

APPENDICES

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Appendix 1

Description of the Project Site

Appendix 1

Description of the Project Site

1.1 Purpose

The purpose of this Appendix is to identify the Project Site.

1.2 Project Site

California American Water purchased an approximate 46-acre property in Marina, California for the purpose of locating a desalination facility. Figure 1-1 shows the location of the property in relation to surrounding cities. The Project Site is generally located to the north of Charles Benson Road, south of the Salinas River, east of State Route 1 and Del Monte Boulevard and west of Nashua Road, near the City of Marina, unincorporated County of Monterey, California. The Project Site consists of a portion of Assessor's Parcel Number (APN) 229-011-021. The property contains an approximate 40-foot wide easement that runs east-west and bisects the site. **Attachment 1** to this Appendix 1 contains the Grant Deed and Record of Survey for the Project Site.

Figure 1-1: Regional Location Map

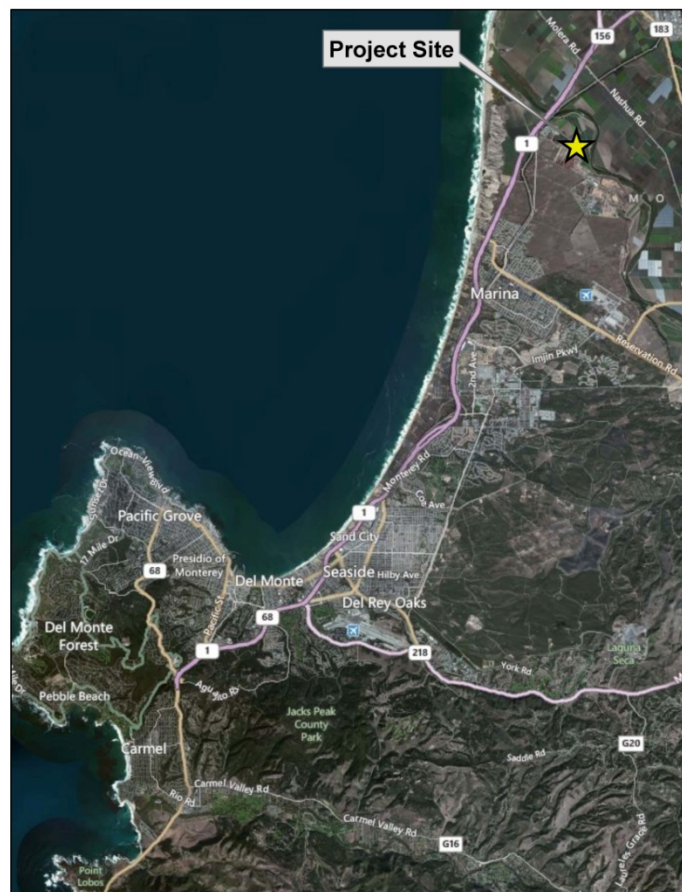



Figure 1-2 depicts the Project Site.

Figure 1-2: Project Site





Appendix 1 - Attachment 1


Grant Deed and Record of Survey


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Property Information

Owner(s)	Bud Antle Inc	Parcel #	228-011-021-000
Property		Map Coord	
	, CA	Census Tract	0143.02
Mailing Addr	Po Box 2018	County	Monterey
	Monterey , CA 93942	Owner Phone	
Legal	VOL 18 SUR MAPS PG 10 45.96 AC PAR		
Lot Number		Tract Number	
Block		Subdivision	Rincon De Las Salinas Rho

Characteristics

Use	Industrial Acreage	Year Built	Sq. Feet
Zoning		Lot Size Ac/Sq Ft	# of units
Bedrooms		Bathrooms	Fireplace
#Rooms		Quality	Heating
Pool/Spa	N	Air	Style
Stories		Improvements	Parking
Flood		Gross Area	Garage Area
Basement Area			
Attributes			
Other			
Property Sale Information			
Sale Date	\$/Sq. Ft.	2nd Mtg.	
Sale Price	1st Loan	Prior Sale Amt.	
Doc No.	Loan Type	Prior Sale Dt.	
Doc Type	Xfer Date	Prior Doc No.	
Seller	Lender	Prior Doc Type	
*\$/Sq. Ft. is a calculation of Sales Price divided by Sq. Feet			

Tax Information

Imp Value		Exemption	
Land Value	\$778,897.00	Tax Year/Area	2011/099039
Total Value	\$778,897.00	Tax Value	\$778,897.00
Tax Amount	\$8,514.88	Improved	

Information compiled from various sources and is deemed reliable but not guaranteed.

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https://fwprodweb1.firstam.com/Fastweb/FASTOrder/propertylookup.ASP?PageName=Pro... 5/2/2012

G 05085

RECORDING REQUESTED BY
Western Title Insurance Company

AND WHEN RECORDED N/E TO

NAME: BUD ANTLE INC.
ADDRESS: P.O. Box 17159
CITY & STATE: Salinas, Calif, 93902
Title Order No. 118728/20 Escrow No.

RECORDED AT REQUEST OF

WESTERN TITLE INSURANCE COMPANY

FEB 8 9 35 AM '80

OFFICE OF RECORDER
COUNTY OF MONTEREY
SALINAS, CALIFORNIA

MAIL TAX STATEMENTS TO
NAME: SAME AS ABOVE

ADDRESS
CITY & STATE

SPACE ABOVE THIS LINE FOR RECORDER'S USE

Documentary transfer tax \$ 213.40
☒ Computed on full value of property conveyed, or
☐ Computed on full value less liens and encumbrances
 remaining thereon at time of sale.

Signature of Agent or Agent Determining Tax - Name same

Individual Grant Deed

WESTERN TITLE FORM NO. 104

FOR VALUE RECEIVED, RICHARD NIELSEN and JANET NIELSEN SMITH, each dealing
with their separate property,

GRANT to BUD ANTLE INC.,

all that real property situate in the

County of Monterey

TRANSFER TAX PAID
MONTEREY COUNTY

State of California, described as follows:

S&E EXHIBIT "A" ATTACHED HERETO AND MADE A PART HEREOF.

A.P. No: 229-011-10

Dated November 12, 1979

Janet Nielsen Smith
Janet Nielsen Smith

Richard Nielsen
Richard Nielsen

STATE OF WASHINGTON
County of Yakima
On NOV 19, 1979, before me, the undersigned,

a Notary Public, in and for said State, personally appeared
Richard Nielsen and Janet Nielsen Smith
known to me to be the persons whose names are subscribed to the within instrument, and acknowledged to me that
they executed the same.

Arthur E. House
Notary Public



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A
A3
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REEL 1389 PAGE 169

Oregon
STATE OF CALIFORNIA
County of *Maricopa*

On *January 7, 1986* before me, the undersigned
a Notary Public, in and for said State, personally appeared *Janet Nielsen*
Smith

known to me to be the person, whose name *is* subscribed
to the within instrument, and acknowledged to me that *she* executed the same

My Commission Expires *July 17, 1986*
Notary Public



EXHIBIT "A"

REEL 1389 PAGE 170

Situate in the County of Monterey, State of California, described as follows:

Certain real property situate in the Rancho Rincon de las Salinas Monterey County, California, being a part of that certain 133.225 acre tract of land designated "PARCEL 1" in the Decree in Action No. 15746 in the Superior Court of the State of California in and for the County of Monterey, a copy of which dated December 30, 1959 is recorded in Volume 2019 of Official Records, at page 20, records of said county, said part being particularly described as follows:

BEGINNING in the southeasterly boundary of said 133.225 acre tract of land at the easterly corner of that certain 4.671 acre strip of land (100 feet wide) described in deed from Opal Nielsen to Monterey Peninsula Garbage and Refuse Disposal District dated August 14, 1964 and recorded in Reel 370 of Official Records, at Page 136, records of said county and running thence along the northeasterly boundary of said strip of land

(1) N. 61° 50' W., 2069.55 feet to the northerly corner thereof in the northwesterly boundary of said 133.225 acre tract of land; thence along last mentioned boundary

(2) N. 14° 42' 30" E., 1594.69 feet to angle point in said boundary at the locus of post marked "125" at angle point in the southwesterly boundary of Zone 2 of Monterey County Flood Control and Water Conservation District; thence along said Southwesterly boundary

(3) S. 40° 23' 14" E., 2869.28 feet (course numbered "717" and designated "N. 40° 29' W., 2873.0 feet" in the description of said boundary) to an angle point in the southeasterly boundary of said 133.225 acre tract of land; thence along last mentioned boundary

(4) S. 52° 47' W., 551.98 feet to the place of beginning.

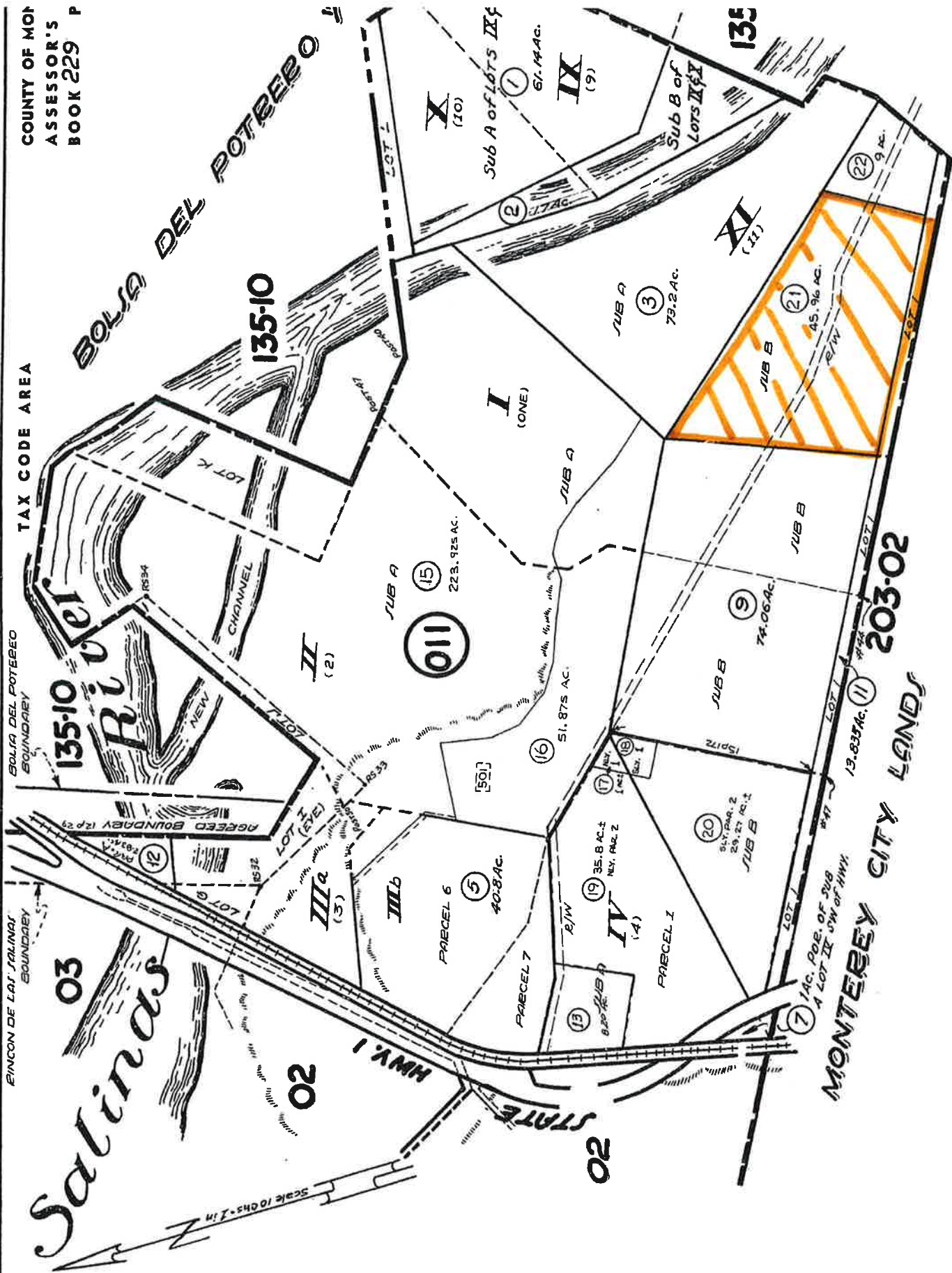
COURSES ALL TRUE.

END OF DOCUMENT

TAX CODE AREA

BOLIA DEL POTEROO
BOUNDARY

EINCON DE LAS SALINAS
BOUNDARY



DISE'S MAP NO. 1 LOTS I THRU XI & XII
EINCON DE LAS SALINAS.

(Pg. 60)

Appendix 2

Design and Construction Requirements

Appendix 2

Design and Construction Requirements

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ATTACHMENTS TO APPENDIX 2

ATTACHMENT	TITLE
1	American Water Engineering Standard T2: Liquid Chemical Storage, Feed, and Containment
2	Raw Water Quality Ranges - Predicted
3	Finished Water Quality Requirements
4	Typical Equipment Manufacturers (except Electrical)
5	Reserved
6	Typical Electrical Equipment Manufacturers
7	General Electrical Design Criteria
8	Power Study Requirements
9	Reserved
10	Chemical Storage Analysis
11	CAD Standards

EXHIBITS TO APPENDIX 2

EXHIBIT	TITLE
1	PRELIMINARY PROCESS FLOW DIAGRAM
2	CONCEPTUAL DESIGN OF POWER SYSTEM RISER DIAGRAM

The purpose of this document is to communicate expectations for the processes and facilities, in terms of features and performance, in a comprehensive and timely manner to Design Builders who are preparing Proposals. When the word “shall” is used, it indicates desired features or approaches that are expected in the Base Proposal. Design Builders are encouraged to present alternatives, on the proper forms, that challenge the design criteria listed here where it can increase value over the life cycle of the facilities. Nothing in this document shall be construed to allow design of facilities to a level less than the applicable building codes or absolve the Design-Builder of its responsibility as Engineer of Record.

This document contains a number of Attachments that are an integral part of this document.

1. INTRODUCTION

The facility to be constructed shall be designed to reliably deliver either 7,168 acre-feet per year with a facility with a design capacity of 6.4 MGD, or 10,752 acre-feet per year with a facility with a design capacity of 9.6 MGD, of desalinated water for potable use. The selected final design capacity depends on the future decision of implementation of the Groundwater Replenishment (GWR) project.

Water from the Pacific Ocean will be delivered to the Project Site by pipeline from slant beach wells on the coast nearby. The beach wells are to be provided by others. Treatment shall consist of oxidation with sodium hypochlorite, granular media filtration, dechlorination, pH adjustment with sulfuric acid, cartridge filtration, a first pass of seawater reverse osmosis (SWRO), a partial second pass of brackish water reverse osmosis (BWRO), disinfection with ultraviolet light, post-stabilization treatment with carbon dioxide and either calcite or hydrated lime, pH adjustment with sodium hydroxide, addition of an orthophosphate corrosion inhibitor and post-chlorination with sodium hypochlorite.

The UV disinfection system shall be capable of delivering a UV dose sufficient to meet CDPH requirements for a minimum of 2-log removal of *Cryptosporidium*. The facility shall meet all CDPH requirements for the removal and/or inactivation of *Cryptosporidium*, *Giardia* and virus.

The post-stabilization system shall be capable of producing a calcium hardness and alkalinity, which ranges from as low as 40 to as high as 100 mg/L as calcium carbonate at pHs, which correspond to slight saturation of calcium carbonate (Langelier Saturation Index of 0 to +0.2). The system shall also have the capability of operating over the same range of hardness and alkalinity while bringing the pH as low as 7.7 to facilitate the effective use of phosphoric acid as a corrosion inhibitor.

The post-stabilization system must be able to consistently hold the target levels of calcium hardness/alkalinity ± 5 percent based on the weekly average of daily measurements and the target pH ± 0.1 pH units based on the daily average of hourly measurements.

Post-stabilization to adjust the calcium hardness, alkalinity and pH may be accomplished with either 1) the combination of hydrated lime and carbon dioxide or 2) a limestone (calcite) contactor with carbon dioxide addition before and after the contactor and sodium hydroxide addition after the contactor.

Downstream of the post-stabilization, orthophosphate may be added as a corrosion inhibitor and sodium hypochlorite will be added for post-disinfection prior to finished water storage and deliver to the distribution system.

The spent filter washwater will be equalized and treated to allow for recycle of the decant in compliance with CDPH's *Cryptosporidium Rule* stream to the head of the plant. The concentrate flows from both the 1° pass SWRO and the 2° pass BWRO will be conveyed to the MRWPCA site via a concentrate pipeline and disposed of via the existing MRWPCA outfall. An on-site equalization basin will allow for temporary off-stream storage of concentrate.

2. GENERAL PROJECT DESIGN CRITERIA

a. Rated Capacity

- i. Rated capacity, also termed “reliable capacity,” is a design criterion defined as the capacity that can be treated and delivered with the single largest redundant process unit out of service, for example pump or RO train, out of service.
- ii. The rated capacity shall be 9.6 mgd or 6.4 mgd. The decision on rated capacity depends on whether a 3,500 afy groundwater recharge project is implemented by MRWPCA.
- iii. The first pass RO system shall be designed to produce the rated capacity with one train off-line.
- iv. Table 2-1 shall be used as a guide to identify the effect of rated capacity on various facility components. Some facility components are modular, such as RO trains, and are identified as “variable capacity”. Other components are not modular, for example the Administration Facilities, and are required regardless of capacity, and are noted as “fixed capacity”. Components that are costly, and can't be readily duplicated, are identified as “fixed capacity”. An ultimate capacity of 12.8 mgd is shown in Table 2-1 to provide a basis for design of fixed capacity components, and to identify space planning requirements for variable capacity components. The ultimate capacity is based on adding two RO trains (1.6 mgd each) to the 9.6 mgd rated capacity design, or adding four RO trains (1.6 mgd each) to the 6.4 mgd rated capacity design. Chemical storage volumes are identified as fixed because storage tanks are sized to safely receive bulk deliveries.

