Lab ID	Sample ID	Matrix	Date Collected	Date Received
3077453001	1217054-01	Drinking Water	09/10/12 11:45	09/17/12 08:45

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SAMPLE ANALYTE COUNT

Project: 1217054
Pace Project No.: 3077453

Lab ID	Sample ID	Method	Analysts	Analytes Reported
3077453001	1217054-01	EPA 903.1	SLA	1
		EPA 904.0	MAW	1
		EPA 905.0	WRR	1
		EPA 906.0	SLA	1

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PROJECT NARRATIVE

Project: 1217054
Pace Project No.: 3077453

Method: EPA 903.1
Description: 903.1 Radium 226
Client: BC Laboratories
Date: September 27, 2012

General Information:
1 sample was analyzed for EPA 903.1. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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PROJECT NARRATIVE

Project: 1217054
Pace Project No.: 3077453

Method: **EPA 904.0**
Description: 904.0 Radium 228
Client: BC Laboratories
Date: September 27, 2012

General Information:
1 sample was analyzed for EPA 904.0. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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PROJECT NARRATIVE

Project: 1217054
Pace Project No.: 3077453

Method: EPA 905.0
Description: 905.0 Strontium 89/90
Client: BC Laboratories
Date: September 27, 2012

General Information:
1 sample was analyzed for EPA 905.0. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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PROJECT NARRATIVE

Project: 1217054
Pace Project No.: 3077453

Method: **EPA 906.0**
Description: 906.0 Tritium
Client: BC Laboratories
Date: September 27, 2012

General Information:
1 sample was analyzed for EPA 906.0. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

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ANALYTICAL RESULTS

Project: 1217054
Pace Project No.: 3077453

Sample: 1217054-01 **Lab ID: 3077453001** Collected: 09/10/12 11:45 Received: 09/17/12 08:45 Matrix: Drinking Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC)	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.175 ± 0.379 (0.700)**	pCi/L	09/26/12 12:53	13982-63-3	
Radium-228	EPA 904.0	**-0.117 ± 0.256 (0.632)**	pCi/L	09/25/12 14:27	15262-20-1	
Strontium-90	EPA 905.0	**0.0600 ± 0.226 (0.510)**	pCi/L	09/23/12 13:00	10098-97-2	
Tritium	EPA 906.0	**7.92 ± 141 (247)**	pCi/L	09/22/12 19:54	10028-17-8	

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QUALITY CONTROL DATA

Project: 1217054
Pace Project No.: 3077453

QC Batch: RADC/13219 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 3077453001

METHOD BLANK: 488503 Matrix: Water
Associated Lab Samples: 3077453001

Parameter	Act ± Unc (MDC)	Units	Analyzed	Qualifiers
Radium-226	0.244 ± 0.480 (0.861)	pCi/L	09/26/12 12:53	

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QUALITY CONTROL DATA

Project: 1217054
Pace Project No.: 3077453

QC Batch: RADC/13222 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 3077453001

METHOD BLANK: 488506 Matrix: Water
Associated Lab Samples: 3077453001

Parameter	Act ± Unc (MDC)	Units	Analyzed	Qualifiers
Radium-228	0.585 ± 0.431 (0.844)	pCi/L	09/25/12 14:23	

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QUALITY CONTROL DATA

Project: 1217054
Pace Project No.: 3077453

QC Batch: RADC/13248 Analysis Method: EPA 906.0
QC Batch Method: EPA 906.0 Analysis Description: 906.0 Tritium
Associated Lab Samples: 3077453001

METHOD BLANK: 489061 Matrix: Water
Associated Lab Samples: 3077453001

Parameter	Act ± Unc (MDC)	Units	Analyzed	Qualifiers
Tritium	-27.0 ± 142 (252)	pCi/L	09/22/12 00:31	

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QUALITY CONTROL DATA

Project: 1217054
Pace Project No.: 3077453

QC Batch: RADC/13254 Analysis Method: EPA 905.0
QC Batch Method: EPA 905.0 Analysis Description: 905.0 Strontium 89/90
Associated Lab Samples: 3077453001

METHOD BLANK: 489067 Matrix: Water
Associated Lab Samples: 3077453001

Parameter	Act ± Unc (MDC)	Units	Analyzed	Qualifiers
Strontium-90	0.0140 ± 0.162 (0.382)	pCi/L	09/23/12 13:24	

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QUALIFIERS

Project: 1217054
Pace Project No.: 3077453

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.
ND - Not Detected at or above adjusted reporting limit.
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
MDL - Adjusted Method Detection Limit.
PRL - Pace Reporting Limit.
RL - Reporting Limit.
S - Surrogate
1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.
Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
LCS(D) - Laboratory Control Sample (Duplicate)
MS(D) - Matrix Spike (Duplicate)
DUP - Sample Duplicate
RPD - Relative Percent Difference
NC - Not Calculable.
SG - Silica Gel - Clean-Up
U - Indicates the compound was analyzed for, but not detected.
N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
Act - Activity
Unc - Uncertainty
(MDC) - Minimum Detectable Concentration
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TNI - The NELAC Institute.

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Certificate of Analysis

Report Date: 09/27/12 11:20
Received Date: 09/12/12 09:30
Turnaround Time: Normal

Project: 1217054

Phones: (661) 327-4911
Fax: (661) 327-1918

P.O. #:

Attn: Kerrie Vaughan

Client: BC Laboratories
4100 Atlas Court
Bakersfield, CA 93308

Dear Kerrie Vaughan :

Enclosed are the results of analyses for samples received 9/12/2012 with the Chain of Custody document. The samples were received in good condition, at 5.3 °C and on ice. All analysis met the method criteria except as noted below or in the report with data qualifiers.

Lab Sample ID: 2I12021-01 **Sample ID:** 1217054-01 **Matrix:** Water
Sampled by: Client **Sampled:** 09/10/12 11:45

Analyte	Result	MDL	MRL	Units	Dil	Method	Prepared	Analyzed	Batch	Qualifier
Gross Beta	18			pCi/L	1	EPA 900.0	9/18/12	9/21/12 13:44	W2I0701	
Counting Error (+/-): 1.066	MDA: 0.05									
Gross Alpha	6.11		0.00	pCi/L	1	SM 7110C	9/24/12	9/26/12 18:41	W2I1000	
Counting Error (+/-): 0.405	MDA: 0.016									

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Quality Control Section

Radiological Parameters by APHA/EPA Methods - Quality Control

Batch W2I0701 - EPA 900.0

Blank (W2I0701-BLK1) Prepared: 09/18/12 Analyzed: 09/21/12 13:44

Analyte	Sample Result	QC Result	Qualifier	Units	Spike Level	%REC	%REC Limits	RPD	RPD Limit
Gross Beta		0.31		pCi/L					
Counting Error (+/-): 0.447	MDA: 0.756								

LCS (W2I0701-BS1) Prepared: 09/18/12 Analyzed: 09/21/12 13:44

Analyte	Sample Result	QC Result	Qualifier	Units	Spike Level	%REC	%REC Limits	RPD	RPD Limit
Gross Beta		17		pCi/L	16.0	108	70-130		
Counting Error (+/-): 0.812	MDA: 0.7								

Duplicate (W2I0701-DUP1) Source: 2I11030-01 Prepared: 09/18/12 Analyzed: 09/21/12 13:44

Analyte	Sample Result	QC Result	Qualifier	Units	Spike Level	%REC	%REC Limits	RPD	RPD Limit
Gross Beta	2.59	2.74		pCi/L				6	30
Counting Error (+/-): 0.417	MDA: 0.602								

Batch W2I1000 - SM 7110C

Blank (W2I1000-BLK1) Prepared: 09/24/12 Analyzed: 09/26/12 18:41

Analyte	Sample Result	QC Result	Qualifier	Units	Spike Level	%REC	%REC Limits	RPD	RPD Limit
Gross Alpha		ND		pCi/L					
Counting Error (+/-): 0.178	MDA: 0.016								

LCS (W2I1000-BS1) Prepared: 09/24/12 Analyzed: 09/26/12 18:41

Analyte	Sample Result	QC Result	Qualifier	Units	Spike Level	%REC	%REC Limits	RPD	RPD Limit
Gross Alpha		3.55		pCi/L	4.80	74	70-130		
Counting Error (+/-): 0.312	MDA: 0.016								

Duplicate (W2I1000-DUP1) Source: 2I12021-01 Prepared: 09/24/12 Analyzed: 09/26/12 18:41

Analyte	Sample Result	QC Result	Qualifier	Units	Spike Level	%REC	%REC Limits	RPD	RPD Limit
Gross Alpha	6.11	6.60		pCi/L				8	30
Counting Error (+/-): 0.423	MDA: 0.016								

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Certificate of Analysis

Notes:
The Chain of Custody document is part of the analytical report.
Any remaining sample(s) for testing will be disposed of one month from the final report date unless other arrangements are made in advance.
All results are expressed on wet weight basis unless otherwise specified.

An Absence of Total Coliform meets the drinking water standards as established by the State of California Department of Health Services.
The Reporting Limit (RL) is referenced as laboratory's Practical Quantitation Limit (PQL).
For Potable water analysis, the Reporting Limit (RL) is referenced as Detection Limit for reporting purposes (DLRs) defined by EPA.

If sample collected by Weck Laboratories, sampled in accordance to lab SOP MIS002

Authorized Signature
Contact: Kim G Tu (Project Manager)

ELAP # 1132
LACSD # 10143
NELAC # 04229CA

The results in this report apply to the samples analyzed in accordance with the chain of custody document. Weck Laboratories certifies that the test results meet all requirements of NELAC unless noted in the Case Narrative. This analytical report must be reproduced in its entirety.

Flags for Data Qualifiers:

ND	NOT DETECTED at or above the Reporting Limit. If J-value reported, then NOT DETECTED at or above the Method Detection Limit (MDL).
Sub	Subcontracted analysis, original report enclosed.
DL	Method Detection Limit
RL	Method Reporting Limit
MDA	Minimum Detectable Activity
NR	Not Reportable

Bakersfield Well & Pump	**Reported:** 10/03/2012 11:20
7212 Fruitvale Ave	Project: BWP - Full Title 22
Bakersfield, CA 93308	Project Number: Charnock Well 20
	Project Manager: Kevin Newlen

Notes And Definitions

MDL	Method Detection Limit
PQL	Practical Quantitation Limit
A01	PQL's and MDL's are raised due to sample dilution.
A10	PQL's and MDL's were raised due to matrix interference.
S05	The sample holding time was exceeded.
S09	The surrogate recovery on the sample for this compound was not within the control limits.
V11	The Continuing Calibration Verification (CCV) recovery is not within established control limits.

Drinking Water Source Assessment

Water System

Santa Monica-City, Water Division

Santa Monica, Los Angeles County, California

Water Source

Charnock Water Plant Well No. 20

Assessment Date

November 2, 2012

California Department of Health Services
Drinking Water Field Operations Branch
DHS *Central* District

District No.	**16**
System No.	**1910146**
Source No.	**NA (New Well)**
PS Code	**NA**

Checklist for Drinking Water Source Assessment - Ground Water Source

District Name	CDPH Central District	District No. 16	County Los Angeles
System Name	Santa Monica-City, Water Division		System No. 1910146
Source Name	Charnock Well No. 20	Source No. NA	PS Code: NA

Completed by Richard C. Slade & Associates LLC Date: November 2, 2012

The following information should be contained in the drinking water source assessment submittal.