Table 2-1 Component Capacity

Item	Component	Variable or Fixed Capacity	Capacity to be Provided	Design Criteria for Ultimate Capacity
1	Administration Facilities/Building	Fixed	As identified in Appendix 2	
2	Arterial Piping (such as Raw Water supply piping, piping to finished	Fixed	Ultimate capacity governs	Ultimate hydraulic capacity of 12.8 MGD

	water tanks)			
3	Chemical Storage Volumes	Fixed	As identified in Appendix 2	
4	Chemical Feeders	Variable	Match selected rated capacity	
5	Electrical Service and Service Transformers	Variable	See electrical criteria in Appendix 2	Ultimate 12.8 MGD Capacity
6	Electrical Bus Capacity (4160 volt)	Fixed	Ultimate capacity governs	Ultimate 12.8 MGD Capacity
7	Standby Electrical Generator	Fixed	As identified in Appendix 2	
8	Granular Media Filtration Capacity	Variable	Selected rated capacity	12.8 MGD
9	Granular Media Filtration Wastewater Clarification	Fixed	9.6 MGD	
10	Post Stabilization Chemical Storage	Fixed	9.6 MGD	
11	Post Stabilization Calcite Contactors	Variable	Selected rated capacity	12.8 MGD
12	Post Stabilization Lime Saturation System	Fixed	9.6 MGD	
13	UV Disinfection	Variable	Selected rated capacity	12.8 MGD
14	Clearwell Size	Fixed	As identified in Appendix 2	
15	Hypochlorite Generation Capacity	Variable	As identified in Appendix 2	12.8 MGD
16	Hypochlorite Storage Capacity	Fixed	As identified in Appendix 2	
17	Reverse Osmosis Capacity	Variable	Selected rated capacity	12.8 MGD
18	Reverse Osmosis Building	Variable	Selected rated capacity	12.8 MGD
19	Concentrate Equalization Pond Volume	Fixed	As identified in Appendix 2	

20	Finished Water Pumping Capacity	Variable	Selected rated capacity	12.8 MGD
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- v. Maximum Capacity: The maximum capacity is the capacity that can be treated and delivered with the spare RO train in operation. Pretreatment systems, chemical feeders and disinfection systems shall be designed to allow maximum capacity to be achieved with no allowance for redundancy. The purpose of defining a maximum capacity is to allow the spare RO rack to be used to “catch up” to annual production, but not exceed annual allowed production.
- vi. Both rated capacity and maximum capacity shall be permitted capacities recognized by CDPH, including the *Cryptosporidium* action plan.

b. Life Expectancy

- i. The expected life of selected assets is identified below to assist Proposers in tailoring their design and Proposal to the Project needs.
- ii. Process Equipment
 - (1) RO Equipment – 25 years
 - (2) Pressure Filters – 15 years
 - (3) Electrical Power Equipment – 30 years
 - (4) Instrumentation and control equipment– 20 years
- iii. Tankage
 - (1) Chemical Bulk Storage Tanks – 25 years
 - (2) Chemical Day Tanks – 15 years
 - (3) Finished Water Storage Tanks – 50 years
 - (4) Earthen reservoirs – 25 years (life of liner)
- iv. Buildings/Structures
 - (1) Reinforced Concrete Structures – 75 years
 - (2) Administration Facilities – 50 years
 - (3) Stand Alone Electrical Buildings – 30 years
- v. Piping and Valves
 - (1) Finished water
 - (2) Piping – 50 years
 - (3) Valves – 25 years
 - (4) Saline water
 - (5) Piping – 25 years
 - (6) Valves – 15 years
 - (7) Chemical piping and valves – 15 years

c. Staffing for Operation

- i. It is expected that the Design-Build Improvements will be staffed 24 hours per day, seven days per week. However, it is a goal that operation of the Design-Build Improvements would be sufficiently reliable to allow partially attended operation. Automation as described elsewhere is prudent to provide safe and efficient operation, monitoring, and control of pumping and treatment facilities.

d. Allowance for future or potential facilities

- i. Seawater Treatment
 - (1) Identify an area of the Project Site where pretreatment processes for treatment of surface water, for example, dissolved air flotation and gravity granular media filtration, and appropriate residual handling facilities could be constructed if an open seawater intake should be required. Detailed design of seawater pretreatment facilities is not necessary.
- ii. Planning for Plant Expansion
 - (1) Reserve space for future build-out of the building housing the RO racks and other structures to allow for expansion to ultimate capacity. These areas shall be maintained free of large piping, ductbanks, and similar obstructions that would be difficult or costly to move/relocate in the future.

e. Sustainable Design, Construction and Operation in Building Technology

- i. The Owner desires to implement sustainable practices for design, construction and operation of the proposed facilities. These practices include efficient use of energy for lighting as well as heating/cooling for administration type facilities. Waste minimization is another goal for construction and operation. Construction activity pollution prevention is highly desirable. Many of the desired design and construction features will qualify for LEED certification by the U.S. Green Building Council, but the Owner has elected to forego the formal LEED certification process.

f. Spill Protection/Secondary Containment for Liquids

- i. The Owner requires that controls be implemented to protect against groundwater contamination from all process fluids for example seawater, RO concentrate, RO chemical waste, and treatment chemicals. Saline fluid waste is to be kept separate from non-saline wastewater and disposed separately to minimize the salinity of sanitary waste. Tankage for saline fluids is to include secondary containment features to prevent groundwater contamination from tank leaks. Tank overflows are to be directed to wastewater basins to the extent possible rather than direct discharge to the ground. High level switches and alarms, independent of continuous level monitors, are to be provided for tanks to prevent overflow caused by uncalibrated level monitors.

- ii. Chemical storage tanks are to be located within concrete curbing/walls to provide secondary containment of chemical tanks. Buried chemical piping is to be provided with secondary containment, either double wall pipe or replaceable tubing within a carrier pipe. Additional detail on secondary containment is provided in the Chemical Facility section and in the American Water Engineering Standard T2 Liquid Chemical Storage, Feed, and Containment. In most cases, chemical piping within buildings does not require double wall piping as the facility provides a measure of secondary containment and leaks are quickly evident. Liquid chemical spill containment is to be provided for chemical delivery trucks as identified in the chemical storage section.

g. Site Arrangement – Integrated vs. Campus Layout

- i. For operational efficiency, it is desired to integrate the administration facilities, the RO housing, and the (liquid) chemical facilities to enable rapid access by walking between each of the functions. Each function shall be separate to the extent necessary for noise control, corrosion control, safety, structural considerations, and building code compliance.
- ii. Electrical transformation, concentrate equalization, post-stabilization, ultraviolet light disinfection, finished water storage, and finished water storage pumping may be distributed around the site.

h. Safety

- i. **The Owner desires facilities that meet or surpass OSHA standards and requirements. For example, ladders are discouraged where stairs can be provided. Underground pits and vaults** for water metering are discouraged because of the safety concerns with confined spaces.

i. Redundancy

- i. Provide redundancy for all major process mechanical equipment such that the plant is capable of operating at design capacity with any single process unit out of service. This does not apply to chemical storage tanks, but does apply to chemical feeders and chemical feed piping.

j. Process Overflows

- i. All processes shall have overflows that will safely direct excess flow away to protect structures, personnel, and the environment. Continuous level monitors, and an independent high level switch, are to be provided on tanks (water, wastewater, and chemical) to alert operations staff of a high level event. Overflow piping is to be directed to secondary containment or waste handling to the extent possible. Direct discharge to the environment is the least desirable approach. Chemical overflows to the concentrate equalization basin is not acceptable.

3. RAW WATER QUALITY

Raw water quality ranges have been inferred from a variety of sources of information because slant beach wells are not in place and are not operating. The Design Builder is to rely on the raw water quality conditions identified in Attachment 2 for design. The raw water quality data in Attachment 2 are a best estimate of the raw water conditions for the MPWSP. Facility design shall be based on the Design Maximum values in Table 1 of Attachment 2. Both the average and maximum values will be used during Acceptance Testing of the RO system, discussed in Appendix 7.

4. FINISHED WATER QUALITY

Finished water quality performance standards have been established for this project, and are presented in Attachment 3. Treated water quality Acceptance Standards and Requirements that will be used as the basis of design and during Acceptance Testing are shown in Table 2 of Attachment 3 for the pretreatment effluent (RO feed stream), the combined RO permeate, and the Finished Water after stabilization for corrosion control and disinfection with chlorine..

5. RAW WATER PUMPING

- i. Beach wells will be provided through a separate procurement process.
- ii. The Owner has been in contact with the property owner and is working to secure permanent easements on an approximately 376-acre parcel of land located due west of its proposed Project Site.
- iii. The final arrangement of well type, number, and location will be determined at a later date.
- iv. For the purposes of the Proposal, Proposers shall assume:
 - (1) Electric power for the beach wells will not be provided from the Project Site. A separate electric service for the beach wells shall be assumed.
 - (2) Source water hydraulic grade line of 155 feet MSL shall be assumed available from the beach well pump station.
 - (3) Communication with the beach well pump station shall be via fiber optic cable or high speed Ethernet radio (spread spectrum). Fiber optic cable shall be buried adjacent to the feedwater pipeline. Off-site fiber optic cable, and piping, shall be provided by others. Antenna towers are unlikely to be acceptable at either the wells or the Project Site.

6. PRE-TREATMENT SYSTEM WITH GRANULAR MEDIA FILTRATION

a. General

- i. Purpose: Pretreatment of beach well supply using granular media filtration shall be provided for 1) iron and manganese removal and 2) potential need for coagulation of particulate matter.

- ii. Scope: This section addresses filters, filtered water storage, filter wastewater treatment and recycle.
- iii. Flow Metering: Provide flow metering of the well water flow prior to the pressure filters, and recycle of spent filter washwater supernatant. Flow meter shall be located above grade and shall have recommended upstream/downstream straight run pipe sections.
- iv. Pretreatment Chemicals/Mixing: Provide sodium hypochlorite injection as an oxidant for iron and manganese prior to pressure filters. Provide in-line static mixer to provide rapid dispersion. A bypass for the static mixer is not required. Chemical injection shall be above grade. Provide emergency shower and safety shower at chemical injection.
- v. Design Filtration Rate: Filter rate shall not exceed 4 gpm/sf with largest single unit out of service for washing plus a second unit out of service for maintenance;
 - (1) Assume 5 percent flow recycle to account for recycle of filter wastewater supernatant.

b. Filter Media: Dual Media: Sand and Anthracite

- i. Media shall comply with AWWA B100
- ii. Sand 12 inch depth; 0.45 to 0.55 mm effective size; UC 1.4 or less
- iii. Anthracite: 18 inch depth; 0.65 to 0.85 mm effective size; UC 1.6 or less
- iv. Media shall be conditioned with permanganate prior to service to establish manganese dioxide coating for manganese removal.
- v. Media Support: Graded gravel
- vi. Underdrain: PVC header encased in concrete with replaceable non-metallic distribution nozzles

c. Pressure Filter Vessels

- i. Filters shall be single cell
- ii. Materials of Construction: Steel with neoprene rubber lining. Lining shall be NSF listed. The lining system, including vulcanizing primer cement, intermediate overcoat adhesive, neoprene tack cement and neoprene liner are to be the product of Blair Rubber Company, or equal. The interior of the pressure vessels are to be lined with a 1/4" thick Enduraflex black, soft neoprene lining
- iii. Vessel shall be constructed in accordance with ASME unfired pressure vessel and shall be code stamped.
- iv. Personnel Access: Two (2) flanged hatches (24" diameter) with self supporting davit.
- v. Media Inspection Port: Two (2) six inch flanged nozzles located top dead center to allow media levels to be measured.

- vi. Drain: Provide drain connection to completely drain the filter vessel for maintenance; minimum 3-inch.

d. Air Wash or Surface Wash

- i. Provide appropriately sized nozzle with blind flange on each filter to accommodate potential future air wash.

e. Filter to Waste

- i. Provide filter to waste capability. Filter to waste flow is to be measured. Filter to waste flow is to be adjustable up to the design rating of the filter. Effluent turbidity is to be monitored during filter to waste. Allow for 15 minutes of filtering to waste at maximum flow.

f. Washwater Collector

- i. Washwater collector (influent distributor) shall be nonmetallic, and shall be located at least 18 inches above the surface of the filter media.

g. Underdrain Maldistribution

- i. Maldistribution of flow during backwash shall not exceed 10%. Calculations shall be submitted to verify maldistribution.

h. Air Release

- i. Provide air release valve for each filter to vent trapped air/gas.

i. Wastewater

- i. Provide a means to observe and sample the wastewater during backwashing

j. Filter Instrumentation

- i. Flow – Filters shall be arranged in banks not to exceed two (2) filters per bank. Each bank shall be equipped with an effluent flow meter and modulating flow control valve to allow the filters to be operated in either constant rate or declining rate flow control.
- ii. Loss of Head – Each bank shall be equipped with a loss of head differential pressure transmitter
- iii. Turbidity – The effluent from each filter shall be monitored by a turbidimeter

k. Valves

- i. Valves shall be butterfly type.
- ii. Open-close actuated valves shall be pneumatic. Provide quarter turn vane type actuator.

- iii. Rate of flow control modulating valves are to be butterfly with electric actuator (208 volt, 3 phase)
- iv. Valve position indicators shall clearly indicate valve position
- v. For each filter, provide local panel with pneumatic valves to allow valves to be opened/closed for maintenance.

l. Housing

- i. The end/head of each filter, with face piping and valves, shall be enclosed in a building. The remainder of the filter vessel shall be outdoors.

m. Backwash and Backwash Supply

- i. Backwash supply shall be obtained from the filtered water storage tanks.
- ii. Provide two backwash pumps: one duty, one reserve
- iii. Backwash shall include a low, high, low rate sequence.
- iv. Only one filter shall wash at a time.
- v. Maximum backwash rate shall provide 30% bed expansion of sand and anthracite media at highest water temperature
- vi. Backwash flow control shall be by means of a flow meter and electrically actuated butterfly valve. Provide bypass/recycle valve if needed for low wash flow control.
- vii. Backwash sequence shall be automated and initiated by Operator based on 1) time, 2) loss of head, and 3) effluent turbidity
- viii. Backwash sequence shall include a filter to waste cycle that is terminated on 1) time, 2) volume, and 3) filtered turbidity

n. Filter Backwash Waste Settling and Recycle

- i. Backwash waste shall be diverted to basins for settling and recycle of supernatant
- ii. Minimum Number of Wastewater Basins: Two (2)
- iii. Minimum Wastewater Basin Volume: Two filter backwashes plus residuals storage (one year)
- iv. Minimum Unit Filter Waste Volume (backwash and filter to waste)
- v. 200 gal/sf/wash
- vi. Basins shall operate in a batch Fill – Settle – Draw/Recycle mode.
- vii. Wastewater Basin Construction
- viii. Lined Earthen Basin– see Concentrate Equalization Basin for typical construction requirements

- ix. Instrumentation: Provide continuous level (ultrasonic) and separate high level switch for alarm, for each basin
- x. Provide supernatant draw-off piping at three levels, or provide floating decanter

o. Recycle Pumping

- i. Provide central supernatant sump with submersible recycle pumps.
- ii. Duty pumps = 2; Reserve pumps = 1
- iii. Submersible recycle pumps shall be equipped with VFD for flow control
- iv. Recycle flow shall be metered
- v. Provide continuous turbidimeter for recycle quality monitoring
- vi. Regulatory Requirements
 - (1) Meet the CDPH Cryptosporidium Action Plan
 - (2) Recycle flow shall be less than 10% of influent flow
 - (3) Recycle flow shall have a turbidity less than 2 NTU
 - (4) Minimum number of settling basins = 2
 - (5) Ability to continuously dose polymer as settling aid (See Chemical Section for polymer system requirements)

7. FILTERED FEEDWATER RECEIVING TANKS

- i. Filters shall discharge to filtered feedwater receiving tanks. Filtered feedwater receiving tanks shall feed the cartridge filters associated with the RO trains, and shall provide backwash water for granular media filters.
- ii. Flow Split: Piping to each feedwater receiving tank shall be identical to obtain a reasonably equal flow to each tank.
- iii. Number of Tanks: two (2)
- iv. Capacity, each: 300,000 gallons
- v. The plant shall be capable of operating at rated capacity with a single feedwater receiving tank.
- vi. Covered: aluminum self supporting dome
- vii. Internal Roof Supports: not allowed
- viii. Piped Overflow: to allow full raw water flow from each tank. Provide internal weir box. Overflow to Concentrate Equalization Basin.
- ix. Materials of Construction Standards:
 - (1) AWWA D103 Factory Coated Bolted Steel Tank
 - (2) AWWA D108 Aluminum Dome Roofs for Water Storage Facilities
 - (3) Tank sidewall panels shall be glass lined for maximum corrosion resistance.
- x. Personnel Access: Sidewall (2) and Roof (1)

- xi. Tank Outlet Anti-Vortex Baffle: provide anti-vortex baffle at outlets to minimize air entrainment
- xii. Sanitary Lip – Provide a removable baffle at the tank outlet to minimize potential for accumulated solids at the bottom of the tank from washing into the tank outlet.
- xiii. Tank Drain – drain to Concentrate Equalization Basin.
- xiv. Level Controls-Each tank shall have a continuous level monitor (pressure transmitter) and an independent high level switch.
- xv. Security Details: Provide security devices to prevent climbing of the tank by unauthorized persons; provide anti-tamper vents; provide checkvalve on overflow

8. FILTERED WATER PUMP STATION

- i. A filtered water pumping stage is needed to provide sufficient pressure to operate the cartridge filters and supply minimum pressure to the RO process.
- ii. Type of pump: End suction pump is envisioned; Proposers have latitude in optimum pump selection
- iii. Number and Capacity: Two at 50% design capacity (one duty, one reserve); Two at 25% duty (two duty); VFD for two smaller pumps
- iv. Materials of Construction: Super duplex
- v. Pump Location: Pumps to be located outdoors
- vi. Electrical Starter Location: Electrical starters are to be protected from the weather inside of a building.
- vii. Flow Metering: not required (flow = Raw Water flow less GMF wastewater)
- viii. Power Metering: Necessary for the pumping stage

9. REVERSE OSMOSIS SYSTEM

a. General

- i. The reverse osmosis system (the “RO System”) consists of:
 - (1) First pass seawater RO (“SWRO”)
 - (2) Second pass brackish Water RO (“BWRO”)
 - (3) Energy recovery device (“ERD”) and associated booster pumps
 - (4) Cartridge filters
 - (5) High pressure RO feed pumps with variable frequency drives
 - (6) Second pass RO feed pumps with variable frequency drives
 - (7) Pressure vessels and RO train support structure
 - (8) Clean-In-Place (“CIP”) system
 - (9) Flush system
- ii. Description

- (1) The purpose of the RO System is to remove dissolved solids from the seawater, and in particular, to meet boron, bromide, chloride, and sodium water quality goals, as set in Attachment 3 and Appendix 7.
- (2) The RO System configuration shall consist of a first pass SWRO system followed by at least a 40% partial or complete second pass BWRO system.
- (3) The RO System design shall integrate each component such that the RO System shall be able to operate across the range of specified operating parameters (e.g. range of TDS and temperature conditions, and the corresponding RO pressure requirements).
- (4) Each RO train should have a dedicated variable speed high pressure pump, energy recovery device, and support and monitoring systems.
- (5) The rated capacity of the RO System shall be such that the Design-Build Improvements produce the capacity defined in Section 2.
- (6) The RO System minimum daily production rate shall be 3.2 mgd.

iii. Requirements

- (1) The anticipated RO feedwater quality is provide in Attachment 2 and the RO system shall be designed based on the maximum raw water concentrations listed in Atrta.
- (2) The first pass RO system shall be capable of providing and demonstrating, on a continuous basis, the necessary TDS reduction (as measured by continuous conductivity) for the purpose of achieving approval from CDPH for a minimum of 2-log virus, *Giardia*, and *Cryptosporidium* removal, each. In addition, the RO system shall be capable of meeting the Finished Water maximum average concentration for the combined RO permeate, as defined in Attachment 3. The RO system shall meet all acceptance tests as defined in Appendix 7.
- (3) Each RO train and the RO system in general shall meet all monitoring and permitting requirements as defined by CDPH and all applicable regulatory agencies.
- (4) The RO system shall be capable of meeting the Finished Water Maximum Average Concentration for the combined RO permeate water quality standards and requirements, as defined in Attachment 3, while operating at the specified design requirements listed in this Appendix. The RO system shall be designed to meet the power consumption provided in the bid forms and the proposed membrane warranty.
- (5) The RO system shall meet all acceptance tests as defined in Appendix 7.
- (6) All materials used in the RO System that are in contact with water shall be approved for contact with potable water in accordance with NSF Standard 61.

iv. RO Equipment Manufacturer Qualifications

- (1) The RO equipment manufacturer (the "ROEM") shall be a corporation, joint venture, or partnership with experience in the design, construction, and startup of RO systems and shall have been in business for at least three years.
- (2) The ROEM shall have designed, fabricated, and installed at least two seawater RO systems which have a permeate capacity of the same modular size as this project or greater each. The minimum scope of design and fabrication shall

include the cartridge filters, the membrane feed pumps, the membrane elements in pressure vessels, the concentrate control valves, interconnecting pipe and manifolding between system components, and instrumentation and control system hardware associated with system components. In addition, the ROEM shall have developed or participated in the development of control software for each of the referenced RO systems. The reference systems shall have been in operation for a minimum of one year at the time of Proposal submittal. Project references shall be submitted with the Proposal for the two seawater RO system claimed by the ROEM on Proposal Form 18. These references shall include project location, RO permeate capacity, date of contract, date of initial operation, current status, and owner's contact information (i.e. name, address, and telephone number). Failure of the ROEM to provide verifiable qualifications meeting the criteria listed herein will result in rejection of the proposed ROEM, and Proposers will be required to submit an alternate ROEM for approval.

- (3) The ROEM shall demonstrate the existence of service capabilities located in the United States that can be called upon to provide continuing service following acceptance testing and beyond the specified warranty period. Upon notification of service needs, a response by the ROEM within two business days is required. The ROEM shall indicate the service organization that will respond and the location of that service organization with the experience documentation.

v. Space Requirements

- (1) Sufficient space shall be provided around and within the equipment of the RO System to allow for routine maintenance and equipment replacement, including but not limited to: the changing out of membrane elements, RO pressure vessels, and pumps.

b. Manufacturers

- i. Refer to Attachment 4 (Acceptable Manufacturers)

c. Cartridge Filters

- i. The purpose of the cartridge filters is to remove particulate matter and serve as a protective barrier for the RO membranes. The pressure filters should remove most particulates, but filter backwashing can cause particulate breakthrough that must be mitigated by the cartridge filters. The cartridge filter effluent silt density index ("SDI") must be less than 2 min^{-1} and must maintain the RO membrane warranty.
- ii. Maximum effluent turbidity: 0.5 NTU
- iii. Effluent SDI: $\leq 2 \text{ min}^{-1}$ 95% of the time, $< 4 \text{ min}^{-1}$ at all times (see Attachment 3)
- iv. The cartridge filters consist of removable filter cartridges inside a filter vessel. One filter vessel will be provided for each RO train. Each filter vessel holds multiple filter cartridges that can be manually removed when the pressure differential across the filters reaches the set maximum level. The filter pore size shall be a maximum of 5 microns (nominal) to adequately protect the RO membranes. Requirements listed

below may be more stringent than the requirements of the RO membrane suppliers. In instances of conflict between the requirements of the RO membrane requirements and this RFP, the more stringent requirements shall apply.