__X__ Cover Page

__X__ Checklist *(this form)*

__X__ Assessment Summary

__X__ Vulnerability Summary

______ Source Location Form *(not currently available, contact DHS for information)*

__X__ Delineation of groundwater protection zones

__X__ Source Data Sheet (select appropriate form)

- __X__ Well Data Sheet
- ______ Spring Data Sheet
- ______ Horizontal Well Data Sheet

__X__ Physical Barrier Effectiveness Checklist

__X__ Possible Contaminating Activities (PCA) inventory form

__X__ Vulnerability Ranking

__X__ Assessment map with source location and protection zone

______ Additional maps (optional) (e.g. local maps of zones and PCAs, recharge area maps, or maps indicating direction of ground water flow)

__X__ Means of Public Availability of Report (indicate those that will be used)

- __X__ Notice in the Consumer Confidence Report* (minimum)
- __X__ Copy in regulatory agency (DHS or LPA) office (minimum)
- ______ Copy in public water system office (recommended)
- ______ Copy in public library/libraries
- ______ Internet (indicate Internet address: ____________________)
- ______ Other (describe)

*The CCR should indicate where customers can review the assessments.

Assessment Summary

District Name	CDPH Central District	District No.	16	County:	Los Angeles
System Name	Santa Monica-City. Water Division			System No.	1910146
Source Name	Charnock Well No. 20	Source No.	NA	PS Code:	NA

Completed by: Richard Slade & Associates LLC   Date: November 2, 2012

Description of System and Source

The City of Santa Monica Water Division is located in Los Angeles County and serves a population of approximately 89, 735 through 17, 847 service connections. The primary drinking water source for the City of Santa Monica (City) water system is imported water from the Metropolitan Water District of Southern California (MWD). However, approximately 14% of the City's drinking water is derived from groundwater wells owned and operated by the City within the Santa Monica Groundwater Basin (SMGB). This is actually a sub-basin located within the Coastal Plain of Los Angeles Groundwater Basin and within the South Coast Hydrologic Region as designated by the California Department of Water Resources. The SMGB encompasses an area of approximately 50 square miles. Water is locally extracted from several existing and active wells within and/or outside the City boundaries at four separate locations. General land use in the Santa Monica area is primarily urban/residential.

Charnock Well No. 20, which is located within the City-owned Charnock Wellfield, is a municipal-supply water well which penetrates the semi-confined to confined aquifer systems of the SMGB. This well was drilled and constructed for the purpose of relocating and replacing existing Charnock Well No. 15, which is scheduled to be destroyed to make way for development of an athletic field for nearby Windward School.

Assessment Procedures

The assessment of the source for Charnock Well No. 20 was conducted by Richard Slade & Associates LLC. The assessment included file review and calculation and the use of Geographic Information System (GIS) mapping techniques.

Contents of this Assessment

Yes	X	No	☐	**Assessment Summary**
Yes	X	No	☐	**Vulnerability Summary**
Yes	☐	No	X	**Source Location Form**
Yes	X	No	☐	**Delineation of Protection Zones**
Yes	X	No	☐	**Physical Barrier Effectiveness Checklist**
Yes	X	No	☐	**Source Data Sheet**
Yes	X	No	☐	**Inventory of Possible Contaminating Activities**
Yes	X	No	☐	**Vulnerability Ranking**
Yes	X	No	☐	**Assessment Map**

Comments

None

Vulnerability Summary

District Name	CDPH Central District	District No. 16	County Los Angeles
System Name	Santa Monica-City, Water Division		System No 191046
Source Name	Charnock Well No. 20	Source No. NA	PS Code: NA

Completed by Richard C. Slade & Associates LLC Date November 2, 2012

THE FOLLOWING INFORMATION MUST BE INCLUDED IN THE SYSTEM CONSUMER CONFIDENCE REPORT

A source water assessment was conducted for the Chanrock Well No. 20 of the Santa Monica-City, Water Division water system in November 2012.

Discussion of Vulnerability

No contaminants have been detected in the source water supply for the well that are above the State Primary Maximum Contaminant Level (MCL). The only detected volatile organic compound (VOC) detected in the water supply was methyl ter-butyl ether (MTBE), but was detected at a concentration of 0.9 micrograms per liter (µg/L), which is well below the MCL of 5 µg/L. However, the primary contaminants of MTBE, tert-butyl alcohol (TBA) and other VOCs, such as 1,1-dichloroethylene (1,1-DCE), 1,2-dichlorothane (1,2-DCA), tetrachloroethylene (PCE), and trichloroethylene (TCE) have been historically detected in the groundwater pumped by the other active wells (Nos. 13, 16, 18, and 19) at the Charnock wellfield. The source of MTBE is known to be from gasoline stations whereas the other remaining VOCs are from solvents used in degreasing. The potential sources of these VOCs are not well known, but could be from local dry cleaners and other industries in the area. The groundwater from these wells is currently treated by an onsite VOC treatment system which went into operation in late-2010.

Delineation of Ground Water Protection Zones

District Name	CDPH Central District	District No. 16	County: Los Angeles
System Name	Santa Monica-City, Water Division		System No. 1910146
Source Name	Charnock Well No. 20	Source No. NA	PS Code: NA

Completed by Richard C. Slade & Associates LLC Date November 2, 2012

Method used to delineate the zones:

Calculated Fixed Radius (the default method, calculations shown below.

Calculated Fixed Radius Equation:

The equation for the calculated fixed radius (R) is: $R_t = \sqrt{Q\, t / \pi\, \eta\, H}$

$R_t = R_2$, R_5, or R_{10} corresponding to t (Calculate R for each travel time)
Q = maximum pumping capacity of well
(ft^3/year = gpm * 70,267): 1,400 gpm or 98,374,332 ft^3/year
t = time of travel (years), 2, 5 and 10 years
π = 3.1416
η = effective porosity (decimal percent) (If unknown, assume 0.2):
Unknown 0.2 assumed
H = screened interval of well (feet) = 123 ft

Calculated Fixed Radius Delineation Method Results:

Using the equation presented above, calculation of the size of zones for a porous media aquifer system yield the following values:

Zone A: (2 year TOT) R_2 = 1,596 ft, minimum = 600 ft —use larger: 1,596 ft
Zone B5: (5 year TOT) R_5 = 2,523 ft, minimum = 1,000 ft—use larger: 2,523 ft
Zone B10: (10 year TOT) R_{10} = 3,568 ft, minimum = 1,500 ft—use larger: 3,568 ft

The attached Figure 1, "Groundwater Protection Zones Map" illustrates the three protection zones listed above.

Physical Barrier Effectiveness Checklist - Ground Water Source

District Name	CDPH Central District	District No. 16	County: Los Angeles
System Name	Santa Monica-City, Water Division		System No. 1910146
Source Name	Charnock Well No. 20	Source No. NA	PS Code: NA

Completed by: Richard C. Slade & Associates LLC Date: November 2, 2012

PARAMETER	*POINTS* Unconfined		*POINTS* Confined	
A. TYPE OF AQUIFER Confinement *(up to **50** points maximum)* choose one				
a. Unconfined, Semi-confined, Fractured Rock, Unknown	10			
b. Confined				
B. AQUIFER MATERIAL (Unconfined Aquifer) Type of materials within the aquifer *(up to **20** points maximum)* choose one				
1. Porous Media (Interbedded sands, silts, clays, gravels) with continuous clay layer minimum 25' thick above water table within Zone A				
2. Porous Media (Interbedded sands, silts, clays, and gravels)	0			
3. Fractured rock * (* Low Physical Barrier Effectiveness - no further questions required)				
C. PATHWAYS OF CONTAMINATION (All Aquifers) Presence of Abandoned or Improperly Destroyed Wells *(up to **10** points maximum)*				
1. Are they present within Zone A (2-year time of travel (TOT) distance)?				
a. Yes or unknown	1			
b. No				
2. Are they present within Zone B5 (2- to 5-year TOT distance)?				
a. Yes or unknown	2			
b. No				
3. Are they present within Zone B10 (5- to 10-year TOT distance)?				
a. Yes or unknown	3			
b. No				
D. STATIC WATER CONDITIONS (Unconfined Aquifer) Depth to static Water (DTW) = <u>101</u> feet *(up to **10** points maximum)* choose one				
1. 0 to 20 feet				
2. 20 to 50 feet				
3. 50 to 100 feet				
4. > 100 feet	10			
E. WELL OPERATION (Unconfined Aquifer) Depth to Uppermost Perforations (DUP) DUP = <u>240</u> feet; Maximum Pumping Rate of Well (Q) Q = <u>1400</u> gallons/minute; Length of screened interval (H) H = <u>123</u> feet				

[(DUP – DTW) / (Q/H)] = 12.2 *(up to **10** points maximum)* choose one			
1. < 5			
2. 5 to 10			
3. > 10	10		

Physical Barrier Effectiveness – Ground Water, page 2 of 2
Source Name: Santa Monica-City, Water Division, Charnock Well No. 20. Source No. NA

PARAMETER	*POINTS* Unconfined	*POINTS* Confined
F. HYDRAULIC HEAD (Confined Aquifer) What is the relationship in hydraulic head between the confined aquifer and the overlying unconfined aquifer? (i.e. does the well flow under artesian conditions?) *(up to **20** points maximum)* choose one		
1. head in confined aquifer is higher than head in unconfined aquifer under all conditions		
2. head in confined aquifer is higher than head in unconfined aquifer under static conditions		
3. head in confined aquifer is lower than or same as head in unconfined aquifer		
4. unknown		
G. WELL CONSTRUCTION (All Aquifers) 1. Sanitary Seal (Annular Seal) Depth = 150 feet *(up to **10** points maximum)* choose one		
a. None or less than 20 feet deep		
b. 20 to 50 ft deep		
c. 50 ft or greater	10	
2. Surface seal (concrete cap) *(up to **4** points maximum)* choose one		
a. Not present or improperly constructed		
b. Watertight, slopes away from well, at least 2' laterally in all directions	4	
3. Flooding potential at well site *(up to **1** point maximum)* choose one		
a. Subject to localized flooding (i.e. in low area or unsealed pit or vault) or Within 100 year flood plain		
b. Not subject to flooding	1	
4. Security at well site *(up to **5** points maximum)* choose one		
a. Not secure		
b. Secure (i.e. housing, fencing, etc.)	5	
Maximum Points Possible	70	100
POINT TOTAL FOR THIS SOURCE	56	

Physical Barrier Effectiveness SCORE INTERPRETATION

Point Total	Effectiveness	
____ 0 to 35 =	Low	(includes all sources in Fractured Rock)
56 __ 36 to 69 =	Moderate	
____ 70 to 100 =	High	

GW6PhysicalBarrierEffectiveness (fini)

Possible Contaminating Activities (PCA) Inventory Form - Ground Water

District Name	CDPH Central District	District No. 16	County Los Angeles
System Name	Santa Monica-City, Water Division		System No. 191046
Source Name	Charnock Well No. 20	Source No. NA	PS Code: NA

Completed by Richard C. Slade & Associates LLC Date November 2, 2012

Check the PCA tables that will be used for this drinking water source (assessment must include the "Other" checklist and at least one of the remaining three checklists):