- Pressure vessel reference standard: ASME Boiler and Pressure Vessel Code, Section X
- Type of filter vessel: Horizontal configuration
- Filter vessel material: AL-6XN stainless steel
- Filter vessel must meet or exceed ASME Section X Code for high pressure vessels
- Minimum vessel design pressure: 150 psi
- Number of filter vessels: 1 per RO train
- Vessel o-rings/gaskets: Buna-N
- Vessels must be designed so one person, at ground level, can easily open and close it to access the entire vessel interior for filter replacement or other maintenance activities.
- Sufficient clearance around each vessel must be provided for access to vent valves and drains, filter element replacement, and other routine maintenance activities.
- Pressure differential indicators and transmitters across the inlet and outlet of the vessels shall be provided.
- Filter pore size: 5 μ m (nominal, minimum 90% efficiency)
- Filter type: string-wound depth cartridges
- Filter materials: polypropylene (FDA grade and ANSI/NSF 61 certified)
- Filter o-rings: Buna-N
- Filter outside diameter (OD): 2 3/8 inches or 2 1/2 inches
- Filter inside diameter (ID): 1 inch
- Filter flow configuration: outside-in
- Filter length: 40"
- Maximum design loading rate: 4 gpm per 10" length
- Maximum differential pressure of clean filter element at design loading rate: 4 psi
- Differential pressure to trigger replacement of filter element: 20 psi
- Filter element replacement interval: not less than 2 months
- The Design-Builder shall provide one set of replacement filter elements for all the vessels.

d. RO System Trains

i. General

- (1) All trains within each pass shall be identical. All equipment and the trains themselves shall be provided by the same manufacturer.
- (2) Each train shall be capable of operating independently of the other trains.
- (3) Each train shall be modular such that a total of either 6.4 or 9.6 mgd Rated Capacity can be achieved.
- (4) All bolts, nuts, washers, anchors, and support systems used to install the train shall be corrosion resistant 316 stainless steel.
- (5) All parts of the RO System including the first pass SWRO, second pass BWRO, ERD, cartridge filters, and pumps, shall be designed to accommodate raw water chlorides of at least 24,000 mg/L and the resulting chloride concentrations in the RO concentrate.
- (6) The frames of each train shall accommodate the number of pressure vessels required to achieve the design performance of the train. The frames of both first pass and second pass trains shall be able to accommodate an additional 10% of the pressure vessels and associated piping. Supports shall also be provided for train piping, valves, and appurtenances.
- (7) Pressure vessels shall not be stacked higher than 6 vessels high.
- (8) The frame and miscellaneous brackets shall be designed and constructed to meet structural and seismic code.
- (9) The frame and miscellaneous brackets shall be epoxy coated carbon steel.
- (10) There shall be no recycle of the second pass concentrate to the head end of the plant.
- (11) Appropriate isolation of the RO system from the pretreatment shall be provided, such that chlorination of the pretreatment granular media filters may be performed without damage to the RO membranes.
- (12) Appropriate provisions shall be provided to ensure that any sealed tanks within the RO system have ventilation systems that control microbiological activity (e.g. HEPA filters).

ii. First Pass SWRO

- (1) Maximum train size shall be 2 mgd (as permeate water).
- (2) First pass recovery shall be 42% minimum and 45% maximum.
- (3) First pass maximum membrane flux rate shall be 8.75 gfd
- (4) First pass maximum feed pressure shall be 1,000 psi.
- (5) RO design shall not exceed 7 elements per pressure vessel.
- (6) The skid shall have the ability to receive the following chemicals for pretreatment prior to the first pass:
 - (7) Sulfuric acid to reduce the pH of the feedwater
 - (8) Scale inhibitor to prevent precipitation of sparingly soluble salts such as calcium carbonate, calcium sulfate, barium sulfate, and strontium sulfate.

iii. Second Pass BWRO

- (1) Second pass maximum recovery shall be 85%.

- (2) Second pass maximum membrane flux rate shall be 18 gfd.
- (3) RO design shall not exceed 7 elements per pressure vessel.
- (4) The maximum pH of the second pass feed water shall be 10 or the maximum specified in the membrane warranty.
- (5) The skid shall have the ability to receive the following chemicals for pretreatment prior to the first pass:
 - (6) Caustic soda to increase the pH of the feedwater and enhance boron removal, in order to meet the maximum average concentration for boron in Attachment 3 and Appendix 7.
 - (7) Scale inhibitor to prevent precipitation of sparingly soluble salts such as calcium carbonate, calcium sulfate, barium sulfate, and strontium sulfate.

e. RO Membrane Elements

- i. The type of first pass RO membrane elements shall be SWRO with minimum 99.6% salt rejection and minimum 90.0% boron rejection.
- ii. The type of second pass RO membrane elements shall be BWRO with minimum 99.0% rejection.
- iii. The size of all elements shall be standard 8-inch diameter, with 400 square feet of surface area.
- iv. Differential pressure across the membrane elements shall not exceed a five percent increase over the minimum membrane warranty period.
- v. All membrane elements installed within a train shall be of a single manufacturer.
- vi. The spiral wound membrane elements shall be manufactured with thin film composite polyamide membranes. The elements shall be suitable for high pressure seawater RO treatment in the first pass and brackish water RO in the second pass.
- vii. The SWRO and BWRO membranes shall each be warranted for at least 5 years.
- viii. The membrane models selected shall have a demonstrated track record of service with a minimum of two (2) years of operation at a full-scale seawater RO facility for drinking water application and of the comparable modular train size as this Project.
- ix. Membrane Factory Testing
 - (1) Each membrane element shall be factory tested by the manufacturer and certified test data for each membrane element shall be supplied to the Owner prior to shipment. The test data shall be accepted by the Owner in writing prior to shipment.
 - (2) The elements shall be tested under the manufacturer's standard published test conditions.
 - (3) The elements shall meet the performance stated in the manufacturer's standards.
 - (4) Each membrane element must have a salt rejection greater than the minimum specified salt rejection defined in the membrane manufacturer's specification sheets for that membrane type.

- (5) Certified test data shall be provided for each element and shall consist of the element serial number, the feed flow, recovery, productivity, rejection, and differential pressure. The Owner reserves the right to have a representative observe factory testing at any time during regular testing by the element manufacturer. In addition, the Owner reserves the right to request retesting by the manufacturer of a random choice (by the Owner's Representative) of five percent of the elements at no additional cost to the Owner. On retest, should any of the elements fail to meet the performance specified above, the Owner reserves the right to require the element manufacturer to retest up to 100% of the elements at no additional cost to the Owner or reject the proposed shipment, at the sole discretion of the Owner.

f. RO Pressure Vessels

- i. The pressure vessels shall have a maximum working pressure of not less than 1200 psig and shall be Code Stamped for the rated pressure in accordance to the ASME Boiler and Pressure Vessel Code – Fiberglass-Reinforced Pressure Vessels.
- ii. Pressure vessels shall be provided with ultraviolet light resistant coating.
- iii. The feed and concentrate ports shall be located in the vessel sidewall.
- iv. Factory testing: Each vessel shall be tested at the manufacturer's facility for compliance with requirements set forth herein. A certified copy of the production test data for each pressure vessel shall be submitted to CAW prior to shipment.

g. RO First Pass High Pressure Pumps

- i. The first pass RO feed pumps shall be high-pressure and centrifugal pumps.
- ii. Minimum efficiency: 80%
- iii. The high pressure pump maximum efficiency shall be designed for the maximum average water quality specified in Attachment 2.
- iv. Acceptable materials of construction: super duplex stainless steel, etc.
- v. One high pressure feed pump, with variable frequency drive, shall be provided for each first pass membrane train.
- vi. The high pressure pump shall be able to accommodate the entire range of operating water qualities, temperature, RO fouling conditions, and ERD requirements.
- vii. Design of the high pressure pump shall take into account the specific RO train configuration and energy recovery device to ensure proper operation and appropriate energy recovery and efficiency over the entire specified range of water quality parameters.
- viii. Equipment Factory Testing
 - (1) Factory acceptance testing shall be performed for each high pressure RO feed pump. Testing shall comply with the latest version of the Hydraulic

Institute/American National Standard for Rotodynamic Pumps for Hydraulic Performance Tests (14.6), referred to as HI Standard 14.6.

- (2) Measurement accuracy shall be Grade 1 as defined by the HI Standard 14.6. Pump performance test acceptance grade shall be 1E.
- (3) Pump tests shall be performed to verify the initial performance of new pumps. Performance testing shall include measurement of flow, head, and power input to the pump or test motor. NPSH testing shall be performed. Factory testing shall be performed at a dedicated test facility.
- (4) Conduct tests on actual equipment to be furnished to the job site, including pump discharge heads and barrels, as applicable.
- (5) Furnish certified test reports which include test data sheets, performance test logs, and equipment performance curves, as applicable. Indicate separately equipment guaranteed operating points identified in the specifications, including efficiency. Testing shall provide data for a minimum of five (5) flows.
- (6) Factory testing of each high pressure pump motor shall be performed as listed below. Certified test results shall be submitted.
- (7) Dielectric test on armature
- (8) Insulation resistance
- (9) No load current at rated voltage
- (10) Efficiency and power factor calculated at 100 percent of full load at full load speed
- (11) Locked rotor current
- (12) Overspeed test
- (13) Winding resistance
- (14) Balance
- (15) Bearing inspection

h. RO Second Pass Pumps

- i. Minimum Efficiency: 70%
- ii. One second pass feed pump, with variable frequency drive, shall be provided for each second pass membrane train.
- iii. The second pass pumps shall be able to accommodate the entire range of operating water qualities, temperature, and RO fouling conditions.
- iv. Pump and motor testing shall be performed as listed above for the high pressure pumps.

i. Energy Recovery Device

- i. The purpose of the energy recovery device (ERD) system is to reduce the RO system's power consumption by recapturing the energy present in the first pass concentrate stream.
- ii. The type of ERD shall be positive displacement.

- iii. Design of the ERD shall take into account the specific RO train configuration and high pressure pump and associated booster pumps to ensure proper operation and appropriate energy recovery.
- iv. One ERD shall be provided per train.
- v. Reference installations for the ERD shall be provided, and be independent plants with no affiliation to the ERD manufacturer.
- vi. The expected lifetime of the ERD shall be at least twenty (20) years.
- vii. The efficiency per ERD shall be a minimum of 95%.
- viii. The ERD maximum efficiency shall be designed for the maximum average water quality specified in Attachment 2.
- ix. Mixing will be no more than three percent (3%) when the ERD low pressure flow rate equals the ERD high pressure flow rate and the membrane recovery rate is less than 50%.
- x. Conductivity of the flows into and out of the ERD shall be relayed to the main plant control system for continual calculation of ERD mixing percent. Sample ports shall also be provided at the same locations as the conductivity sensors.
- xi. The ERD must be able to operate within all the parameters of this Project (e.g., temperature, flow, pressure,)

j. RO System Piping and Valves

- i. Interconnecting pipe manifolds for operation and sampling of the RO trains shall be provided that include but are not limited to connections for feed line, permeate line, brine line, CIP feed and recirculation lines, and flush feed and waste lines. Pipe manifold materials shall be in accordance with materials listed in Appendix 2..
- ii. Backflow prevention or air gap separation shall be provided on CIP waste, CIP recirculation and flush waste lines, as required by CDPH.
- iii. The contractor shall be responsible for providing sample ports and backflow prevention devices as required by CDPH. At a minimum sample ports and backflow prevention devices shown in the Drawings shall be provided.
- iv. Permeate sample points shall be provided on all vessels, and shall be such that a probe tube may be passed through for profiling and sampling within a vessel.
- v. Additional sample points shall be provided on the feed and concentrate lines of each vessel, as well as on any interstage headers.
- vi. RO Trains shall use vertical feed/concentrate manifolds and vertical permeate manifolds.
- vii. Side ported vessels (without a multiport, close coupled arrangement) shall be used for ease of maintenance.
- viii. Piping shall be run at the ends or alongside the trains in easily accessible piping trenches. All horizontal runs shall be located beneath trench grating.

- ix. The RO System shall be designed such that permeate backpressure cannot exceed the concentrate pressure by more than 5 psi to prevent damage to the RO membranes.

k. Flush System

- i. The flush system shall be able to flush the entire RO system and each individual RO train.
- ii. The Design-Builder shall provide the ability to flush each train independently of the plant to allow for individual train shutdown and flushing. The first pass system shall be able to be flushed separately from the second pass.
- iii. The flush water source shall be RO permeate from the flush tank.
- iv. The first and second pass RO systems shall be designed and constructed with piping, valving, and instrumentation for an automated flushing even to occur. A flushing event shall occur if a train is taken offline. The Design-Builder shall provide the ability to manually initiate a flushing event.
- v. Flush feed connections shall be provided to each train, along with automated flush supply and waste valves. The system shall be activated automatically through the RO system PLC on shutdown of the RO train to flush residual low pH feed and concentrate from the high pressure pump and pressure vessels. On initiation of a flush cycle, flush water shall be pumped to the flush feed valve on the suction side of the high pressure pump. A flush to waste valve shall be opened off the concentrate line ahead of the control valve, routing the flush water to waste.
- vi. Flush feed connections shall be placed in close proximity to the train itself, without excess piping.
- vii. The Design Builder shall ensure that there is enough volume in the flush tank such that each train can be flushed in the event of a plant shut down.
- viii. The Design-Builder shall provide the ability to add preservative solution to the flush system.
- ix. A minimum of one standby pump shall be provided and at all times at least one flush pump shall be available to flush a first or second pass RO train.
- x. Duty and standby pumps shall be connected to the standby power generator bus such that a single pump could operate during a power outage.
- xi. The flush waste pumps shall be sized to flush an entire first or second pass RO train, including the ERD.
- xii. The Design-Builder shall provide the flexibility to flush the first pass RO feed pumps.
- xiii. Provisions shall be included to allow for proper sanitization of the flush tank to control microbiological activity.

I. Clean-In-Place System

- i. A chemical cleaning system that includes CIP pumps, tanks, tank heater, and cartridge filter(s) shall be provided by the Design-Builder. This CIP system, including storage, make-up, piping, connections, and feed facilities, shall be permanently installed.
- ii. Sufficient piping and valving shall be provided to clean each entire stage within each train individually.
- iii. The Design-Builder shall provide a chemical storage area within the CIP area of the desalination building. Chemical containment and feed system design shall be consistent with Attachment 1.
- iv. The Design-Builder may provide a dry or liquid CIP chemical system. If a dry system is selected, the CIP tanks shall be installed with a dry chemical feed system and submersible tank mixer. If a liquid chemical CIP system is selected, the Design-Builder shall provide a metering pump from the chemical storage to the CIP tank and a submersible mixer.
- v. CIP tanks shall be HDPE, and suitable for storage of solutions between pH of 2 to 12. Tanks larger than 1000 gallons shall be FRP.
- vi. Each CIP tank shall have adequate volume to perform a CIP for either the first or second pass train, assuming heavily fouled conditions, and for chemical addition to neutralize the CIP solution.
- vii. CIP tanks shall be installed with a drain at the tank bottom
- viii. The CIP system shall be supplied with a heating system to raise the temperature of the CIP solution for a heavily fouled condition up to 45 °C in 8 hours or less.
- ix. Design Builder shall provide a minimum of one CIP pumps to perform the cleaning of the entire first pass
- x. Design Builder shall provide a minimum of one CIP pump to perform the cleaning of the second pass, and provisions shall allow each stage to be cleaned individually with the provided pumps(s).
- xi. The CIP system shall be manually initiated.
- xii. An appropriate hose connection shall be provided between the CIP system and the RO train system to provide separation for CDPH compliance.
- xiii. The CIP cartridge filter shall be a minimum of 5 micron pore size. The materials of construction for the cartridge filter shall be suitable for a cleaning solution with pH between 2 and 12.
- xiv. A local control panel (LCP) is to be provided for the CIP system, the LCP shall be mounted at the CIP area at 4 ft above the building floor. The control system shall at a minimum display temperature, pH, pump status, flow and pressure during a CIP.

m. Neutralization Tank

- i. A neutralization tank, separate from the CIP tank, shall be provided to receive CIP waste.
- ii. The neutralization tank shall be large enough to receive 150% of the volume needed to clean one entire train.
- iii. The neutralization tank shall be equipped with a mixer and equipment to add neutralization chemicals.
- iv. The neutralization tank shall be equipped with a drain for disposal of the contents via trucking.
- v. Level monitor and an independent high level switch shall be provided to monitor level and alarm on high level.

n. RO Membrane Storage and Preservation

- i. The RO System shall be delivered to allow for proper storage and preservation of the RO elements.

o. RO System Control and Instrumentation

- i. The RO system shall be controlled by a programmable logic controller (“PLC”) based control system.
 - (1) The PLC shall be Allen Bradley and shall communicate with treatment plant instrumentation and control system over data highway
- ii. An operator graphical interface will be provided to communicate with the system.
- iii. The RO system shall be designed to operate at a constant permeate flow rate. At a minimum, the following information for each RO train shall be relayed to the main plant control system:
 - (1) Train Status
 - (2) Permeate Flow Rate
 - (3) Differential Pressure
 - (4) RO Feed Pressure
 - (5) RO Feed Temperature, Conductivity, and pH
 - (6) RO Permeate Temperature and Conductivity
 - (7) Feed, Permeate, and Brine Valve Positions
 - (8) RO Feed Rate and Calculated Recovery Rate
 - (9) Alarm Condition for RO Feed Pumps and Energy Recovery Device.
- iv. The capability for real-time online normalization shall be provided.
- v. Sufficient sample points shall be provided on the process system to allow the operator to determine the performance of the RO system. Each stage of multistage trains shall be instrumented.
- vi. SDI measurement connection points shall be provided.

- vii. Meters and sampling points shall be compliant with the provisions of Appendix 2 and Appendix 7.

p. Spare Parts

- i. The manufacturer's recommended spare parts shall be provided by the Design-Builder.

q. Special Tools

- i. The Design-Builder shall furnish any special tools that are necessary for maintenance of the system or for the removal and replacement of membrane elements.
- ii. A single element test unit shall be provided at the plant for testing of individual membrane elements.

r. Factory Testing

- i. Factory tests shall be conducted on all actual equipment to be furnished to the job site.
- ii. Test reports shall be provided to the Owner documenting the performance of each piece of equipment. Equipment guaranteed operating points shall be indicated.

s. RO System 14-day Run-In Test

- i. The Design-Builder shall conduct a 14-day performance test on the complete RO system to demonstrate its competent operation.
- ii. As applicable to the equipment furnished, state in writing that all necessary hydraulic structures, piping systems, and valves have been successfully tested; that all necessary equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are all operational; that the systems and subsystems are capable of performing their intended functions; and that the facilities are ready for startup and intended operation.
- iii. After the Design-Build Improvements are operating, but prior to initiation of the 14-day run-in test, complete the testing of those items of equipment, systems, and subsystems which could not be or were not adequately or successfully tested prior to plant startup. This shall include verification of proper membrane element installation by conducting a conductivity profile on the pressure vessels of each RO train while the train is operating.
 - (1) The Design-Builder's personnel shall conduct the profiles by sampling permeate from the sample valves on each pressure vessel within a given train.
 - (2) Those vessels not meeting pre-established conductivity criteria shall be opened up by the Design-Builder and examined for proper installation of end connectors and element interconnectors, damaged o-rings, misaligned brine seals, and other like causes.