Commercial/Industrial ______

Residential/Municipal __X__

Agricultural/Rural ______

Other (required for all) __X__

Proceed to appropriate checklist or checklists. Indicate whether the PCA is located in the zone by placing a Y (yes), N (no), or U (unknown) in the appropriate boxes.
Example:

Zone A	Zone B5	Zone B10
Y	N	N
N	**Y**	**U**
U	N	N

Risk Ranking of PCAs, where VH = Very High Risk, H = High Risk, M = Moderate Risk, L = Low Risk

PCA Checklist RESIDENTIAL/MUNICIPAL

PCA (Risk Ranking)	PCA in Zone A?	PCA in Zone B5?	PCA in Zone B10?	Comments
Airports - Maintenance/ fueling areas (VH)	N	N	N	
Landfills/dumps (VH)	N	N	N	
Railroad yards/ maintenance/ fueling areas (H)	N	N	N	
Septic systems - high density (>1/acre) (VH if in Zone A, otherwise M)	N	N	N	
Sewer collection systems (H, if in Zone A, otherwise L)	N	N	N	
Utility stations - maintenance areas (H)	N	N	N	
Wastewater treatment plants (VH in Zone A, otherwise H)	N	N	N	
Drinking water treatment plants (M)	Y	N	N	
Golf courses (M)	N	N	N	
Housing - high density (>1 house/0.5 acres) (M)	Y	Y	Y	
Motor pools (M)	N	N	N	
Parks (M)	Y	N	N	
Waste transfer/recycling stations (M)	N	N	N	
Apartments and condominiums (L)	Y	Y	Y	
Campgrounds/ Recreational areas (L)	Y	N	N	
Fire stations (L)	N	N	N	
RV Parks (L)	N	N	N	
Schools (L)	Y	Y	Y	
Hotels, Motels (L)	N	N	Y	

PCA Checklist OTHER ACTIVITIES

PCA (Risk Ranking)	PCA in Zone A?	PCA in Zone B5?	PCA in Zone B10?	Comments
NPDES/WDR permitted discharges (H)	Y	U	Y	
Underground Injection of Commercial/Industrial Discharges (VH)	N	N	N	
Historic gas stations (VH)	N	N	Y	
Historic waste dumps/ landfills (VH)	N	N	N	
Illegal activities/ unauthorized dumping (H)	N	N	N	
Injection wells/ dry wells/ sumps (VH)	N	N	N	
Known Contaminant Plumes (VH)	U	U	U	
Military installations (VH)	N	N	N	
Mining operations - Historic (VH)	N	N	N	
Mining operations - Active (VH)	N	N	N	
Mining - Sand/Gravel (H)	N	N	N	
Wells - Oil, Gas, Geothermal (H)	N	N	N	
Salt Water Intrusion (H)	N	N	N	
Recreational area - surface water source (H)	N	N	N	
Underground storage tanks - Confirmed leaking tanks (VH)	U	U	U	
Underground storage tanks - Decommissioned - inactive tanks (L)	U	U	U	
Underground storage tanks - Non-regulated tanks (tanks smaller than regulatory limit) (H)	U	U	U	
Underground storage tanks - Not yet upgraded or registered tanks (H)	U	U	U	
Underground storage tanks - Upgraded and/or registered - active tanks (L)	U	U	U	
Above ground storage tanks (M)	Y	N	N	
Wells - Water supply (M)	Y	N	N	
Construction/demolition staging areas (M)	N	N	N	
Contractor or government agency equipment storage yards (M)	N	N	N	
Dredging (M)	N	N	N	
Transportation corridors - Freeways/state highways (M)	Y	Y	Y	
Transportation corridors - Railroads (M)	N	N	N	
Transportation corridors - Historic railroad right-of-ways (M)	N	N	N	
Transportation corridors - Road Right-of-ways (herbicide use areas) (M)	U	U	U	
Transportation corridors - Roads/ Streets (L)	Y	Y	Y	
Hospitals (M)	N	N	N	
Storm Drain Discharge Points (M)	Y	Y	Y	
Storm Water Detention Facilities (M)	N	N	N	

PCA Checklist OTHER ACTIVITIES (continued)

PCA (Risk Ranking)	PCA in Zone A?	PCA in Zone B5?	PCA in Zone B10?	Comments
Artificial Recharge Projects - Injection wells (potable water) (L)	N	N	N	
Artificial Recharge Projects - Injection wells (non-potable water) (M)	N	N	N	
Artificial Recharge Projects - Spreading Basins (potable water) (L)	N	N	N	
Artificial Recharge Projects - Spreading Basins (non-potable water) (M)	N	N	N	
Medical/dental offices/clinics (L)	N	N	Y	
Veterinary offices/clinics (L)	N	N	N	
Surface water - streams/ lakes/rivers (L)	Y	Y	Y	
Wells - monitoring, test holes (L)	Y	Y	Y	

VULNERABILITY RANKING MASTER LIST - Ground Water

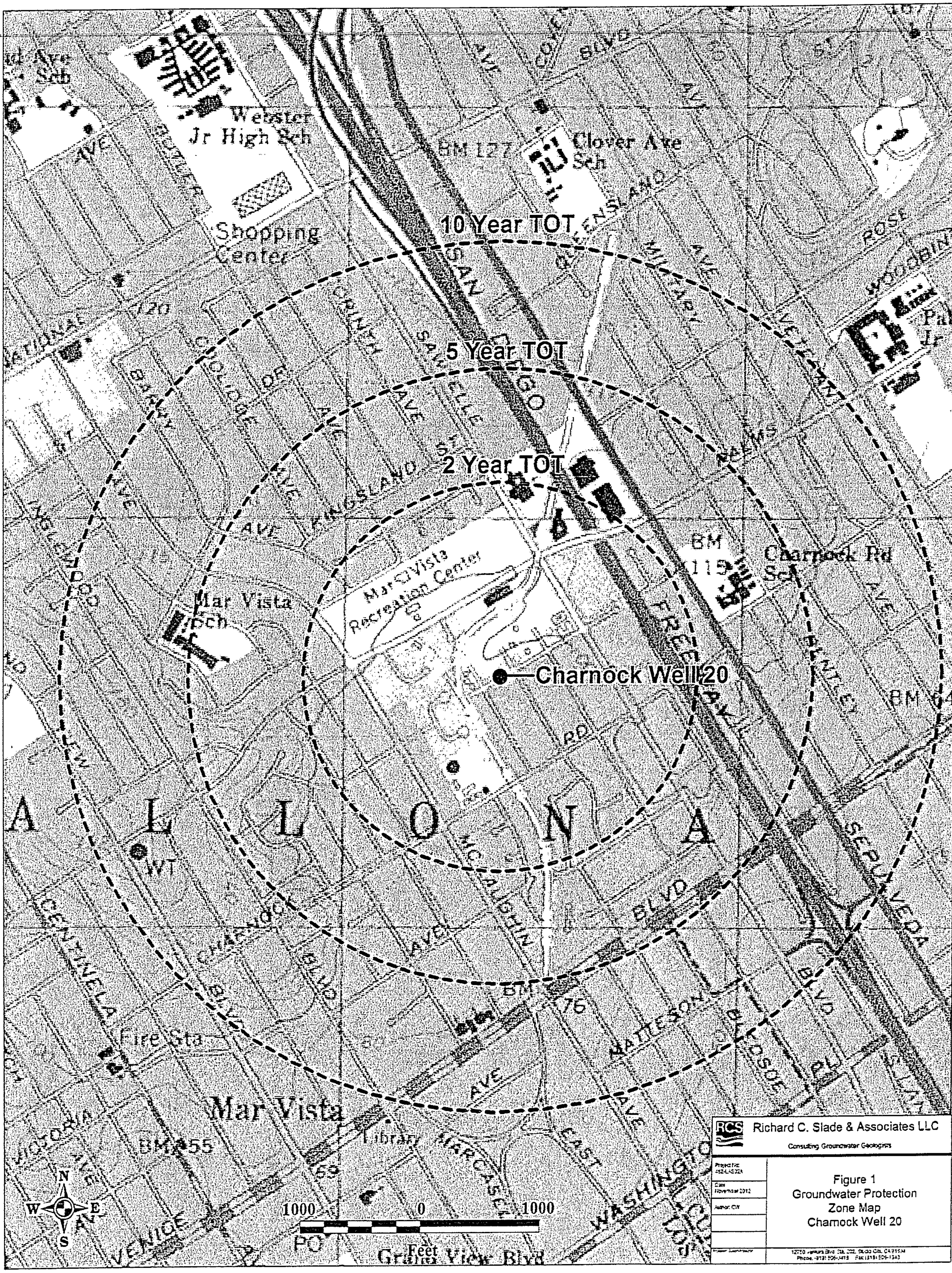
District Name:	CDPH Central District	District No.	16	County: Los Angeles	
System Name:	Santa Monica-City, Water Division	System No.	1910146		
Source Name:	Charnock Well No. 20	Source No.:	NA	PS Code: NA	

Zone	PCA (Risk)	PCA Risk Points VH = 7 H = 5 M = 3 L = 1	Zone Points A = 5 B5 = 3 B10 = 1 Unknown = 0	PBE Points L = 5 M = 3 H = 1	Vulnerability Score Risk + Zone + PBE points
A	Drinking water treatment plant (M)	3	5	3	11
A	Housing - high density (>1 house/0.5 acres) (M)	3	5	3	11
B5	Housing - high density (>1 house/0.5 acres) (M)	3	3	3	9
B10	Housing - high density (>1 house/0.5 acres) (M)	3	1	3	7
A	Apartments and condominiums (L)	1	5	3	9
B5	Apartments and condominiums (L)	1	3	3	7
B10	Apartments and condominiums (L)	1	1	3	5
A	Parks (M)	3	5	3	11
A	Campground/Recreational areas (L)	1	5	3	9
A	Schools (L)	1	5	3	9
B5	Schools (L)	1	3	3	7
B10	Schools (L)	1	1	3	5
B10	Hotels, Motels (L)	1	1	3	5
A	NPDES/WDR permitted discharges (H)	5	5	3	13
B10	NPDES/WDR permitted discharges (H)	5	1	3	9
A	Above ground storage tanks (M)	3	5	3	11
A	Wells- Water supply (M)	3	5	3	11
A	Transportation corridors - Freeways/state highways (M)	3	5	3	11
B5	Transportation corridors - Freeways/state highways (M)	3	3	3	9
B10	Transportation corridors - Freeways/state highways (M)	3	1	3	7

VULNERABILITY RANKING MASTER LIST - Ground Water

District Name:	CDPH Central District	District No.	16	County: Los Angeles	
System Name:	Santa Monica-City, Water Division	System No.	1910146		
Source Name:	Charnock Well No. 20	Source No.:	NA	PS Code: NA	