- (3) Any observed deficiencies shall be corrected by the Design-Builder and the vessel retested.
- iv. Successful checkout of the RO system and performance testing of related ancillary systems shall constitute grounds for substantial completion of the RO system and allow it to proceed to the Acceptance Test.
- v. The test shall be considered complete when, in the opinion of the Owner, the complete treatment system has operated in the manner intended at plant design capacity for 14 continuous days without significant interruption. This period is in addition to any training, functional, or performance test periods specified elsewhere. A significant interruption will require the test then in progress to be stopped and restarted after corrections are made.
- vi. Significant interruption: May include any of the following events:
 - (1) Failure of Design-Builder to maintain qualified onsite startup personnel as scheduled.
 - (2) Failure of any equipment item or treatment subsystems furnished by the Design-Builder to meet specified performance requirements for more than 2 consecutive hours.
 - (3) Failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within 5 hours after failure.
 - (4) Failure of noncritical unit, system, or subsystem that is not satisfactorily corrected within 8 hours after failure.
 - (5) As may be determined by the Owner.
- vii. The following events will not be considered cause for significant interruption:
 - (1) Loss of feedwater delivered to the RO system for reasons beyond the control of the Design-Builder.
 - (2) Loss of power to the plant for reasons beyond the control of the Design-Builder.
 - (3) As may be determined by the Owner.
- viii. Minimum prerequisites prior to initiation of the 14-Day Run-In Test include the following:
 - (1) Successful completion of the performance tests for the reverse osmosis trains.
 - (2) Completion of membrane element loading and checkout for the reverse osmosis trains.
 - (3) Completion of initial startup operations, including successful completion of performance testing on remaining equipment items as specified herein.
- ix. Report: At the end of the 14-day run-in test, the Design-Builder's representative shall prepare a test report which shall include daily operating and normalized performance data for each day of the test, for each RO train and the system as a whole.
- x. Acceptance Testing: Final Acceptance Testing is described in Appendix 7 and in Article 4 of the Design-Build Agreement.

10. HANDLING OF TREATMENT RESIDUALS

- a. **Types of Residuals:** The Design-Build Improvements shall have different types of residual streams, as summarized in Table 2.

Table 2-Residuals Summary

Residual Stream	Disposal Method	Frequency of Disposal
CIP waste, neutralized	Neutralization holding tank, Trucking offsite (to MRWPCA)	Intermittent,
Sanitary waste	Leachfield	Continuous, variable
Special laboratory waste	Discharge through neutralization pot to Holding tank, Trucking offsite	Intermittent (expect no more than twice per year)
Sample streams	Recycle to the extent possible; minimize discharge to sanitary	
Spent Granular Media Filter Wastewater	Settling followed by recycle, or discharge to concentrate/MRWPCA Concentration/treatment process then Trucking offsite	Periodic; no more than twice per year
Settled Solids from Granular Media Filtration	Concentration in settling basins; mechanical or non-mechanical dewatering ; landfill disposal	Not to exceed once per year
Lime Sludge Blowdown	Comingle with granular media filtration waste; Concentration/treatment process then Trucking offsite	
First Pass RO Concentrate	Pipeline to MRWPCA	Continuous
Second Pass RO Concentrate	Pipeline to MRWPCA	Continuous

- b. All RO reject water handling and disposal facilities shall be designed for no more than 75% recovery of permeate.**

c. RO Concentrate Disposal

- i. Concentrate flows from both the first pass and the second pass of the RO system are to be conveyed to the MRWPCA site via a proposed concentrate pipeline and disposed of via the existing MRWPCA outfall.
 - (1) The concentrate pipeline, beyond the Project Site, is designed and constructed by others.
- ii. RO concentrate, and related streams, shall be discharged to the MRWPCA ocean outfall. The discharge shall be piped to the effluent junction structure located at the MRWPCA facility. Piping from the Project Site property boundary to the MRWPCA tie-in is by others. The top elevation of the effluent junction structure is 101.0 feet MSL. The effluent junction structure is not pressurized.
- iii. Discharge must be in compliance with MRWPCA concentrate discharge agreement.
- iv. Previous analyses have indicated a need for on-site (Project Site) concentrate flow equalization. The capacity of the concentrate equalization lagoon shall be a minimum of 3,000,000 gallons.
- v. A pumping facility shall be provided to drain the equalization lagoon over a 12 hour period. The pumping facility shall provide one or two duty pumps, and a reserve pump. Discharge flow shall be continuously measured.
- vi. Flow metering of the discharge to MRWPCA shall be provided.
- vii. A sampling station, with automatic sampler, shall be provided on the discharge to MRWPCA. The area in which the sampler and associated piping are located shall be protected with a roof. A suitable drain shall be provided. Continuous monitoring of pH, conductivity, turbidity, and dissolved oxygen shall be provided and input to SCADA.
- viii. An air break is needed between the reverse osmosis system and the wastewater outfall to eliminate backflow concerns.
- ix. A revised National Pollutant Discharge Elimination System (NPDES) permit will be required to allow discharge of desalination concentrate to the MRWPCA outfall. The conditions of the permit have not been identified to date. Discharge of objectionable wastes/contaminants to the concentrate stream for disposal to MRWPCA outfall is not allowed.
 - (1) Minimum dissolved oxygen is expected to be a permit condition of discharge.
 - (2) Beach well water is likely to have low levels of dissolved oxygen.
 - (3) Aeration of concentrate is proposed downstream of reverse osmosis. Non-mechanical aeration by cascade or natural draft type tray aerators is preferred over mechanical aeration systems for reliability and assurance of permit compliance.

- (4) The California American Water Coastal Water Project Final EIR (2009) recommended aeration of the discharge to achieve a dissolved oxygen value of 5.0 mg/L to avoid a significant impact.
- x. Concentrate Equalization Lagoon Details
 - (1) Design and construction details shall comply with all regulatory requirements. Details presented below are not inclusive of all technical and regulatory requirements.
 - (2) Top of embankment shall be suitable for use as a service road, and shall be a minimum of 12 foot wide and designed to support the weight of service vehicles.
 - (3) Minimum freeboard of 3 feet is to be provided.
 - (4) Protect lagoon from surface runoff.
 - (5) Provide continuous level measurement with ultrasonic level monitor; provide high level switch to alarm.
 - (6) A double lined lagoon is required. Leak collection material between the two liners shall be designed to rapidly transmit liner leakage to a collection sump. Provide level switch on collection sump connected to alarm in SCADA. Provide sump pump and flow meter for measuring leakage.
 - (7) The primary liner shall be textured on the exposed side for personnel slip protection. Provide a means of emergency egress.
 - (8) Protect liner from wind uplift, oxidation and sharp objects.
 - (9) Liner penetrations are to be limited to the extent possible and reserved to areas above the lagoon freeboard to reduce the potential for leaks.
 - (10) Provide seepage collars; provide erosion protection at inlet
 - (11) Fence the lagoon. Provide gates for vehicles and personnel.

d. Dewatering of Settled Solids from Granular Media Filtration

- i. Settled solids from granular media filtration, and lime system blowdown, are to accumulate in the wastewater basins identified under Granular Media Filtration. The solids are to be periodically removed and then mechanically or non-mechanically dewatered and disposed of at a landfill. Dewatering is expected to occur once per year.
- ii. Power supply and water supply are to be provided to support contract dewatering.

11. PRODUCT WATER STABILIZATION

a. Purpose:

- i. The RO permeate will have different characteristics than water in the Owner's existing drinking water distribution system. RO feed water quality is very different than other sources used for drinking water and the RO process rejects more than 99 percent of constituents such as calcium, magnesium, sulfate, sodium, and chloride. RO product water has low hardness, alkalinity, and pH, and sodium and chloride are the principal ions. Water with these characteristics is associated with corrosion, the release of corrosion byproducts that can cause "red water" (drinking water with

elevated levels of iron causing a red or brown color and increased turbidity), and difficulty complying with the United States Environmental Protection Agency Lead and Copper Rule (LCR).

- ii. Minimizing the likelihood of these problems requires corrosivity to be reduced by adding calcium hardness and alkalinity to adjust the pH and stabilize the water and/or through the use of a corrosion inhibitor. The Owner's existing distribution uses orthophosphate for corrosion control, which is a capability that will be incorporated into the stabilization of the RO product water to conform to the Owner's current corrosion control practices. However, the RO product water stabilization system is also required to have sufficient corrosion control without orthophosphate to provide the Owner with the flexibility to modify its approach for corrosion control in its distribution system, using higher hardness and alkalinity and hardness and calcium carbonate saturation instead.

b. Water quality requirements for stabilized RO product water are shown in Attachment 3.

c. Acceptable Options for Post-Stabilization

- i. The Design-Builder shall ultimately be responsible for designing and constructing a product water stabilization strategy that can meet the range of water quality objectives listed in Attachment 3, meeting the LCR requirements, and not resulting in red water events. Two post-stabilization treatment strategies determined to be acceptable were hydrated lime addition and calcite contactors.
- ii. Calcite contactors have reduced operation and maintenance requirements compared to continuous lime feed but it must be demonstrated that they can provide the flexibility required and that large-scale experience is available.

d. Option 1 – Hydrated Lime System

- i. Hydrated lime dosing system:
 - Maximum flow to be treated: Refer to Section 2.
 - Range of hydrated lime dose: 30 to 74 mg/L as $\text{Ca}(\text{OH})_2$
 - Range of hydrated lime dose: 40 to 100 mg/L as CaCO_3
 - Range of hydrated lime consumption at maximum flow of 9.6 MGD: 2,370 to 5,925 lb/d as $\text{Ca}(\text{OH})_2$
 - Range of hydrated lime consumption at maximum flow of 6.4 MGD: 1,580 to 3,950 lb/d as $\text{Ca}(\text{OH})_2$
 - Minimum hydrated lime storage: 15 days
 - Hydrated lime slurry tank feed rate at 9.6 MGD flow: 99 to 247 lb/hr as $\text{Ca}(\text{OH})_2$
 - Hydrated lime slurry tank feed rate at 6.4 MGD flow: 66 to 165 lb/hr as $\text{Ca}(\text{OH})_2$

- Target hydrated lime slurry tank feed concentration: 8.0%
- Acceptable range for hydrated lime slurry tank feed concentration: $\pm 5\%$ of target concentration
- Hydrated lime slurry tank flow rate at 9.6 MGD: 3.1 to 7.7 gpm
- Hydrated lime slurry tank flow rate at 6.4 MGD: 2.1 to 5.2 gpm
- Source of water for hydrated lime system and saturators shall be from second pass RO permeate to minimize calcium carbonate formation.
- Minimum number of lime saturators: 2 duty
- Saturated limewater concentration: 1.8 g/L as $\text{Ca}(\text{OH})_2$ at 12°C
- Maximum turbidity of saturated limewater: 5 NTU
- Range of limewater flow rate at 9.6 MGD: 114 to 286 gpm
- Range of limewater flow rate at 6.4 MGD: 76 to 190 gpm
- Number of limewater flow equalization tanks: 2 duty
- Capacity of limewater flow equalization tanks for 9.6 MGD: 17,200 gallons, each
- Capacity of limewater flow equalization tanks for 6.4 MGD: 11,500 gallons, each
- The saturated lime dose will be controlled based on the flow rate (primary control variable) and trimmed on target alkalinity of the product water downstream (secondary control variable) using a PID feedback control loop.
- Cleanouts and flushing connections at all lime slurry and/or lime sludge pipeline transition points.
- Long radius elbows and fittings along the lime slurry and/or lime sludge pipelines.
- Vertical piping runs shall not be used for lime slurry and/or lime sludge pipelines.
- When feasible, provide flexible hose and quick disconnect fittings on lime slurry and lime sludge pipelines to facilitate replacement/cleanout of pipelines.
- Minimize aeration of lime solutions to prevent uptake of carbon dioxide and formation of calcium carbonate.

ii. CO_2 dosing system:

- The CO_2 dose will be controlled based on the flow rate (primary control variable) and trimmed on pH of the product water downstream (secondary control variable) using a PID feedback control loop.

- CO₂ needs to be added so chemical reactions and blending of the main flow of water with the limewater are completed and pH has stabilized before the pH measurement location that provides process control
- Minimum number of CO₂ storage tanks: 1
- Minimum storage capacity: 30 days (15 days/tank)
- Minimum number of vaporizers: 2
- Minimum number of vapor heaters: 2

e. Alternative to Option 1 –Lime Slurry System

- This alternative to a continuous hydrated lime feed system is an automated batching system.
- The Design-Builder is to provide pricing and scope for a Required Alternative using the RDP Tekkem system for preparing hydrated lime slurry.
- The RDP Tekkem system is to be designed to allow future upgrading to quick lime.
- Minimum design requirements:
 - (1) Batch Slurry Tanks: 2
 - (2) Aging Tanks: 1

f. Option 2 – Calcite Contactor System

- Calcite contactors:
 - Minimum empty bed contact time: 20 minutes
 - Turbidity must be ≤ 0.15 NTU for 95% of the time and ≤ 0.5 at all times.
 - Turbidity cannot exceed 0.25 NTU when limestone is being added to the calcite contactors.
 - There must be at least one standby calcite contactor.
 - CO₂ addition is required before the calcite contactors.
 - Caustic soda and CO₂ addition must be provided after the calcite contactors
- CO₂ dosing system:
 - The PID process variable for CO₂ addition after the calcite contactors is pH.
 - CO₂ needs to be added so chemical reactions are completed and pH has stabilized before the pH measurement location that provides process control.
 - Minimum number of CO₂ storage tanks: 1
 - Minimum storage capacity: 30 days (15 days/tank)
 - Minimum number of vaporizers: 2

- Minimum number of vapor heaters: 2
- iii. Caustic soda dosing system:
 - The PID process variable for caustic soda addition is pH.
 - Caustic soda needs to be added so chemical reactions are completed and pH has stabilized before the pH measurement location that provides process control.
 - Storage and Feed Requirements: See Chemical section.

12. DISINFECTION REQUIREMENTS

a. Source Water Characterization

- i. Disinfection requirements must be set prior to construction and startup of the treatment facilities. The proposed test well will not be sufficient for definitive water quality characterization. The USEPA Long Term 2 Enhanced Surface Water Treatment Rule (LT2 Rule) identifies disinfection requirements for surface water and groundwater under the direct influence of surface water.
- ii. The (2010) CDPH permit for the Sand City Water Treatment Plant set a precedent for how CDPH views disinfection requirements for seawater desalination and required the following disinfection criteria:
 - (1) LT2 Rule Bin Classification: 2
 - (2) Cryptosporidium Treatment, log: 4
 - (3) Giardia Treatment, log: 5
 - (4) Virus Treatment, log: 6
- iii. The CDPH permit for the Sand City Water Treatment Plant provides the following disinfection credits:
 - (1) RO membranes, with continuous demonstration of specific log reduction of conductivity:
 - (2) 2 log Giardia removal
 - (3) 2 log Cryptosporidium removal
 - (4) 2 log Virus removal
 - (5) UV Disinfection
 - (6) 3 log Giardia inactivation
 - (7) 3 log Cryptosporidium inactivation
 - (8) Free chlorine residual
 - (9) 4 log virus inactivation
- iv. A watershed survey and 24 months of monitoring for *Cryptosporidium* per the requirements of the LT2 Rule have not been performed.
- v. The Owner is presenting a source water characterization plan to CDPH in June 2013 with the goal of eliminating the need for UV disinfection.

- b. UV disinfection is to be designed, as outlined below. Based on the outcome of discussions with CDPH and future testing results, it may be possible to avoid constructing the UV disinfection facilities. Eliminating UV disinfection from the construction scope is a required alternative in Proposal Form 13B and 13C.
- c. **Disinfection Design Criteria –Case 1 (with UV disinfection)**
 - i. Design-Builder shall use Case 1 as the basis of design.
 - ii. Cryptosporidium Treatment Required: 4 log; meet with RO membranes (2 log) and UV disinfection (2 log)
 - iii. Giardia Treatment Required: 5 log; meet with RO membranes (2 log), chlorine disinfection (1 log) and UV disinfection (2 log)
 - iv. Virus Treatment Required: 6 log; meet with RO membranes (2 log) and chlorine disinfection (4 log)
- d. **Disinfection Design Criteria – Case 2 (without UV disinfection)**
 - i. Cryptosporidium Treatment Required: 2 log; meet with RO membranes (2 log)
 - ii. Giardia Treatment Required: 3 log; meet with RO membranes (2 log), chlorine disinfection (1 log)
 - iii. Virus Treatment Required: 6 log; meet with RO membranes (2 log) and chlorine disinfection (4 log)

13. UV DISINFECTION

- i. Design in accordance with the USEPA UV Design Guidance Manual (2006).
- ii. Provide minimum 2 log inactivation of Giardia and *Cryptosporidium*
- iii. Validation of UV reactor performance reactors must have been previously validated off-site in accordance with USEPA requirements identified in the UV Design Guidance Manual (2006). CFD analysis is not a substitute for validation.
- iv. Maximum Flow: 11.2 MGD for 9.6 mgd design capacity
- v. Process Location: Downstream of RO membranes; upstream of post-stabilization
- vi. Number of Reactors: N+1
- vii. UV Lamp Technology: Low pressure high output (LPHO) or medium pressure lamps
- viii. Identify special lamp requirements (limits on starts per day, etc)
- ix. Identify cooling requirements (startup or shutdown).
- x. Identify mass of mercury in one lamp, one reactor, all reactors.
- xi. Identify startup and shutdown requirements and timing
- xii. Identify intensity sensor verification and calibration methods

- xiii. Minimum UVT: 95% transmittance
- xiv. Submergence: UV lamps shall be inherently submerged at all times by the location within the hydraulic gradeline.
- xv. Power Supply: The Design-Builder shall provide uninterrupted power supply (“UPS”); UPS to provide 10 minutes of ride through upon power failure for UV reactors, controls, and instrumentation. The UPS is to be provided with a remote maintenance by-pass switch to allow isolation of the unit for servicing and testing. UPS status is to be monitored through SCADA
- xvi. Flow Distribution and Measurement: Each UV reactor shall be paired with a magnetic flow meter to document flow through UV reactor.
- xvii. UV Dose Control Strategy: Control strategy shall minimize power consumption through monitoring of UV transmittance and flow rate.
- xviii. UV Transmittance Monitoring: Provide an on-line UV transmittance monitor with appropriate sample delivery/conditioning system
- xix. Start-up and Shutdown Sequence: CDPH typically requires that flow cannot enter/leave a UV reactor until the minimum dose, intensity and UV treatment performance levels are reached on startup. Provide an automated startup shutdown sequence that is in accordance with CDPH requirements as well as UV supplier requirements. Provide a “bumpless” sequence that allows for the spare UV unit to be brought on-line and an on-line unit to be taken out of service. The 10% off-spec water allowance in the LT2SWTR for UV treatment is not allowed by CDPH. Automatic plant shutdown, in a controlled fashion, is required if the UV reactor(s) fails to achieve any UV performance standards for more than 15 (fifteen) consecutive minutes.
- xx. Housing: UV reactors, associated electrical supply equipment, and instrumentation shall be protected from the weather inside a building.
- xxi. Spare Parts: Provide two year’s worth of spare parts. Spare parts shall include but not be limited to UV lamps, UV sensors, quartz sleeves, seals, ballasts, fuses.
- xxii. Extended Warranty and Service Contract: Provide extended warranty and service contract for one year after the Project warranty. Provide a minimum of 12 service visits over the one year Project warranty period and the extended warranty period.
- xxiii. Operating Cost Analysis of UV System
 - For the UV system selected by the Design-Builder, provide an economic analysis of operating and maintenance costs in Proposal Forms 13B and 13C, and in the Design Memorandum/Basis of Design Report. Economic evaluation shall include O&M requirements for sleeves, ballasts, sensors and lamps. The following financial and process assumptions are to be used:
 - (1) Period: 20 years
 - (2) Inflation rate: zero percent
 - (3) Electrical costs: \$0.10 per kWhr
 - (4) Discount Rate: 5%

- (5) UVT: 95% Transmittance
- (6) Labor Cost: \$40 per hour

14. FINISHED WATER STORAGE

- i. Finished Water storage is an important plant asset and serves multiple functions.
- ii. Disinfection: To achieve 1 log inactivation of *Giardia* using a free chlorine residual, the minimum volume is 615,000 gallons (assumes: 9.6 mgd rate of flow; 1.2 mg/L free chlorine residual, pH=8.0, baffling factor = 0.5; and temperature = 10 deg C).
- iii. CT compliance is based on the highest flow, minimum clearwell/tank level, lowest chlorine residual, lowest temperature, and highest pH value recorded for each day.
- iv. Tank Number, Volume, and Operation: Two tanks, each sized at 750,000 gallons; tanks shall operate in series.
- v. Operation with One Tank out of Service: Tanks must be taken out of service for inspection, cleaning, and maintenance. When operating with only one tank in service, operational adjustments may be required to provide reliable disinfection, including increasing chlorine residual, decreasing flow, and operating within a more narrow level band.
- vi. Tank Type:
 - (1) Above Ground: Steel (AWWA D100 Standard for Welded Steel Tanks for Water Storage) or Concrete (AWWA D 110 Standard for Wire and Strand-Wound, Circular, Prestressed Concrete Water Tanks)
 - (2) Below Ground: Concrete cast-in-place
- vii. Level Controls: Provide continuous level and independent high level switch for alarm in each tank
- viii. Drain: Provide method to drain each tank without creating a cross-connection
- ix. Access: Provide at least two points of access to each tank. Access is to be secure.
- x. Overflow: Provide overflow at maximum capacity. Provide overflow secure from tampering.
- xi. Vents: Provide vents appropriately sized for inlet/outlet flows; Vents are to be screened, highly corrosion resistant, and secure against tampering.