Zone	PCA (Risk)	PCA Risk Points	Zone Points	PBE Points	Vulnerability Score
		VH = 7	A = 5	L = 5	Risk + Zone + PBE points
		H = 5	B5 = 3	M = 3	
		M = 3	B10 = 1	H = 1	
		L = 1	Unknown = 0		
A	Transportation corridors - Roads/Streets (L)	1	5	3	9
B5	Transportation corridors - Roads/Streets (L)	1	3	3	7
B10	Transportation corridors - Roads/Streets (L)	1	1	3	5
A	Storm Drain Discharge Points (M)	3	5	3	11
B5	Storm Drain Discharge Points (M)	3	3	3	9
B10	Storm Drain Discharge Points (M)	3	1	3	7
B10	Medical/dental offices/clinics (L)	1	1	3	5
A	Surface water - streams/lakes/rivers (L)	1	5	3	9
B5	Surface water - streams/lakes/rivers (L)	1	3	3	7
B10	Surface water - streams/lakes/rivers (L)	1	1	3	5
A	Wells- monitoring, test holes (L)	1	5	3	9
B5	Wells- monitoring, test holes (L)	1	3	3	7
B10	Wells- monitoring, test holes (L)	1	1	3	5



Richard C. Slade & Associates LLC

Consulting Groundwater Geologists

Figure 1
Groundwater Protection Zone Map
Charnock Well 20

WELL DATA SHEET (Sheet 1 of 3)

Complete as much information as possible. Leave blank if information is not available, use N.A. if not applicable.
** Indicates items required for Source Water Assessment*
*** Indicates additional items required for assessments and Ground Water Rule*

	(separate multiple entries in field with semi-colon)	Actual, Estimated or Default?
DATA SHEET GENERAL INFORMATION		
System Name	City of Santa Monica	*from CDPH database*
System Number	1910146	*from CDPH database*
Source of Information *(well log, DHS/County files, system, etc)*	Well log/CDPH files/system	
Organization Collecting Information *(DHS, County, System, other)*	CDPH	
Date Information Collected/Updated	10/15/2012	
WELL IDENTIFICATION		
* Well Number or Name	Charnock Well 20	
* DHS Source Identification Number (**FRDS ID No.**)		
DWR Well Log on File? (yes or no)	Yes	
State Well Number (from DWR)	02S15W11D003S	
Well Status (Active, Standby, Inactive)	Inactive/New	
WELL LOCATION		
Latitude	34.015079	
Longitude	118.426147	
Ground Surface Elevation (ft above MSL)	99.52'	
Street Address	11375 Westminster Av	
Nearest Cross Street	Purdue Av	
City	Los Angeles	
County	Los Angeles	
* Neighborhood/Surrounding Area *(see Note 1)*	Residential	
Site plan on file? (yes or no)	Yes	
DWR Ground Water Basin	Coastal Plain of Los Angeles	*from DWR*
DWR Ground Water Sub-basin	Santa Monica	*from DWR*
SANITARY CONDITIONS		
** Distance to closest Sewer Line, Sewage Disposal, Septic Tank (ft)	35	
Distance to Active Wells (ft)	225	
Distance to Abandoned Wells (ft)	80	
Distance to Surface Water (ft)	330	
** Size of controlled area around well (square feet)	238	
* Type of access control to well site *(fencing, building, etc)*	Fencing	
* Surface Seal? (Concrete slab)(yes or no)	Concrete Slab	
* Dimensions of concrete slab: Length(ft)/ Width(ft)/ Thick(in)	14' x 17' x 6'	
* Within 100 year flood plain? (yes or no)	Not Sure	
* Drainage away from well? (yes or no)	Yes	
ENCLOSURE/HOUSING		
Enclosure Type *(building, vault, none, etc.)*	Building	
Floor material	Concrete	
Located in Pit? (yes or no)	No	
Pit depth (feet) (if applicable)	N/A	
WELL CONSTRUCTION		
Date drilled	7/13-19/2012	
Drilling Method	Reverse Circulation Rotary	
Depth of Bore Hole (feet below ground surface)	450	
Casing Beginning Depth/Ending Depth(ft below surface); 2nd Casing Beginning	0-405	
Casing Diameter (inches); 2nd Casing Diameter; 3rd Casing, etc.	36; 16-5/8 (remainder)	
Casing Material; 2nd Casing Material; 3rd Casing, etc.	Low Carbon Steel; stainless steel (remainder)	

WELL DATA SHEET (Sheet 2 of 3)

Complete as much information as possible. Leave blank if information is not available, use N.A. if not applicable.

** Indicates items required for Source Water Assessment*

*** Indicates additional items required for assessments and Ground Water Rule*

	(separate multiple entries in field with semi-colon)	Actual, Estimated or Default?
WELL CONSTRUCTION (continued)		
Conductor casing used? (yes, no or not sure) *(See Note 2)*	Yes	
Conductor casing removed? (yes, no or not sure)	No	
* Depth to highest perforations/screens(ft below surface)	242	
Screened Interval Beginning Depth/Ending Depth (ft below surface); 2nd Screened Interval Beg. Depth/Ending Depth; 3rd Screened Interval, etc.	242-295	
* Total length of screened interval (ft) *(default = 10% pump capacity in gpm)*	123	
* Annular Seal?(yes, no, or not sure) *(See Note 3)*	Yes	
* Depth of Annular Seal (ft)	150	
Material of Annular Seal *(cement grout, bentonite, etc.)*	Cement	
Gravel pack, Depth to top (ft below ground surface)	150-425	
Total length of gravel pack (ft)	275	
AQUIFER		
Aquifer Materials *(list all that apply: sand, silt, clay, gravel, rock, fractured rock)*	Sand; silt; gravel	
* Effective porosity (decimal percent) *(default = 0.2)*	0.2	
* Confining layer (Impervious Strata) above aquifer? (yes, no or not sure)	No	
Thickness of confining layer, if known (ft)	N/A	
Depth to confining layer, if known (ft below ground)	N/A	
* Static water level (ft below ground surface)	101	
Static water level measurement: Date/Method	9/10/2012; transducer	
Pumping water level (ft below ground surface)	106	
Pumping water level measurement: Date/Method	9/10/2012; transducer	
WELL PRODUCTION		
Well Yield (gpm)	1400	
Well Yield Based On (i.e., pump test, etc.)	Pump test	
Date measured	9/10/2012	
Is the well metered? (yes or no)	Yes	
Production (gallons per year)	500 MG (est)	
Frequency of Use (hours/year)	Daily	
Typical pumping duration (hours/day)	Continuous	
PUMP		
Make	American	
Type	Vertical Turbine	
Size (hp)	100	
* Capacity (gpm)	1150	
Depth to suction intake (ft below ground surface)	242	
Lubrication Type	Oil lube	
Type of Power: *(i.e., electric, diesel, etc.)*	Electric	
Auxiliary power available?(yes or no)	No	
Operation controlled by: *(i.e., level in tank, pressure, etc.)*	City SCADA	
Pump to Waste capability? (yes or no)	Yes	
Discharges to: *(i.e., distribution system, storage, etc.)*	Raw Water EQ Tank	
REMARKS AND DEFECTS (use additional sheets as necessary)		