15. SALINAS VALLEY DESALINATED WATER RETURN PUMPING AND CONVEYANCE

a. General Design Criteria:

- i. Convey a portion of the desalinated product water to the Salinas Valley groundwater basin via the Castroville Seawater Improvement Project (CSIP). The Finished Water is to be pumped from the Finished Water storage tanks through a proposed 1.2-mile-long, 12-inch-diameter Salinas Valley return pipeline to the existing CSIP pond at the southern end of the MRWPCA regional wastewater treatment plant. The CSIP pond

has a storage capacity of 80 acre-feet. From the CSIP pond, water is to be delivered to agricultural users in the Salinas Valley through existing infrastructure.

b. Pumping Equipment:

- i. Provide two (2) pumps to deliver Finished Water.

c. Capacity:

- i. Capacity of each pump shall be 1.2 mgd ; head conditions are expected to be 30 feet or less.

d. Type of Pump:

- i. End suction pump

e. Capacity Control:

- i. Provide variable frequency drives for variable speed operation.

f. Housing:

- i. Pump may be located outdoors. Electrical equipment shall be located in secure building located near the pumps.

g. Flow Metering:

- i. Provide one (1) flow meter with input to SCADA.

h. Water Quality Monitoring:

- i. Provide analyzers for conductivity.

i. Appurtenances:

- i. Valves, checkvalves; provide electrically actuated shutoff butterfly valve to isolate pump from finished water storage upon pump shutdown. Provide air gap at discharge to eliminate backflow concerns.

16. FINISHED WATER PUMPING AND PRESSURE TRANSIENT CONTROL

- i. General Design Criteria: Four Finished Water pumps providing a minimum capacity of 9.6 mgd with the largest capacity unit out of service.
- ii. Number of Pressure Gradients Served: 1
- iii. Gradient Served: Monterey
- iv. Distribution System Hydraulic Grade Line at Project Site: (all values preliminary)
 - (1) Maximum: 425 feet

- (2) Pumping head assuming finished water storage elevation of 120 feet
 - (3) 305 feet plus plant piping and valve losses
- v. Number of Pumps: Four (4)
- vi. Housing: Pumps may be located outdoors. Electrical gear is to be housed in a secure building located near the pumps.
- vii. Pump Capacity: Pumps shall be provided in two capacities. The highest capacity pumping units shall be sized at 50% of plant rated capacity (each) while the two smaller units shall be sized at 25% of plant rated capacity (each). Pump rating shall be at the maximum head anticipated.
 - (1) Provide sufficient electrical capacity to allow any three pumps (including two largest pumps) to operate concurrently.
- viii. Type of Pump:
 - (1) Horizontal split case centrifugal if finished water storage is above ground. Vertical orientation of split case pump is not allowed.
 - (2) Vertical turbine type pump if finished water storage is below ground.
- ix. Pump Starters and Controls:
 - (1) The two larger pumps shall be constant speed with soft-starters.
 - (2) The two smaller pumps shall be equipped with adjustable frequency drives.
- x. Finished Water Flow Meters:
 - (1) Provide flow meter on each of the two small pumps.
 - (2) Provide one (1) common flow meter.
- xi. Pump Control Valve:
 - (1) For each pump, provide rubber seated ball valve with hydraulic (water) actuator to provide two speed closure. Size for up to 14 fps full open velocity. Normal slow closure time shall be identified in hydraulic transient study. Emergency fast close time shall be identified in the hydraulic transient study. Provide manually operated butterfly type isolation valve downstream of pump control valve.

b. Hydraulic Transient Control:

- i. Perform evaluation of hydraulic transient conditions and identify recommended control devices at the treatment plant and along transmission pipeline. For the purpose of the proposal, provide one 25,000 gallon hydropneumatic tank(s) with appurtenances on discharge of finished water pumping station.

c. Design for Maintenance:

- i. Provide concrete slab and unobstructed access to pump and pump motor with mobile A-frame gantry. Provide one A-frame gantry and manual chain fall rated for largest pump and pump motor.

d. Appurtenances:

- i. Design shall include all necessary appurtenances including but not limited to air release valves, pressure gages and motor controls and protection devices.

17. YARD PIPING AND VALVES

- a. Yard piping and valves is defined as piping and valves outside of structures.
- b. No yard piping is allowed within 25 feet of primary electrical service transformers or switchgear.

c. Finished Water

- i. Finished Water piping may be ductile iron pipe, steel, or HDPE. Ductile iron pipe is generally preferred on the treatment Project Site.
- ii. Ductile Iron Pipe shall be Class 52 on the Project Site.
- iii. Valves less than 12 inch pipe size shall be resilient seated gate valves; valves 12 inches and larger shall be butterfly type;
- iv. Valves shall open LEFT.
- v. Valves shall be provided with valve box and lid. A concrete collar shall be poured at the top of the valve box. A stainless steel valve identification tag shall be embedded in the concrete collar listing the Valve ID, type of valve, and number of turns.

d. Permeate

- i. Permeate piping shall be HDPE pipe below grade and 304L stainless steel above grade. Provide HDPE pipe. Valves shall be as listed for Finished Water.

e. Raw/Saline water – Below ground, less than 100 psi: HDPE

f. CIP waste – Double wall CPVC underground

g. Chemicals

- i. Liquid chemicals shall be run underground within flexible PVC tubing, or other type tubing or hose compatible with the specific chemical. The tubing or hose shall be run within a HDPE carrier pipe providing support and secondary containment. Each HDPE pipe shall have only one length of tubing to allow for ease of replacement. Chemical piping/tubing shall be run together, to the extent possible, and the HDPE carrier piping is to be encased in concrete. The HDPE carrier piping is to be intentionally sloped to pull boxes. Pull boxes, constructed of pre-cast concrete, shall be located no less than 100 ft intervals along the route of the piping. Each pull box shall be equipped with a level sensor to detect chemical leakage. Splices in tubing are to be minimized. Where splices are necessary, they shall be made within a pull box. The top of pull boxes shall be above ground to prevent surface water entry, and shall

be equipped with lockable aluminum hinged access door. Door frame drain shall be piped to a dry well.

18. PROCESS PIPING AND VALVES

- i. Process piping is generally defined as the piping within structures. Piping and valves shall be NSF 61 listed.
- ii. Pipe Schedule is shown in Table 3

Table 3 Preliminary Pipe Schedule

Duty	Example	Below Grade/Buried	Joints	Above Grade	Joints
Saline Water (<100 psi)	Raw Water, Concentrate	HDPE		FRP	Flanged, glued
Saline Water (>200 psi)	RO High Pressure Pump Discharge	n/a		Superduplex	Flanged, welded, grooved
Permeate	Permeate	HDPE		316SS	Welded Flanged Grooved
RO Flush				316SS	Welded Flanged Grooved
Permeate Following Stabilization		DIP		DIP	Flanged (above ground)
Finished Water		DIP		DIP	Flanged (above ground)

b. Preliminary Valve Schedule

- i. Saline Water (< 100 psi): Butterfly; Nylon coated steel butterfly
- ii. Saline Water (> 100 psi): Plug; Superduplex
- iii. Permeate: Butterfly; Nylon coated steel butterfly
- iv. Permeate Following Stabilization:
 - (1) Isolation: Resilient Seated Gate Valve < 12 inch
 - (2) Isolation: Butterfly Valve \geq 12 inch
- v. Finished Water (same as permeate following stabilization)

c. Chemical Piping

- i. Generally, CPVC above ground
- ii. Tru-union type ball valves
- iii. Butterfly valves close coupled to bulk storage tanks for isolation

19. GENERAL PUMPING EQUIPMENT REQUIREMENTS

a. Introduction

- i. This section provides general guidance on desired pump station design, construction, and operation features. Specific information on each pumping stage is presented elsewhere. This section does not address chemical pumping.
- ii. Pumping information described below is to be included in the BODR as the design progresses.
- iii. Pumping design is to follow Hydraulic Institute standards.
- iv. A system head curve is to be prepared for each pumping stage. The proposed pump performance shall be shown against the system head curve.
- v. Pumping with a suction lift is undesirable.
- vi. Pump design and selection, including valve design and selection, is to consider life-cycle costs.
- vii. Pump layout must consider space for maintenance and removal of pump, motor, valves and instrumentation.
- viii. Emergency stop pushbuttons are to be provided (locally) at each pump.
- ix. Materials of selection are to be suitable for production of potable water. Materials of construction are to prevent dezincification.
- x. Rated capacity shall be achievable with the largest unit out of service.
- xi. Variable speed drives are to be used/applied judiciously where energy savings are real, or process conditions require variable capacity.
- xii. Mechanical seals are preferred

b. Pump Station Design

- i. Hydraulic design information such as system head curves, pump operating curves, net positive suction head ("NPSH"), hydraulic calculations, transient analysis and surge control, and other pertinent information is to be presented in the BODR as the design progresses.
- ii. Flow Velocities
 - (1) Maximum allowable suction velocity shall be 5 fps
 - (2) Maximum allowable discharge velocity shall be 14 fps

c. Piping and Pipe Joints

- i. Pipe materials shall be suitable for the fluid and pressure conditions. Pipe materials are specified elsewhere. Pipe joints shall allow disassembly for pump repair and replacement, and future piping modifications.
- ii. Piping and valves are to be supported independently of the pump.
- iii. Fittings for differential settlement shall be provided where differential settlement is a concern.

d. Vibration Control

- i. Causes of vibration include:
 - (1) Poor suction conditions
 - (2) Poor alignment
 - (3) Air entrainment
 - (4) Radial thrust
 - (5) Pump operation at conditions outside the manufacturer's limits
 - (6) Pump not installed properly
 - (7) Pump base too small
 - (8) Pump in poor condition
- ii. To minimize vibration and resonance, Design-Builder shall:
 - (1) Properly design suction and discharge piping
 - (2) Select a pump that operates within a stable range to prevent cavitation
 - (3) Select a mounting pedestal, floor or inertial block, of sufficient mass, typically five times greater than the mass of the pump
 - (4) Require, and provide, level installation of the pump base and anchor bolts, and dynamically balanced pump
 - (5) Specify vibration amplitude that is no more than 75% of the limits set by Hydraulic Institute standards.
 - (6) Specify unit responsibility and a single manufacturer for all pump components
- iii. Pump Characteristic and System Head Curves
 - (1) The Design-Builder shall identify and present system head curves and pump performance curves for minimum flow, maximum flow, and expected average flow conditions. Assumptions for pipe roughness shall be stated. Curves for efficiency, NPSH and BHP shall be presented.
 - (2) The Design-Builder shall carefully review and confirm that:
 - (3) The pump characteristic curve is not "flat" where a small change in total dynamic head results in a large change in pump flow.
 - (4) The operating point on the system curve, for prevailing operating conditions is near the maximum efficiency point (optimally just to the right of this point) of the pump characteristic curve. The maximum efficiency point is also known as the best efficiency point.

- (5) The pumps can operate, even with compromised efficiency, for both minimum and maximum operating conditions.
- (6) The pump/impeller combination is located near the center of the pump operating curve to allow modifying the pump with a different impeller to change pump performance. The maximum diameter impeller shall not be selected for a pump housing unless no other alternative is possible.
- (7) The NPSH available shall be calculated and presented for maximum flow and maximum temperature operating conditions (pumps operating alone, and together). The NPSHA shall be compared to the NPSHR of the selected pumps at maximum flow conditions. The NPSHR shall be less than the NPSHA under all conditions with a reasonable margin of safety, not less than 6 feet. Streams with high entrained air/gas require special attention.
- (8) The following calculations shall be made per Hydraulic Institute methods for pumping equipment.
- (9) Pump specific speed, N_S ;
- (10) Suction specific speed, N_R
- (11) Available specific speed, N_A
- (12) Available specific speed shall be greater than suction specific speed
- (13) Available specific speed shall be less than 8500

20. ROTATING EQUIPMENT MONITORING

a. Pumps and motors that are 200 hp or above are to be equipped with temperature and vibration data collection systems as described below.

b. Temperature:

- i. Motor windings, motor bearings, and pump bearing temperatures are to be continuously monitored through 100 ohm platinum RTD's and input to Schweitzer Engineering Laboratories ("SEL") devices provided for power monitoring and motor protection. Values are to be available for trending and monitoring through the California American Water Business Network.

c. Vibration:

- i. Vibration data is to be gathered and made available for off-site analysis through the internet.
- ii. Online vibration data collection system is to be provided based on multichannel continuous processor. Locate processors in a suitably protected area. Provide enclosures suitably rated for the environment in which they are installed.
 - (1) Manufacturer: Ludeca
 - (2) Model: Vibnode
 - (3) Dynamic Range: 96dB 16 bit A/D converter
 - (4) Frequency Range: 2-1000 Hz
 - (5) Frequency Resolution 3200 lines
 - (6) RPM Tracking

- (7) Measurement Functions: Fast Fourier Transform (FFT), Time signal, High frequency envelope FFT, overall values, narrow and broadband alarms, process parameters
- (8) Band Analysis: 12 bands per spectrum
- (9) High Frequency Enveloping: Band pass filters for low, medium and high speed machines
- (10) Digital Output: for external trigger
- (11) Analog Output: 4-20 ma
- (12) Digital Input: 5-30 volt
- (13) Ethernet Capable
- (14) License: Provide licenses for each processor as needed
- iii. Power supply: provide 15 minute UPS on power supply to multichannel processor and monitoring devices.
- iv. Protect multichannel processors and monitoring devices from electric transients including lightning
- v. Analysis Software
 - (1) Provide OMNITREND software by Ludeca
 - (2) Band Analysis capable
 - (3) Narrowband and broadband alarm capable
 - (4) Real time overall values
 - (5) Email alarm capable
 - (6) Built in reporting features
 - (7) Web based for remote access
 - (8) Built in Fault Frequency Markers
- vi. Local Personal Computer for display of overall vibration levels and alarm notifications
 - (1) Processor: 4G RAM; 2.5 GHz
 - (2) USB and Ethernet ports
 - (3) 24 inch monitor
- vii. Tachometer – Inductive type; vendor to be Ludeca. Device shall be suitable for outdoor installation.
- viii. Accelerometers- provide the number and type needed for the specific application. Vendor to be CTC. Coordinate accelerometer installation with pump vendor. Install accelerometers per California American Water's recommendations. Device shall be suitable for outdoor installation.
 - (1) Vertical pumping systems require a minimum of five (5) measured points each.
 - (2) Single stage horizontal split case pumps require ten (10) measured points each.
 - (3) Accelerometer Mounting:
 - (4) Remove paint and mount transducer on flat metal surface. Stud mount preferred. Epoxy mounted pads to be used where stud mounting is not possible.
 - (5) Mount on bearing housing in location with best available direct path to bearing and shaft vibration.

- (6) Two accelerometers shall be mounted at two perpendicular planes on each bearing housing. One accelerometer per machine shaft mounted parallel to the axis of rotation.
- ix. Cabling: Cables from sensors to multi-channel monitor shall be of the type and length with connectors needed for each application. Cables shall be provided by CTC. Cables shall be installed in conduit where physical protection is needed.
- x. Device Driver : Provide the device driver for the Project Site.
- xi. On-site Commissioning: Provide a minimum of 2 days of on-site startup service with Ludeca application engineer.

21. CHEMICAL SYSTEMS

a. Overview of Chemical Systems

- i. Lime, calcite, and carbon dioxide requirements are addressed in Section 11 Post-Stabilization.
- ii. Clean in place chemicals are to be addressed by the Design-Builder. Secondary containment and other safeguards are to be provided in accordance with the design features for other chemicals on this project.
- iii. Chemicals addressed in this section are listed below. Tabulation of chemical dosages and storage volumes are included in Attachment 12.
 - (1) Sodium Hypochlorite (liquid) for chlorination
 - (2) Ferric Chloride (liquid) for coagulation
 - (3) Sodium Bisulfite (liquid) for quenching chlorine residual
 - (4) Sulfuric Acid (liquid) for pH adjustment prior to cartridge filters
 - (5) Threshold Inhibitor (liquid) to inhibit scale formation in RO membranes
 - (6) Non-Ionic Polymer (dry or emulsion) for settling of granular media wastewater
 - (7) Sodium Hydroxide (liquid) for pH adjustment
 - (8) Phosphoric Acid (liquid) for corrosion control
- iv. Design of liquid chemical systems shall comply with the intent of American Water Engineering Standard T2 (see Attachment 1) to contain leaks and spills, prevent unintentional overfeed, and provide prudent process control.
 - (1) Day tanks are to be provided where bulk storage is provided and where process control(s) cannot insure overfeed protection, with the exception of dilute sodium hypochlorite.
 - (2) Secondary containment of the liquid chemical delivery area is to be provided to capture leakage from delivery trucks. Containment volume shall be 125% of a full bulk delivery.

b. Sodium Hypochlorite

- i. Chlorine equivalent dose
 - (1) Raw Water, mg/L: min, avg, max: 0.5, 2, 3

- (2) Spent Filter Backwash Storage, mg/L: min, avg, max: 0.5, 1, 1.5
(3) Post Treatment, mg/L; min, avg, max: 1, 1.5, 2
- ii. Sodium hypochlorite shall be generated onsite using electrolytic equipment. Equipment sizing shall be based to provide sufficient capacity 3 ppm dose to Raw Water and 2 ppm dose to Finished Water.
 - iii. Number of Units: Provide three 500 ppd units. Provide sufficient power supply to allow operation of three (3) units concurrently.
 - iv. High quality salt shall be delivered in bulk, transferred pneumatically, and stored in dissolvers to create a brine supply to the generation equipment.
 - v. Provide two (2) salt dissolvers with usable capacity of 23 tons each.
 - vi. Salt dissolvers may be located outdoors; provide secondary containment curbing to capture leaks.
 - vii. Provide low hardness reverse osmosis permeate as supply water to brinemakers and to generators.
 - viii. Provide online conductivity meter, reading in percent NaCl, to monitor the brine concentration in the feed to the generators.
 - ix. Locate generators in a room separate from hypochlorite storage and feeders.
 - x. Provide redundant hydrogen in air monitors in generation and hypochlorite storage rooms.
 - xi. Provide two (2) dilute sodium hypochlorite storage tanks. Each tank shall be sized at approximately 6500 gallons.
 - xii. Hypochlorite storage tanks shall be installed within a concrete secondary containment, located within a secure building. A means must be provided to readily replace storage tanks with either a roof hatch or removable wall section.
 - xiii. Sodium hypochlorite storage tanks shall be high density cross linked polyethylene HDXLPE type with a fixed medium density linear polyethylene lining, or FRP.
 - (1) For HDXLPE Tanks, tank outlet shall be IMFO type for complete drainage. Tanks shall be supplied by Poly Processing. Tank shall be NSF 61 listed. Provide 5 year warranty on sodium hypochlorite tanks. All polyprocessing recommended appurtenances shall be provided. Coordinate tank procurement with EJ Monahan, Coastal Technical Sales: 215-628-1965.
 - xiv. Provide capability to receive bulk sodium hypochlorite (12.5%) in both tanks should the generators not be operating. Provide a manual adjustable dilution panel to continuously dilute bulk hypochlorite to 0.8 percent for storage in the second storage tank.
 - xv. Feed of the dilute hypochlorite solution to the application point shall be by use of sealless magnetic drive gear pumps with variable speed capacity control.
 - xvi. Provide two units for Raw Water dosing (one duty, one spare), and two units for post-treatment dosing (one duty, one spare).

- xvii. Feed Control: Control modes shall be local manual, remote manual, remote flow pace, and remote compound loop with chlorine residual.

c. Ferric Chloride

- i. Product: Liquid form; 40% concentration
 - (1) Specific Gravity: 1.4
 - (2) Viscosity (75 deg):
- ii. Application Points
 - (1) GMF Inlet
- iii. Dose (min, avg, max), mg/L: 2,3,5
- iv. Bulk Storage
 - (1) Bulk Storage Tanks, Number: One (1)
 - (2) Bulk delivery Volume: 3,800 gallons
 - (3) Bulk Storage Volume Criteria (minimum): 1.5 x bulk delivery volume
 - (4) Bulk Storage Tank Volume : 5,700 gallons
 - (5) Bulk Tank Material: HDXLPE or FRP
 - (6) Bulk Tank Nozzles: Fill, outlet, vent, overflow, level sensor (ultrasonic), high level switch
 - (7) Bulk Tank Outlet Valves: Butterfly with lever actuator; electric actuator on ball valve
- v. Day Tank (if needed)
 - (1) Day Tanks, Number : One (1)
 - (2) Day Tank Capacity: <300 gallons
 - (3) Nozzles: Fill, outlet, overflow, level sensor (ultrasonic), high level switch, metering pump return
 - (4) Day tank to be weighed to provide loss-in-weight tracking to measure actual dose and provide alarm on insufficient feed to protect membranes from free chlorine residual.
- vi. Transfer Pumps (if needed)
 - (1) Number of pumps required: Two (2) - one duty, one reserve
 - (2) Number of pumps operating concurrently: one (1)
 - (3) Type: magnetic drive sealless centrifugal
 - (4) Approximate Flow Rate: 50 gpm
 - (5) Control: Local Panel for control; push to run pump; open/close bulk tank isolation valve; select transfer pump; bulk tank and day tank level display
- vii. Metering Pumps
 - (1) Number of pumps required per application point: Two (2)
 - (2) Type of Pump:
 - (3) Diaphragm metering pumps
 - (4) Anticipated Discharge Pressure: < 30 psi

viii. Piping

- (1) Bulk Tank to Day Tank to Metering Pump: CPVC
 - (2) Discharge of Metering Pump: CPVC above ground;
 - (3) Below Ground Piping: Reinforced flexible PVC tubing inside secondary HDPE containment pipe.
- ix. Continuous Dilution Water (post metering pump): Provide continuous dilution water to improve dispersion at point of application; provide 0.5-2.0 gpm

d. Sodium Bisulfite

i. Product: Liquid form; 38% concentration

- (1) Specific Gravity: 1.33
- (2) Viscosity (75 deg)

ii. Application Points

- (1) GMF discharge
- (2) Concentration Discharge

iii. Dose (TBD)

iv. Bulk Storage

- (1) Bulk Storage Tanks, Number Required: One (1)
- (2) Bulk delivery Volume: 4,000 gallons
- (3) Bulk Storage Volume Criteria (minimum): 1.5 x bulk delivery volume
- (4) Bulk Storage Tank Volume : 6,000 gallons
- (5) Bulk Tank Material: HDXLPE or FRP
- (6) Bulk Tank Nozzles: Fill, outlet, vent, overflow, level sensor (ultrasonic), high level switch
- (7) Bulk Tank Outlet Valves: Butterfly with lever actuator; electric actuator on ball valve; See detail

v. Day Tank (if needed)

- (1) Day Tanks, Number Required: One (1)
- (2) Day Tank Capacity: <200 gallons
- (3) Nozzles: Fill, outlet, overflow, level sensor (ultrasonic), high level switch, metering pump return
- (4) Day tank to be weighed to provide loss-in-weight tracking to measure actual dose and provide alarm on insufficient feed to protect membranes from free chlorine residual.

vi. Transfer Pumps (if needed)

- (1) Number of pumps required: Two (2) - one duty, one reserve
- (2) Number of pumps operating concurrently: one (1)
- (3) Type: magnetic drive sealless centrifugal
- (4) Approximate Flow Rate: 25 gpm

- (5) Control: Local Panel for control; push to run pump; open/close bulk tank isolation valve; select transfer pump; Bulk tank and day tank level display

vii. Metering Pumps

- (1) Number of pumps required per application point: Two (2)
- (2) Type of Pump: Diaphragm metering pumps
- (3) Anticipated Discharge Pressure: < 30 psi

viii. Piping

- (1) Bulk Tank to Day Tank to Metering Pump: CPVC
- (2) Discharge of Metering Pump: CPVC above ground;
- (3) Below Ground Piping: Reinforced flexible PVC tubing inside secondary HDPE containment pipe.

- ix. Continuous Dilution Water (post metering pump): Provide dilution water to improve dispersion at point of application; provide 0.5-2.0 gpm from UV disinfected permeate water supply.

e. Sulfuric Acid (50%)

- i. Product: Liquid form; 50% concentration

- (1) Specific Gravity: 1.4
- (2) Viscosity (75 deg)

- ii. Application Points

- (1) GMF Filtered Water

- iii. Dose (min, avg, max) mg/L, 5, 10, 30

- iv. Bulk Storage

- (1) Bulk Storage Tanks, Number Required: One (1)
- (2) Bulk delivery Volume: 3,800 gallons
- (3) Bulk Storage Volume Criteria (minimum): 1.5 x bulk delivery volume
- (4) Bulk Tank Recommended Volume : 10,000 gallons
- (5) Bulk Tank Material: XLHDPE or FRP
- (6) Bulk Tank Nozzles: Fill, outlet, vent, overflow, level sensor (ultrasonic), high level switch
- (7) Bulk Tank Outlet Valves: Butterfly with lever actuator; Electric actuator on ball valve; See detail

- v. Day Tank (if needed)

- (1) Day Tanks, Number Required: One (1)
- (2) Day Tank Capacity: 500 gallons
- (3) Nozzles: Fill, outlet, overflow, level sensor (ultrasonic), high level switch, metering pump return

- vi. Transfer Pumps (if needed)

- (1) Number of pumps required: Two (2) - one duty, one reserve

- (2) Number of pumps operating concurrently: one (1)
- (3) Type: magnetic drive sealless centrifugal
- (4) Approximate Flow Rate: 50 gpm
- (5) Control: Local Panel for control; push to run pump; open/close bulk tank isolation valve; select transfer pump; bulk tank and day tank level display ; transfer pump to shutoff on full level

vii. Metering Pumps

- (1) Number of pumps required per application point: Two (2)
- (2) Type of Pump: Diaphragm metering pumps
- (3) Anticipated Discharge Pressure: < 30 psi

viii. Piping

- (1) Bulk Tank to Day Tank to Metering Pump: CPVC
- (2) Discharge of Metering Pump: CPVC above ground;
- (3) Below Ground Piping: Reinforced flexible PVC tubing inside secondary HDPE containment pipe.

- ix. Continuous Dilution Water (post metering pump): Provide dilution water to improve dispersion at point of application;

f. Threshold Inhibitor

- i. Product: Liquid form; 100% concentration

- (1) Specific Gravity: 1.25
- (2) Viscosity (75 deg):

- ii. Application Points

- (1) Inlet to First Pass RO
- (2) Inlet to Second Pass RO

- iii. Dose (min, avg, max), mg/L: 2,3,6

- iv. Bulk Storage

- (1) Bulk Storage Tanks, Number Required: One (1)
- (2) Bulk delivery Volume: 4200 gallons
- (3) Bulk Storage Volume Criteria (minimum): 1.5 x bulk delivery volume
- (4) Bulk Storage Tank Volume : 6,300 gallons
- (5) Bulk Tank Material: HDXLPE or FRP
- (6) Bulk Tank Nozzles: Fill, outlet, vent, overflow, level sensor (ultrasonic), high level switch
- (7) Bulk Tank Outlet Valves: Butterfly with lever actuator; Electric actuator on ball valve.

- v. Day Tank (if needed)

- (1) Day Tanks, Number Required: One (1)
- (2) Day Tank Capacity: <150 gallons

- (3) Nozzles: Fill, outlet, overflow, level sensor (ultrasonic), high level switch, metering pump return
 - (4) Provide weigh scale to track loss-in-weight of day tank. Loss-in-weight is a safeguard to identify feed failure that could cause scaling of membranes.
- vi. Transfer Pumps (if needed)
 - (1) Number of pumps required: Two (2) - one duty, one reserve
 - (2) Number of pumps operating concurrently: one (1)
 - (3) Type: magnetic drive sealless centrifugal
 - (4) Approximate Flow Rate: 25 gpm
 - (5) Control: Local Panel for control; push to run pump; open/close bulk tank isolation valve; select transfer pump; Bulk tank and day tank level display
- vii. Metering Pumps
 - (1) Number of pumps required per application point: Two (2)
 - (2) Type of Pump: Diaphragm metering pumps
 - (3) Anticipated Discharge Pressure: < 30 psi
- viii. Piping
 - (1) Bulk Tank to Day Tank to Metering Pump: CPVC
 - (2) Discharge of Metering Pump: CPVC above ground;
 - (3) Below Ground Piping: Reinforced flexible PVC tubing inside secondary HDPE containment pipe.
- ix. Continuous Dilution Water (post metering pump): Provide to improve dispersion at point of application; provide 0.5-2.0 gpm

g. Non-Ionic Polymer

- i. Product: Liquid (emulsion) form; 35% concentration
 - (1) Specific gravity: 1.1
 - (2) Viscosity (75 deg):
- ii. Application Points
 - (1) GMF wastewater clarification
- iii. Dose (TBD)
- iv. Bulk storage – none; provide storage for 5 gallon pails (within secondary containment)
- v. Batch tank and feed tank (over under configuration)
 - (1) Prepare batches manually
 - (2) Transfer (by gravity) to feed tank
- vi. Metering Pumps
 - (1) Number of pumps required per application point: Two (2)
 - (2) Type of Pump: peristaltic tubing pump

- (3) Anticipated Discharge Pressure: < 30 psi
- vii. Piping
 - (1) Bulk tank to day tank to metering pump: CPVC
 - (2) Discharge of metering pump: CPVC above ground;
 - (3) Below ground piping: Reinforced flexible PVC tubing inside secondary HDPE containment pipe.
- viii. Continuous Dilution Water (post metering pump): Provide dilution water to improve dispersion at point of application; provide 0.5-2.0 gpm

h. Sodium Hydroxide

- i. Product: Liquid form; 50% concentration
 - (1) Specific gravity: 1.4
 - (2) Viscosity (75 deg):
- ii. Application Points
 - (1) RO second pass
 - (2) Finished Water for stabilization
- iii. Dose
 - (1) RO Second Pass (min, avg, max) mg/L: 5, 10, 20
 - (2) Finished Water (min, avg, max) mg/L : 2,3,5
- iv. Bulk Storage
 - (1) Bulk Storage Tanks, Number Required: one (1)
 - (2) Bulk Delivery Volume: 3500 gallons
 - (3) Bulk Storage Volume Criteria (minimum): 1.5 x bulk delivery volume
 - (4) Bulk Storage Tank Volume : 5,200 gallons
 - (5) Bulk Tank Material: Steel
 - (6) Bulk Tank Nozzles: Fill, outlet, vent, overflow, level sensor (ultrasonic), high level switch
 - (7) Bulk Tank Outlet Valves: Butterfly with lever actuator; electric actuator on ball valve;
- v. Day Tank (if needed)
 - (1) Day Tanks, Number Required: One (1)
 - (2) Day Tank Capacity: <200 gallons
 - (3) Nozzles: Fill, outlet, overflow, level sensor (ultrasonic), high level switch, metering pump return
- vi. Transfer Pumps (if needed)
 - (1) Number of pumps required: Two (2) - one duty, one reserve
 - (2) Number of pumps operating concurrently: One (1)
 - (3) Type: Magnetic drive sealless centrifugal
 - (4) Approximate Flow Rate: 25 gpm

- (5) Control: Local panel for control; push to run pump; open/close bulk tank isolation valve; select transfer pump; bulk tank and day tank level display

vii. Metering Pumps

- (1) Number of pumps required per application point: Two (2)
- (2) Type of Pump: Diaphragm metering pumps
- (3) Anticipated Discharge Pressure: < 30 psi

viii. Piping

- (1) Bulk Tank to Day Tank to Metering Pump: CPVC
 - (2) Discharge of Metering Pump: CPVC above ground;
 - (3) Below Ground Piping: Reinforced flexible PVC tubing inside secondary HDPE containment pipe.
- ix. Continuous Dilution Water (post metering pump): Provide dilution to improve dispersion at point of application; provide 0.5-2.0 gpm from UV disinfected permeate (low hardness) water supply.
- x. Other: Provide low power density (external) heating of tanks; provide insulation jacket to maintain temperature of not less than 80 deg F in tanks. Pipe insulation is not required.

i. Zinc Orthophosphate/Phosphoric Acid Corrosion Inhibitor

- i. Product: Liquid form; zinc orthophosphate (5:1 ratio of PO₄ to Zn); Future conversion to phosphoric acid
- (1) Specific Gravity of Zinc Orthophosphate: 1.4
 - (2) Percent Phosphate: 32.5%
 - (3) Specific Gravity of Phosphoric Acid (75%): 1.57
 - (4) Percent Phosphate:
- ii. Dose (as PO₄) Min = 0.5 mg/L; Average = 1.0 mg/L; Maximum = 4.0 mg/L
- iii. Bulk Storage
- (1) Bulk Storage Tanks, Number Required: One (1)
 - (2) Bulk delivery Volume: 3700 gallons (zinc orthophosphate)
 - (3) Bulk Storage Volume Criteria (minimum): 1.5 x bulk delivery volume
 - (4) Bulk Tank Material: HDXLPE or FRP
 - (5) Bulk Tank Nozzles: Fill, outlet, vent, overflow, level sensor (ultrasonic), high level switch
 - (6) Bulk Tank Outlet Valves: Butterfly with lever actuator; electric actuator on ball valve; See detail
- iv. Day Tank (if needed)
- (1) Day Tanks, Number Required: One (1)
 - (2) Day Tank Capacity: <200
 - (3) Nozzles: Fill, outlet, overflow, level sensor (ultrasonic), high level switch, metering pump return

v. Transfer Pumps (if needed)

- (1) Number of pumps required: Two (2) - one duty, one reserve
- (2) Number of pumps operating concurrently: one (1)
- (3) Type: magnetic drive sealless centrifugal
- (4) Approximate Flow Rate: 25 gpm
- (5) Control: Local Panel for control; push to run pump; open/close bulk tank isolation valve; select transfer pump; bulk tank and day tank level display

vi. Metering Pumps

- (1) Number of pumps required: Two (2)
- (2) Type of Pump: Solenoid driven diaphragm pumps
- (3) Anticipated Discharge Pressure: < 30 psi

vii. Piping

- (1) Bulk Tank to Day Tank to Metering Pump: CPVC
- (2) Discharge of Metering Pump: CPVC above ground;
- (3) Below Ground Piping: Reinforced flexible PVC tubing inside HDPE secondary containment pipe

viii. Continuous Dilution Water (post metering pump): provide dilution water flow of 0.5-2.0 gpm

22. ARCHITECTURE

a. General

- i. CAW has partnered with the College of Architecture and Environmental Design of California Polytechnic State University to prepare a conceptual design of site layout, building arrangement, building features, landscaping, and xeriscaping. The students will present their recommendations to CAW and the Governance Committee on June 13, 2013 and again on August 1, 2013 with a final report due August 8, 2013. The final report along with desired features and/or goals identified by CAW and the Governance Committee will be issued to Design Builders via an addendum.
- ii. The architectural design shall be developed in character, style, form, color and materials to harmonize effectively with the surrounding environment.
- iii. Height of Structures: The Design-Build Improvements should be kept as low in profile as is functionally possible, Where appropriate, the design shall de-emphasize verticality and encourage the grounding of planar elements of the Design-Build Improvements into the natural landscape. Low, horizontal site walls, berming, and the use of sloping wall planes shall be considered in achieving balance.
- iv. Avoid Reflective Exterior Finishes: Visible and highly reflective materials and surface finishes shall be avoided on the exterior of the Design-Build Improvements.
- v. Exterior Walls: The use of low maintenance indigenous materials such as masonry and concrete for the exterior walls of the Design-Build Improvements is encouraged. The use of surface textures and horizontal banding of harmonious colors are some of

the techniques to be considered in blending the Design-Build Improvements with its environment. Material coloration should be achieved through the use of integral coloration rather than applied coloration such as paint.

- vi. Roofs: The design of roof systems shall be carefully developed to harmonize with the visual context of the Design-Build Improvements. Where flat roofs are appropriate, they shall be predominately hidden by parapet walls. Where pitched roofs are desired, consideration shall be given to selecting, pitch, materials, and coloration to harmonize with surroundings. Highly reflective roof materials shall not be visible from adjacent properties. Mansard and jogging roof lines shall be employed only when appropriate to the setting. The use of securable skylights for natural lighting is encouraged where feasible.
- vii. Windows: Where windows are appropriate to the design, they shall be selected carefully for energy efficiency, acoustic characteristics, and security. Glazing systems are designed to avoid light leakage to adjacent as direct glare or reflected glare from sunlight. Glass tinting and window frame colors shall be chosen for their consistency with the palette of materials and colors selected for the Design-Build Improvements.
- viii. Exterior Insets, Grills, Trim and Accents: Insets, grills, trim material, and accents shall be employed judiciously and only where necessary or appropriate for compatibility with adjacent structures. Insets, grills, trim, and accents shall be consistent with the color palette chosen for the facility and shall avoid bold, strong, or reflective colors.
- ix. Exterior Doors and Frames: Door and frame colors shall be compatible with the wall surface in which they are located.
- x. Exterior Lighting: Lighting shall satisfy functional and security needs while not creating light pollution in the form of point sources of direct glare visible from a distance. Lighting shall be sensitive to the privacy of adjacent land uses. Fixtures shall be carefully selected for efficiency, cutoff, consistent lamp coloration throughout the project, and effectiveness in delivering only the light necessary to the task, while avoiding unnecessary spill lighting beyond site boundaries. Low level light fixtures that light immediate areas are encouraged.
- xi. Natural Lighting: Natural lighting of building interiors in the form of skylights and clerestory windows is encouraged.
- xii. Equipment and Service Areas: All mechanical and electrical equipment should be located and screened from public view.
- xiii. Materials of Construction: Construction materials and methods are established and defined in terms of their physical appearance and overall visual effect in harmonizing with the surrounding environment, their emergence from the basic structural system, and their appropriateness in accommodating the deployment of mechanical and electrical systems within the facility. Materials used in the construction of the Design-Build Improvements shall conform in composition and application to all applicable regulations, including those concerning volatile organic

content, lead, mercury, CFCs and asbestos. Materials used for the roofing system and the building perimeter envelope shall be established for optimum durability over the full range of climatic variations typical to the region.

b. Anticipated Structures:

- i. The major structures listed below are anticipated. Some facilities/buildings may abut others.
 - (1) Administration Facilities
 - (2) Reverse Osmosis Building
 - (3) Chemical Storage and Feed Building
 - (4) UV Disinfection Building
 - (5) Filter Building
 - (6) Electrical Switchgear Buildings

c. Administration Facilities

- i. The administration facilities include visitor reception area, control room, laboratory, offices, locker rooms, restrooms, and maintenance area. These facilities are to be provided on a single level adjacent to the RO systems.
- ii. All administration facilities are to be in compliance with all Applicable Law, including the Americans with Disabilities Act.
- iii. Security Concern: Separate visitors from secure process
 - (1) Facility layout shall keep areas available to public tours and visitors separated from process areas.

d. Visitor reception / Exhibits

- i. An area suitable for public access and viewing of exhibits related to water supply, treatment, distribution and conservation, shall be provided. The area shall be approximately 600 sf in size.
- ii. Separate restrooms (one male, one female) shall be provided for visitors. Each restroom shall be provided with sink, mirror, toilet, and waste receptacle.

e. Offices

- i. Plant Manager – 150 sf; including small conference table with four chairs; four (4) four drawer file cabinets for records
- ii. Operation and/or Maintenance Supervisor– 120 sf each;
- iii. Offices shall be secured.

f. Cubicles for Clerks

- i. Provide two (2) cubicles for clerk type work; (50 sf each)

g. Restrooms and Locker Rooms

- i. Provide separate locker room and restrooms for personnel.
- ii. Male Locker Room: Provide 10 metal lockers with 12 inch width and 6 ft height; bench; double sink and countertop; two urinals, one toilet; shower.
- iii. Female Locker Room: Provide 5 metal lockers with 12 inch width and 6 ft height; bench, double sink and countertop; two toilets; shower.
- iv. Finishes: Tile floor.

h. Conf Room

- i. Provide conference room suitable for 12 people.
- ii. Provide ceiling mounted computer projector
- iii. Provide electric coiled projection screen

i. Break Room

- i. Purpose of the break room is to provide access to kitchenette and assemble for training.
- ii. Break room shall be sized for 12 seated persons
- iii. Provide kitchenette with sink, microwave oven, and 25 cf refrigerator/freezer. No stove top shall be provided.
- iv. Provide 8 lf of countertop and cabinetry
- v. Provide 46-inch flat screen monitor/television for training

j. Laboratory and Storage Room

- i. A process control laboratory suitable for wet chemistry testing shall be provided sized at approximately 200 sf with 25 lf of countertop and casework.
- ii. Metal casework
- iii. Bacteriological testing will not be performed at this site
- iv. Provide storage room for supplies, sample boxes, DI water supply, upright freezer/refrigerator (125 sf)
- v. Safety eyewash and shower
- vi. Dishwasher
- vii. Provide a sample sink for continuously flowing samples of plant effluent, filtered saline water, Finished Water tank inlet. Recycle wastewater from the sample sink to the plant inlet.
- viii. Provide a sanitary sink with hot/cold water; discharge to sanitary sewer following acid neutralization tank.