WELL DATA SHEET (Sheet 3 of 3)

WELL DATA SHEET NOTES

1. Neighborhood/Surrounding Area (list all that apply): A= Agricultural, Ru = Rural, Re = Residential, Co = Commercial, I = Industrial, Mu = Municipal, P = Pristine, O = Other

2. Conductor Casing - Oversized casing used to stabilize bore hole during well construction. Should be removed during installation of annular seal.

3. Annular Seal - Seal of grout in the space between the well casing and the wall of the drilled hole. Sometimes called "sanitary seal".

LOS ANGELES COUNTY WELL PERMIT APPLICATION - PRODUCTION WELLS
DRINKING WATER PROGRAM - ENVIRONMENTAL HEALTH DIV.
5050 COMMERCE DRIVE, BALDWIN PARK, CA 91706 TELE (626) 430-5420 FAX (626) 813-3013

DATE June 15, 2012

☒ NEW WELL CONSTRUCTION ☐ RECONSTRUCTION OR RENOVATION ☐ DECOMMISSIONING ☐ OTHER:
☐ PRIVATE DOMESTIC ☐ PRIVATE IRRIGATION ☐ OTHER:

WELL LOCATION

Site Address	City	Zip Code
11375 W. Westminster Avenue	Los Angeles, Ca.	90066

Town ship	Range	Section	Map Book Page/Grid
R15W	T2S	11	MB99-29/30

GPS location: (To be completed after the final seal)

WELL STRUCTURE

Type and Size of Production Casing	Sanitary / Annular Sealing Material
16"ID x.312"wall, 304L SS	Cement/Grout
Depth of Sanitary / Annular Seal	**Conductor Casing Seal**
50ft.	Cement/Grout

OWNER INFORMATION

Owner's Name	Telephone Number	
City of Santa Monica	(310) 458-8230	
Address	**City**	**Zip Code**
1212 5th Street, Ste. 300	Santa Monica	90401

DRILLER INFORMATION

Driller's Name	Telephone Number	C-57 License Number
Zim Industries, Inc. dba Bakersfield Well & Pump Co.	(661) 393-9661 661-393-9647	440537
Address	**City**	**Zip Code**
7212 Fruitvale Avenue	Bakersfield, Ca.	93308

WELL DECOMMISSIONING INFORMATION

Well Depth ☐ log/records	Method of Well Assessment		Depth and Number of Perforations
Type and Amount of Sealant	**Type of Perforator**	**Size of Perforations**	**Method of Upper Seal Pressure Application**

CONSULTANT INFORMATION

Company			
Black & Veatch			
Address	**City**	**State**	**Zip Code**
800 Wilshire Blvd. Ste. 600	Los Angeles	Ca.	90017
Project Manager		**Telephone Number**	
Hala Titus		(213)312-3300	

ATTENTION: WORK PLAN MODIFICATIONS MAY BE REQUIRED IF WELL AND GEOLOGIC CONDITIONS ENCOUNTERED AT THE SITE INSPECTION ARE FOUND TO DIFFER FROM THE SCOPE OF WORK PRESENTED TO THIS DEPARTMENT.

I hereby agree to comply in every respect with all the regulations of the County Environmental Health Division and with all ordinances and laws of the County of Los Angeles and the State of California pertaining to well construction, reconstruction, and decommissioning. Upon completion of the well and within thirty days thereafter, I will furnish the Environmental Health office with a completion log of the well, giving date drilled, depth of the well, perforations in the casing, and any other data deemed necessary by the County Environmental Health Division.

Signature of C-57 Licensee: [signature] Printed Name: John C. Zimmerer V.P.

THIS PERMIT IS NOT COMPLETE UNTIL EACH OF THE FOLLOWING REQUIREMENTS ARE SIGNED OFF BY THE DEPUTY HEALTH OFFICER. WELL CONSTRUCTION OR DECOMMISSIONING CANNOT BE INITIATED WITHOUT A WORK PLAN APPROVAL FROM THIS DEPARTMENT.

**********************(DEPARTMENT USE ONLY)**********************

WORK PLAN APPROVAL
This Approval is valid for 180 Days

REHS: Juan Rodriguez DATE: 6/28/12

Conditions: Permit #892213 issued to develop a production well No 20. Observed work plan details submitted. Maintain all setbacks. Notify this office at 626-430-5386 4 days prior to start drilling.

FINAL INSPECTION
The placement of the annular seal must be witnessed by a Deputy Health Officer for the permit to be valid. Contact this Department to arrange for an appointment.

REHS DATE

WATER QUALITY
The completed water well must be properly disinfected and meet required bacteriological and inorganic chemical standards prior to approval.

REHS DATE

PERMIT ISSUED
Well completion log must be received by this Department prior to issuance of final approval.

REHS DATE