- ix. Ventilation Hood – not required
- x. Deionized Water supply – provide replaceable tank system
- xi. Provide desk area suitable for computer use, and four (4) filing drawers

k. Maintenance Shop

- i. Provide a 240 sf area for maintenance.
- ii. 20 lf of workbench
- iii. No welding will be performed
- iv. Provide overhead door to allow vehicle access.
- v. Provide compressed air supply (5 hp compressor and 80 gallon receiver)

l. Equipment and Tool Storage

- i. Locked room with shelving (80 sf)
- ii. Locked fenced area for larger equipment/tools (150 sf)

m. Control Room

- i. Control Room shall be suitable for two persons working concurrently. Control room shall be adjacent to laboratory. Control room shall be provided with viewing panels to allow views of the RO units and also allow public views into the control room. Control room shall be secured. (300 sf)

n. Secured Telecom Room

- i. Provide secured telecom room for location of computer servers and telecom access panels (150 sf).

o. Janitorial Room

- i. Provide janitorial room with water supply and sink, storage of mop bucket, mops, brooms, buffer, and maintenance supplies. (40 sf)

p. File and Drawing Room

- i. Provide secured room for storage of files, 24 x 36 flat file drawings, maps, and catalogs (125 sf)

q. Copier, printer area in coordination with Clerk Area

- i. Provide open area for location of copier, printer, and associated office machines. Provide 5 foot long work table or counter.

r. RO Building

- i. Materials of construction for the walls and roof shall be identified by the Design-Builder.
- ii. Electrical equipment such as switchgear and large motor starters shall be located in a room separate from the RO trains and piping.
- iii. RO piping shall be run in grated trenches to provide ready access to the RO systems. Trenches shall be sized to allow access to piping, pipe connections, and pipe supports for inspection, repair, and replacement. Grating shall be aluminum or FRP.
- iv. Provide an overhead door to allow pumps, RO membranes, and other equipment to be removed/replaced.
- v. Center hallway should be adequately sized for a forklift and scissors lift to allow for maintenance and replacement of RO membranes.

s. Chemical Building

- i. Liquid chemicals shall be stored in a building to provide security and protection of tanks, pumps, piping, and ancillary devices from the elements.
- ii. Generally, each chemical is to be located in a separate room to provide corrosion protection and avoid the potential of mixing of incompatible chemicals.
- iii. Each room requires lighting and HVAC.
- iv. Secondary containment is to be provided for liquid chemical storage. The preferred approach is for the floor of each chemical room to be depressed relative to a central hallway to provide sufficient secondary containment. The chemical equipment (tanks, metering pumps, etc) are located on the lower level. Stairs provide access from the central hallway to the lower level of each room.
- v. Certain non-hazardous chemicals, such as polymers, may be located in a common area. Secondary containment is to be provided with a depressed (two to four inches deep) area covered with FRP grating flush with the surrounding floor.
- vi. Fire suppression is to be provided per local requirements.

t. UV Disinfection Building

- i. The UV reactors, flow meters, and associated valves and piping are to be housed in a secure building. Electrical equipment is to be located within a room separate from the UV piping.
- ii. Design-Builder is to identify materials of construction for walls and roof. Floor shall be concrete.

u. Filter Building

- i. The filter valves and actuators for the granular media filters are to be protected within a building.

- ii. Design-Builder is to identify materials of construction for walls and roof. Floor shall be concrete.

v. Electrical Buildings

- i. Significant electrical equipment such as motor starters (greater than 10 hp), motor control centers, and switchgear, shall be located indoors. Suitable lighting, ventilation, and security shall be provided. Generous access is desired to meet or exceed arc flash space requirements.

23. GEOTECHNICAL AND STRUCTURAL DESIGN

- a. Design-Builder and design professional(s) shall be guided by the local, State, and federal building codes that are appropriate for the Design-Build Improvements. For cast-in-place concrete process structures, design shall be performed in accordance with ACI 350-Code Requirements for Environmental Engineering Concrete Structures.
- b. Design-Builder shall identify dead loads and live loads for all structures
- c. Design-Builder and design professional(s) shall develop foundation designs and building designs based on Project and Project Site requirements. The BODR is to be updated with the structural design approach as it is developed through preliminary and detailed design.
- d. Geotechnical Investigation: Proposer is to submit the plan for geotechnical investigation along with the Proposal in accordance with Section 4 of the RFP.

e. Seismic Design

- i. Seismic considerations should apply to every building system, subsystem and component including electrical systems, piping systems, and water treatment processes. The Design-Builder is expected to develop a unified and cross-discipline approach within the design team to meet the Owner's expectations for seismic performance of the Design-Build Improvements. The assignment of roles and responsibilities is critical if the performance objectives are to be adequately defined and for integrated seismic design and construction to be achieved.
- ii. The intent of this section is to convey to the Design-Builder the expectations of the Owner on the performance of the Design-Build Improvements during and following earthquakes. It is expected that the expectations will be further developed during design with input from the Owner.
- iii. The following objectives for this Project are adapted from FEMA 389 Communicating with Owners and Managers of new Buildings on Seismic Risk – Chapter 8 Design and Performance Issues Relating to Light Manufacturing Facilities.
 - (1) Protection of building occupants is a very high priority
 - (2) Building occupancy is relatively low. Visitors are typically low in number, and infrequent, but groups of visitors can be expected to tour the facility.

- (3) Ensuring the survival of costly and difficult to replace equipment is an important concern
- (4) Closure or non-operation of the Design-Build Improvements for an extended period represents a serious water supply problem
- (5) Tilt-up construction: A number of failures of tilt-up structures occurred during the 1995 Northridge earthquake near Los Angeles. Changes to the wall anchorage requirements were introduced in the 1997 *Uniform Building Code*.
- (6) The Design-Builder may need to go beyond the minimum code requirements to achieve the desired building performance.
- (7) Continued operation is particularly dependent on nonstructural components and systems. These include electrical systems and chemical systems. Protection against significant chemical spillage is desired during an earthquake.
- (8) Recent earthquakes have caused a high level of nonstructural damage, particularly to ceilings and lighting. This type of damage is costly and its repair is disruptive. Responsibility within the design team for nonstructural component support and bracing design should be explicit and clear.
- (9) Performance Expectations and Requirements
- (10) Persons within and immediately outside facilities must be protected at least to a life-safety performance level during design-level earthquake ground motions.
- (11) Building occupants should be able to evacuate buildings quickly and safely after the occurrence of design level ground motions.
- (12) Emergency systems in the facility should remain operational after the occurrence of design level earthquake ground motions.
- (13) Emergency workers should be able to enter the building immediately after the occurrence of design level earthquake ground motions, encountering minimum interference and danger.
- (14) Key equipment should be protected from damage.
- (15) Large tanks holding chemicals, saline water, and Finished Water should remain operable. Flexible connections to piping should be provided to prevent damage at tank connections.
- (16) There should be no significant release of treatment chemicals to the environment as a result of the occurrence of design-level earthquake ground motions.
- (17) Finished Water stored in the clearwells/Finished Water tanks should be able to be pumped to the distribution system using purchased power or standby generator immediately following a design level earthquake.
- (18) Another means of conveying the Owner's expectations with respect to seismic risk is provided in the checklist tables below. These checklists are adapted from FEMA 389 – Chapter 12.

Table 4 - Earthquake Performance of Structures

	Damage			
Seismic Shaking	No Life Threat,	Repairable Damage:	Repairable Damage; No	No Significant

Hazard Level	Collapse	Evacuation	Evacuation	Damage
Low				√
Moderate			√	
High		√		

Table 5 Earthquake Performance of Nonstructural Components

	Damage			
Seismic Shaking Hazard Level	No Life Threat, Collapse	Repairable Damage: Evacuation	Repairable Damage; No Evacuation	No Significant Damage
Low				√
Moderate			√	
High		√		

Table 6 Function Continuance: Structural/Nonstructural

	Time to Reoccupy and Restart Facility			
Seismic Shaking Hazard Level	6 Months +	To 2 Months	To 2 Weeks	Immediate
Low				√
Moderate			√	
High		√		

Notes:

Seismic Shaking Hazard Level	Spectral Acceleration (Short period or 0.2 sec)	Spectral Acceleration (long period or 1.0 sec)
Low	<0.167 g	< 0.067 g
Moderate	≥ 0.167 g and < 0.50 g	≥ 0.067 g and < 0.20 g
High	≥ 0.5 g	≥ 0.2 g

24. HVAC SYSTEM

- i. The design of HVAC systems shall be based on site and process specific conditions. Design-Builder is to identify weather and design conditions. Design-Builder is to

identify codes to be followed in the design of HVAC systems. Energy efficiency shall be considered in design of HVAC systems.

- ii. The administration areas are to be air conditioned and provided with heat to control temperature and humidity. Thermostats are to be provided in each room for local control. Design-Builder shall identify the equipment and systems to be provided.
- iii. Ventilation is outdoor air brought into a building to maintain the space temperature, control moisture, replace exhaust air, protect building components, and remove indoor pollutants.
- iv. Equipment is to be located where it can be readily and safely maintained.
- v. Electrical rooms will be provided with air ventilation system to control temperature to within electrical manufacturer limits. Air conditioning is not universally required for electrical rooms. Design-Builder shall identify ventilation and temperature control design criteria.
- vi. Rooms with large pumping units, and heat rejection, shall have appropriately sized makeup air ventilation system. Provide unit heaters for freeze protection. Design-Builder shall identify design criteria.
- vii. Chemical storage and feed rooms require year round ventilation. Low rate continuous ventilation shall be provided. High rate ventilation shall be provided for each chemical room triggered by 1) high temperature, 2) personnel entry, and 3) operator manual initiation. Operator need not enter the room to initiate high rate ventilation. Heat shall be provided as required to maintain minimum temperatures.
- viii. Onsite hypochlorite generation process generates hydrogen gas. The hydrogen gas is vented outdoors. Only under unusual conditions would hydrogen gas enter the building. It is proposed that with the combination of hydrogen gas detectors and continuous ventilation, that explosion proof electrical system is not necessary.
- ix. Ventilation design shall limit noise to non-objectionable levels.
- x. Ductwork material shall be appropriate for the conditions.
- xi. Installation and support of all HVAC systems shall be coordinated with other disciplines, including seismic design.

25. PLUMBING

- a. **Plumbing systems include domestic cold and hot water, sanitary, vent, natural gas, laboratory de-ionized water supply and laboratory waste handling, and includes in-plant service water, and in-plant permeate water supply. Plumbing also includes water supply to micro-irrigation system.**
- b. **Plumbing for potable systems must be lead-free in accordance with California Health and Safety Code Sections 116875-116880 and federal Public Law 111-380 that takes effect in January 4, 2014.**

c. Domestic Hot and Cold Water, Nonpotable Water, and Pressure Drain Piping

- i. Above Grade: Piping must be Type L hard drawn copper tubing, ASTM B88, with wrought copper solder type fittings conforming to ANSI B16.22, or cast copper alloy solder joint fittings conforming to ANSI B16.18, or cast copper alloy flanged fittings Class 150 conforming to ANSI B16.24. Screwed joints in piping are restricted to pipe sizes 2" and smaller.
 - (1) Copper or Bronze Pressure-Seal Fittings: Copper or bronze housing, factory-installed Ethylene Propylene Diene Terpolymer sealing element, 200 pounds per square inch (psi) working pressure with a 0 to 250°F temperature rating. ASME B16.18 and B16.22, ASTM B88, and D 2000. Rigid ProPress™, or Stadler-Viega, or NIBCO® INC
- ii. Below Grade: Type K copper tubing must be used. When piping is installed within a building and within or under a concrete slab, it must be installed without joints. Where joints are unavoidable, they must be brazed.
 - (1) Protective pipe covering must be factory- or field-applied according to manufacturer's written instructions.
 - (2) 2½ Inches and Larger: Products must be Polyken® No. 1027 primer and Polyken No. 930-35 tape coating, 35 mil, 21kV dielectric strength, as manufactured by Tyco adhesives, Corrosion Protection Group. Minimum one-inch overlap required.
 - (3) 2 Inches and Smaller: Products must be 27 MIL plastic sleeve-protector. LSP® Products Group, Plasti-Sleeve or equivalent.

d. Soil, Waste, Drain, and Vent Piping: Cast iron soil pipe, fittings, and connections must comply with CISPI guidelines

- i. Below Grade: Piping must be service weight hub and spigot (with gasket) coated cast iron and must conform to ASTM A74.
- ii. Above Grade: Piping must be Schedule 40, galvanized steel pipe, ASTM A53, with threaded, galvanized cast iron Durham drainage fittings, ANSI B16.12; or drain-waste-vent (DWV) copper pipe with solder joint DWV wrought copper fittings; or service weight hub-spigot (with gasket) coated cast iron pipe and fittings conforming to ASTM A74; or hubless cast iron pipe and fittings conforming to CISPI 301.

e. Backflow prevention:

- i. The domestic water system is to be protected with a single reduced pressure zone (RPZ) type backflow preventer.
- ii. Potable water supply to process facilities is to be protected with RPZ backflow preventers in parallel.
- iii. Bypass of a RPZ device is not allowed.
- iv. RPZ devices are not to be installed in below grade pits.

- v. RPZ devices can discharge water at a high rate. Suitable drains and curbs are to be provided to minimize potential for flooding. Funnels may not be adequate.
- vi. Pressure indicators are required upstream and downstream of RPZ devices.
- vii. Hose bibs are to be equipped with vacuum breakers to prevent back-siphonage.
- viii. The design of continuous dilution water for chemical systems is to prevent backflow and contamination of in-plant water system.

f. Metering:

- i. A high degree of metering of water consumption is desired to carefully monitor water use within the facility. Plant service meters are to be integrated with SCADA to allow continuous monitoring and reporting of in-plant water consumption. Where loss of water supply cannot be tolerated, a meter bypass piping and valves are to be provided to allow for meter changeout and testing.

g. Tempered Water System:

- i. A tempered water system is required to supply emergency eyewash and emergency showers. The tempered water system shall be designed to provide tempered water quickly after activation of the eyewash/shower valve. Long branches of piping with untempered water are not acceptable. Drains shall be provided to carry away eyewash or shower water. Tempered water systems shall be designed in accordance with the latest version of American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1). The design and installation guidance in Appendix B, provided with the Standard, are to be followed. Electric instantaneous heaters are undesirable due to high electric demand.

- h. Water hammer arrestors are to be provided where solenoid valves are installed.**
- i. Sanitary sewer is not available. A septic system is to be provided for sanitary wastes.**
- j. Saline waste streams are not to be sent to septic system.**
- k. Sanitary drainage system is to be coordinated with process elements so that drains are located in appropriate locations.**
- l. Floor drains are not permitted in chemical secondary containment areas.**
- m. Each lavatory is to include a floor drain.**
- n. Sump pumps in critical locations are to be duplex type with high level alarm to SCADA.**
- o. Process wastes such as continuous sample streams, are to be recycled or sent to process waste handling rather than discharged to sanitary. Sample streams are not to be discharged onto the floor.**
- p. A laboratory de-ionized water system is required with a single tap in the laboratory.**

26. ELECTRICAL SYSTEM

a. Introduction

- i. The conceptual electrical equipment sizes and configurations presented in this document are preliminary and are meant to convey the expected features of the Work. The Design-BUILDER shall be responsible to evaluate the overall power system loading in selecting appropriate electrical service and distribution to provide the final design required.
- ii. A power factor of 0.93 or greater is desired for the Design-Build Improvements when operating at design capacity.
- iii. See Attachment 6 for suggested electrical equipment manufacturers
- iv. See Attachment 7 for basic electrical materials and design criteria to be included in the design of the Design-Build Improvements.
- v. See Attachment 8 for power system study requirements. This study is to be performed during design to help optimize power system performance and minimize arc flash hazards. Submittals as outlined are to be included during the design phases associated with the Project. Final adjustments and record document modifications are to be included in the final study prior to printing and labeling of the equipment by the Engineer.
- vi. Major electrical loads include:
 - (1) Filtered feedwater pumping
 - (2) RO high pressure pumping

(3) Finished Water pumping

b. Electrical Service

- i. It is anticipated that the treatment plant will be powered from a single Utility service utilizing the existing 13.2 KV in the area to supply two (2) 5 MVA (*preliminary sizing only; final sizing to be developed by Design-Builder*), (55/65/65 C rated), liquid-cooled (non-flammable), 13.2 KV (WYE) to 4160 V (WYE) substation transformers (provided by the Design-Builder).
- ii. This service to be Utility metered as a single service application under this proposed scope of work. These transformers are to be protected with pad-mounted, outdoor 15 KV fusible disconnect switches unless it is determined medium voltage (MV) 15 KV circuit breakers are otherwise required.
- iii. It is expected that each of the (13.2 KV / 4160 VAC) service transformers, feeders, and breakers will be sized to have the following capacities:
 - (1) Each transformer, feeder, and breaker can supply approximately 100% of plant capacity at a plant rated capacity of 6.4 MGD.
 - (2) Each transformer, feeder, and breaker can supply approximately 65% of plant capacity at a plant rated capacity of 9.6 MGD.
 - (3) Each transformer, feeder, and breaker can supply approximately 50% of plant capacity at a plant rated capacity of 12.8 MGD.

c. Medium Voltage Switchgear

- i. From the outdoor electrical service transformers, 4,160 VAC is to be extended via concrete-encased conduit ductbanks into 5 KV rated MV circuit breaker switchgear located within a building. Automated transfer control of the main-tie-main arrangement is to be incorporated into the operational design requirements; initiated through the SCADA system but capable of being fully automated in the future should dual Utility services eventually be developed.
- ii. The high pressure pump motors will be supplied power at 4,160 volts from MDS-1.

d. Alternate Electric Service:

- i. Additionally, manual (key-interlocked) provisions are to be included to allow future utilization of an alternate 5 KV power supply from the adjacent landfill power generation system on one side of MDS-1. It is anticipated that the alternate supply would not be sufficient for the entire facility at all times, but may be capable of supplying a portion of the facility.
- ii. Standby Electric Generator – It is expected the standby electric generator will supply power to the 480 volt bus that supplies Finished Water pumps and other loads. Standby electric generator design criteria is presented in another section.
 - (1) Provide a central control and metering/monitoring system to sequence and properly interlock the proposed generator with the switchgear and loads.

e. Supply to Filtered Water Feedwater Pumps and Finished Water Pumps

- i. Power from this MV switchgear (MDS-1) is to be routed via concrete-encased ductbanks to two (2) outdoor, dry-type, cast-coil transformers; (4,160 VAC – 480Y277 VAC). From these transformers, provide concrete-encased ductbanks and cabling to a low voltage, main-tie-main, 480 VAC switchboard assembly (MDS-2) to supply power to Finished Water pumping equipment, filtered water feedwater pumping equipment, and other 480 volt loads. This switchboard to utilize draw-out, power circuit breakers for the main-tie-main and molded-case solid-state trip circuit breakers to supply the sub-distribution to the various loads and motor controllers in this building.
- ii. Manual transfer control (normal power situations only) of the main-tie-main is to be incorporated into the operational design requirements; initiated through key-interlocks on the circuit breakers. Regardless, these main breakers are to be electrically operated in developing an automatic transfer control associated with the 480 VAC standby power generator. It is intended that the standby power source be used in energizing one side of the double-ended switchboard assembly to allow limited operational capabilities in the event of a Utility power failure as well as for load-testing of the generator unit. Selection of which automated transfer interface will be utilized is to be provided through SCADA along with manual selection via a three-position selector switch on the switchboard assembly.
 - (1) Local building power (480/277 and 208/120 VAC) to be developed within the building(s) as required to serve support system loads. It is proposed that general power / lighting loads be separated from instrumentation and sensitive electronic equipment loads by means of providing separate step-down transformers; electrostatically isolated for “clean-power” loads / conventional for general power and lighting equipment.
 - (2) Surge protective devices (UL-1449, Rev 3 Listed/Labeled) are to be provided on panels serving “clean-power” systems.

f. Owner Metering and Protective Relays

- i. Power quality meters (SEL 735) with fiber optic communications to the SCADA system shall be utilized for monitoring the utility service parameters. Feeder protection relays (SEL 751A and medium voltage motor protective relays (SEL 710) where applicable, shall also be interfaced using dualport, fiber optic communications.
- ii. Each RO high pressure pump motor shall be monitored with an appropriate SEL device and ancillary sensors to monitor power consumption data in real time. Power consumption and other electrical parameters shall be monitored through SCADA.
- iii. Each pumping stage (Raw Water, filtered feedwater, and Finished Water) shall be monitored with an appropriate SEL device and ancillary sensors to determine the power consumption for the pumping stage (not the individual pump). Power consumption and other electrical parameters shall be monitored through SCADA.

27. STANDBY POWER

- i. Standby power shall be provided with a diesel fueled generator
- ii. Standby power shall be provided to power the following loads:
 - (1) any one (1) Finished Water pump (including largest capacity pump)
 - (2) administration facilities,
 - (3) interior and exterior lighting
 - (4) sump pumps
 - (5) RO flush pumps,
 - (6) instrumentation,
 - (7) compressed air supply for valve actuators,
 - (8) security systems
 - (9) critical valves
- iii. Genset shall start automatically upon loss of power. Interlock with facility switchgear.
- iv. Provide double wall fuel storage tank with 24 hours run time at full load.
- v. Provide SCADA monitoring of genset performance
- vi. Genset is to installed such that it can be tested under load on a routine basis
- vii. Noise control shall comply with local ordinances and codes.
- viii. Provide stairs as required to access controls and equipment
- ix. Provide UL 2200 listed packaged genset
- x. Provide walk-in sound attenuated, weatherproof enclosure, designed to reduce noise levels to less than 75 dBA @ 23 feet at 100% load, or local criteria whichever is more stringent. Super critical grade exhaust silencer mounted internally in enclosure. Genset and enclosure to be IBC rated for local wind and seismic conditions. Provide corrosion protection against salt in air corrosion.
- xi. Provide Pritchard Brown Sound Attenuating, Weather Proof Genset Enclosure as described in Pritchard Brown Specification No. 2130. Allow Owner to select color at no additional cost to Owner.
- xii. Provide synchronous, four pole, brushless generator, 105 deg temperature rise
- xiii. Factory test at 0.8 lagging power factor
- xiv. On-site test with load bank at 0.8 lagging power factor

28. CONTROL STRATEGY OVERVIEW

- i. Design Builder is to identify control strategies for the following unit processes:
 - (1) Beach Wells
 - (2) Granular Media Filtration Pretreatment and Break Tank
 - (3) Cartridge Filters
 - (4) Reverse Osmosis – Startup, Operation, Shutdown

- (5) Reverse Osmosis Clean in Place
- (6) Post Treatment and Stabilization
- (7) Finished Water Storage and Pumping
- (8) Chemical Storage and Feed
- (9) Concentrate Disposal

29. PROCESS CONTROL

a. Design Builder is to identify sample points, analyzers, and points of chemical addition.

i. Chemical Addition

(1) Sample points

- 1. Continuous
- 2. Grab

(2) Continuous analyzers

- 1. Flow requirements
- 2. Disposal

30. INSTRUMENTATION AND CONTROL

- i. The treatment and pumping facilities shall be operated through a distributed instrumentation and control system (the “DCS”), also termed SCADA, allowing for automated and manual control of the overall system, subsystems, and individual pieces of equipment. Control logic will be distributed throughout the control network and will be designed in a manner to allow sub-systems to operate independently of communications to other PLCs and computers. The HMI computers are to be used for monitoring and operator input only; all control logic is to reside within the PLCs. The HMI software is to be designed in a redundant configuration so that loss of a single computer does not interrupt operator monitoring or control. Two databases will be maintained for historical data, alarm history, and SQL information.
- ii. The Design-Builder shall procure the services of a single process control system supplier and integrator (the “Integrator”) to furnish and install the process control system.
- iii. System Architecture: The process control system for the proposed facility shall consist of PLCs located in all major process areas communicating via fiber optic cable to a WTP central control and monitoring facility located in the administration facilities.

b. PLCs:

- i. Process controllers shall be Allen Bradley – Logix Series. All OEM Equipment requiring controllers shall also be Allen Bradley.

- ii. PLC Cabinets: Include compact lighting fixture activated by a door switch. Each PLC shall have a UPS. PLCs shall be located indoors in a controlled environment with fans and heaters wherever possible. PLCs located outdoors shall have outdoor rated enclosures (NEMA 4X, SS) with sunshades, thermostatically controlled heaters and cooling.
- iii. Network: PLCs are to be interconnected using an ethernet network. Network connections between buildings will be through ethernet to fiber converters and fiber optic cables. A self-healing fiber optic ring will be created to maintain a high degree of reliability in the control network.
- iv. Keypads: No keypads shall be used; OITs are preferable. Provide a touch-screen type operator interface unit on suitable cabinet.
- v. Terminal Blocks: multilevel terminal blocks are permitted
- vi. Spare Wired Terminals: Provide a minimum of 20% of each I/O type in each cabinet.
- vii. Convenience Receptacles: Puse ground-fault interrupter type or RVSS as applicable to the installation.
- viii. Separation of Power Cable and Signal Wires: 120VAC control cable shall be physically separated from 4-20 ma signals and 24 volt cabling as much as practicable inside control cabinets; provide barriers for compliance with ISA standards. Field wiring into the control panel, including junction boxes, shall be labeled as per the P&ID drawings (not wiring numbers).
- ix. Number of I/O slots: As required plus minimum 20% spare
- x. 3 Wire Control of Motors: Required for all motor driven equipment; consisting of one normally-closed contact for stop and one normally-open contact for start, etc, except for chemical metering pumps.
- xi. Modulating valves: Analog control with full open and full closed feedback or open/closed control with position feedback and full open and full closed feedback.
- xii. Fieldbus valve control and communication is not permitted.
- xiii. Analog inputs shall be 4-20 ma; discrete inputs shall be 24 VDC. Isolated dry relay contacts shall be furnished for all discrete outputs-relays may be integral to the I/O module. Interposing relays shall be furnished in cases where the I/O module relay contacts do not have adequate electrical ratings.
- xiv. I/O modules: provide high density I/O modules
- xv. Arc Flash Safety: Instrumentation is to be separated from power in separate enclosures. 480 volt starters shall not be located within instrumentation enclosures.

c. Uninterruptible Power Supply (UPS):

- i. A central UPS power supply shall be furnished to serve the control room personal computers, printers and server room, switches, routers, firewalls and other network equipment. The UPS equipment shall include a static bypass switch along with a

separate maintenance bypass switch to fully isolate the unit for maintenance and/or replacement.

- ii. The bypass feed shall be provided with transient voltage surge suppression and shall be served from a shielded isolation transformer to provide “clean power” to this system.
- iii. Provide the UPS equipment with IP communication to the HMI for status and alarm reporting. Minimum reporting shall include alarms for overload, equipment over temperature, low batter, load on bypass and load transferred to the maintenance bypass.
- iv. All PLCs and analyzers containing programming shall be powered from individual UPS units provided with each enclosure. UPS’s for PLCs and field analyzers shall be mounted in the PLC panels as applicable. AC power source to be provided from normal/standby power system.
- v. UPS Power Duration; The UPS shall provide a minimum of 15 minutes of backup power.

d. Operator Interface Hardware and Software

- i. HMI shall be ICONICS Genesis 32
- ii. LAN Connection: shall be provided in all control panels using 8 port DIN rail mounted ethernet switches. LAN connections shall be wired to a separate network independent of the SCADA LAN and the Business WAN.
- iii. Local Area Network: Personal computers and printers shall be placed on a process control local area network (“LAN”). The LAN shall be implemented using ethernet type cards in each operator interface personal computer. The LAN shall be interconnected to various computers using a 100-base T stackable hub. The cable between devices on the LAN shall be a Category 6 type cable or fiber optic cable. LAN cables between devices in different buildings shall be fiber optic.

e. Modes of Operation:

- i. Each piece of process equipment is to be equipped with a local-off-remote selector switch (at the piece of equipment) to allow the location of control to be changed. In order to ensure that the RTU/PLC in the remote manual or remote automatic mode has control, an additional contact block will be added on the remote leg of the selector switch. The output of the contact block will drive a digital input that will serve as a permissive in the DCS. If the DCS attempts to control a device from the RTU/PLC when it is not in the remote mode, a failure condition will be delineated at the operator interface. Equipment furnished as part of a package system with a local control panel may not require individual LOR selector switches.
- ii. Local-Manual: An operator at a piece of process equipment will turn the device on and off and make adjustments. Required for all equipment.

- iii. Local-Automatic: Controls are hardwired into pieces of equipment by a vendor (such as prepackaged process equipment).
- iv. Remote-Manual: An operator turns items on and off via the operator human machine interface (the “HMI”) connected to the DCS.
- v. Remote-Automatic: The DCS turns items on and off and performs all control while monitored thru the HMI. Required for equipment as necessary for overall plant coordinated control.

f. Operator Interface Functions

- i. Screens: The Design-Builder, following consultation with the Owner, shall include paragraph descriptions of the OIT and HMI screens (including a listing of each specific I/O point required on each screen) to give the system integrator an understanding of the level of detail required. Each screen shall utilize the Owner’s standard color conventions for stop, run, open, closed and intermediate conditions. Text based screens shall be considered in the design. An operator (or supervisor only) shall have the capability to manually enter data onto the screen that is not generated by the system, but is appropriate to be displayed on a screen, such as a manual valve change for a chemical feed point of application. Control programs shall include limiting parameters for operator inputs, such as chemical feed dosages to prevent excursions. Only supervisors are to have access to modify those parameters. Provide a list of all screens to be created by the system integrator. Provide sample screens to establish the standard for layout and acceptable level of detail.
- ii. Reports: Reports shall be generated to summarize plant operation, electrical consumption, water production, chemical inventory, and regulatory compliance. The reports shall be accomplished by creating the forms in Microsoft Access (latest release) format and downloading data directly from the system. When data that is not generated by the system is required on certain forms, the operator shall have the capability to manually enter this information into the report, or overwrite data that the system has downloaded. Assume that ten (10) reports are required with the ability to update them on a daily, weekly, monthly, quarterly, and annual basis as well as month and year to date basis.
- iii. Alarms: An alarm summary table shall be developed by the Design-Builder and reviewed with the Owner during design. The table shall include specific initial values for all high and low alarm set points. Analog set points are also to be configurable on the graphic displays. The specific alarm software package that is ultimately selected must have auto dialing capabilities such that alarm conditions can notify on-call personnel without the need for separate auto dialer. Operators shall not be permitted access to modify alarm setpoints without special authorization.
- iv. Database: Provide a SQL database package to store process data and act as a server to database users outside the process control system.

g. Factory Acceptance Test (“FAT”)

- i. The Owner and Design-Builder shall witness a complete FAT of the control system prior to its shipment to the Project Site. The specifics of the FAT are described in Appendix 4.

h. On-Site Testing

- i. Specifics of on-site testing are described in Appendix 4.

i. Training:

- i. Operator Training is to be provided to the Owner’s staff to operate the Design-Build Improvements through the control system;
- ii. Maintenance training to maintain the hardware of the control system;
- iii. Administrative training to make basic security related changes.
- iv. Specifics of training are described in Appendix 4..

j. Calibration Plan:

- i. It is expected that a detailed calibration plan is to be developed during the construction phase (testing and commissioning) of the Project.

k. Protection of Sensitive Equipment

- i. General: The Design-Builder shall follow the guidelines for powering and grounding of sensitive electronic equipment listed in IEEE Standard 1100-1999.
- ii. Transient Voltage Surge Suppression (TVSS): Provide TVSS at point of use for all instrumentation loads. Required for all 4 wire instruments (such as chlorine analyzer), and placed on the 120VAC branch circuit and on the 4-20 mA portion of the circuit. The transient voltage surge suppression on the 4-20 mA wiring shall be located on the PLC end. For all two wire 4-20 mA instruments that have signal cable running from outdoor to indoor locations (or signal wire between buildings) transient voltage surge suppression on the field side of the 4-20 ma signal is required. All analog signaling shall be shielded cable.
- iii. Grounding: Each PLC cabinet shall be provided with a direct connection to the ground grid via a driven rod in addition to the equipment safety ground required by the National Electrical Code. Daisy chaining of grounds is not acceptable if it is the only grounding source. A grounding detail showing the interface between the PLC cabinet and the proposed grounding system is required. Instrumentation shields shall be grounded at the PLC end only. The electrical grounding specifications must be cross referenced to the instrumentation and control specifications so that it is understood that the system integrator monitors the quality of system grounding. In order to facilitate an electrically active ground mass, provide connections to structural steel and interface them to the grounding system.

- iv. Power Supplies: Separate power supplies shall be provided for analog inputs and PLCs, and digital outputs.
- v. Conduit Spacing: Required between power and signal/control cables as listed in IEEE 518-1982.
- vi. Enclosures shall be located away from chemicals and sources of moisture to the extent possible. Where enclosures are located in the vicinity of chemicals, provide fiberglass NEMA 4X enclosures with non-metallic hinges and latches.

I. Field Devices:

- i. The following is a partial listing of the field instrumentation required.
- ii. General: Output to be 4-20 mA with HART protocol where possible. Display shall be in engineering units. Mount indicator at height and location for ease of access and clear view. Provide remote indicator when warranted. Provide calibration accessories. Preferred manufacturers are provided elsewhere.
- iii. Pressure Transmitters: Microprocessor type; accuracy: 0.075% of span; Provide 3 valve manifold to allow field calibration check.
- iv. Differential Pressure Transmitters: Microprocessor type; accuracy: 0.075% of span; Provide 5 valve manifold to allow field calibration check.
- v. Flow Meters: Process flowmeters are to be magnetic type. Provide upstream and downstream straight run of pipe to allow high measurement accuracy. Provide grounding rings and ground per manufacturer's recommendation. Provide removable electrodes where coating is possible. Meters shall not be submerged or direct buried. Provide remote indicator as needed. Select appropriate materials of construction.
- vi. Level Transmitters: Provide ultrasonic or radar type to continuously monitor level. Units shall be corrosion resistant with appropriate rated enclosures. Provide local indicator at ground level. Install per manufacturer's recommendations.
- vii. Use of Pressure Transmitters for Level Sensing: A pressure transmitter may be used to sense water level where an ultrasonic or radar transmitter is not appropriate. Provide pressure indicator adjacent to transmitter.
- viii. Level Switches: Level switches, independent of continuous level monitors, are required where overflows could occur. Level switches are to be used to sense and alarm when fluid has entered a sump. RF admittance type, with self test feature, are preferred in most applications.
- ix. Weight Transmitters: Certain tanks (day tanks) shall be weighed to determine loss-in-weight over time to calculate/verify chemical feed rate.
- x. Analytical Instruments: Analytical instruments include conductivity, pH, turbidity, ORP, particle count, and residual chlorine. Final selection of instruments to be made with consultation of Owner. Mount and provide sample supply, and sample conditioning for good operation. Where possible, provide digital output to SCADA for analytical instrument self diagnostic.

m. Control Panels

- i. Design-BUILDER shall prepare a schedule of control panels for the project and identify which CSI Division (Div 11, Div 13, Div 15, Div 16, etc) has primary responsibility for each panel. Control panels provided by vendors shall meet a consistent standard of design to be specified by Design-BUILDER with common equipment to the extent possible.

31. PHYSICAL SECURITY, ELECTRONIC SECURITY AND SPECIAL SYSTEMS

- i. The design of the Design-Build Improvements is to include implementation of physical facility protection features to deter, detect, and delay vandals, criminals, saboteurs, and insider threats.
- ii. The Owner will provide input on security design at appropriate points during the design phase.
- iii. The Owner will provide cyber protection and implement management practices.
- iv. Site Fencing: The Project Site is to be fenced; 6 ft high fence, PVC coated galvanized steel for salt air corrosion protection. Architectural grade fencing is to be provided within 50 feet, either side, of the main entrance.
- v. Gate: The main entrance is to be equipped with closed circuit camera, intercom, lighting, and card access. The gate is to be electrically actuated and shall be slide type with electric actuator manufactured by HY Security.
- vi. All wiring and cabling is to be run in conduit and protected from tampering.
- vii. Site Lighting: To be designed by the Design-BUILDER for safety and security purposes in accordance with local requirements and expectations, and to allow proper functioning of security cameras.
- viii. Security features are to be incorporated into hatches, vents, and overflows on all water storage tanks
- ix. Signs are to be placed at 50 ft intervals around the Project Site perimeter; wording to be determined by the Owner.
- x. Chemical fill lines are to be locked.
- xi. Site Areas:
 - (1) The outdoor electric service equipment is to be protected with anti-climb security fencing and provided with intrusion detection.
 - (2) Critical pumping equipment areas such as Finished Water pumps and filtered feedwater pumps that are located outdoors are to be protected with anti-climb security fencing and intrusion detection.
 - (3) Wastewater clarification and recycling areas are to be fenced and provided with intrusion detection.
 - (4) Concentrate equalization basin is to be fenced.
- xii. Vehicle parking is to be away from the building.

xiii. Enterprise Electronic Security System

- (1) The Owner shall extend its company wide EESS to the Project Site and the facilities on the site. The system shall include both an electronic security system and an electronic fire alarm system.
- (2) The system shall be designed by the Owner's security subcontractor, Tyco, Inc. Tyco will provide design and installation details during the design phase.
- (3) All buildings shall have an electronic access system. Card readers will be used to control access to buildings.
- (4) Tyco shall furnish and install the terminal devices such as cameras and card readers.
- (5) Security Cameras – The Design-BUILDER is to assume that up to 20 cameras will be provided. Cameras are IP type. Cameras will be located indoor and outdoor.
- (6) External Doors – All external doors will be monitored electronically. Some doors will be equipped with card swipe entry devices. Some doors will be exit only. Each external door shall require four (4) low voltage cables (3-18/6, and 1-16/4) with back boxes. Final placement of back boxes will be based on the Tyco design and per Tyco design typical details.
- (7) Internal Doors- Internal doors that bound the secure portion of the administration area shall be equipped with card swipe entry devices to prevent unauthorized access to process areas such as control room, computer room, etc.
- (8) Glass Break System: Rooms with glass windows shall be monitored with a glass break detection system. These devices shall be wired per Tyco design typical details.
- (9) Motion Detection System: The Owner shall locate motion detectors when room layouts are complete. For the purposes of the Proposal, the Proposer is to assume at least twenty (20) motion detectors are to be provided
- (10) Security Panel and Computer Server Room (SCPS Room): Security panels shall be located in a secure room. All monitoring devices shall be routed as "home runs" to the security panels. All fiber optic cabling shall be routed to the SCPS room. This room shall also contain the network routers and equipment which will be provided by CAW. The room shall be a minimum of 10 ft by 15 ft. The room shall be temperature and humidity controlled.

b. Electronic Fire Alarm System:

- i. The facility shall have an electronic fire alarm system installed by Tyco and manufactured by Edwards. All wiring, cabling, and conduit shall be provided by the Design-BUILDER. The Design-BUILDER shall base the amount of devices on a fire code compliant fire alarm system.

c. Telephone and Intercom System:

- i. All telephone and intercoms devices shall be IP based and provided by the Owner. The Design-BUILDER shall assume 20 telephony locations.

32. LANDSCAPING AND IRRIGATION

- i. Design Builder is to prepare a landscaping and irrigation/xeriscaping plan for the site. See Architectural section for planned input from CAW and the Governance Committee from conceptual design prepared by students from the College of Architecture and Environmental Design of California Polytechnic State University.

33. SITE DEVELOPMENT

- i. Site layout has a number of design considerations including cost, hydraulic profile, security, aesthetics, considerations for future improvements, and operations.
- ii. The RO process is modular and allowance is to be made for expansion to 12.8 MGD.
- iii. An area of the site is to be identified for potential installation of seawater pretreatment facilities.
- iv. Paved roadways are to accommodate large loads of liquid treatment chemicals. Turning radii are to be suitable for the size of trucks and trailers. The chemical unloading area is to be on a slight upward grade to allow for drainage to the rear outlet of delivery vehicles. Curbing is to be provided for paved roadways.
- v. The following items are generally not aesthetically pleasing, and should not be featured prominently to visitors:
 - (1) Chemical unloading
 - (2) Electrical service substation
 - (3) Aboveground Finished Water storage
 - (4) Wastewater treatment facilities
- vi. Exterior lighting is to be appropriate for the location and comply with local codes, but also be sufficient for security.

APPENDIX 2, ATTACHMENT 1

AMERICAN WATER ENGINEERING STANDARD
T2: LIQUID CHEMICAL STORAGE, FEED, AND CONTAINMENT

Liquid Chemical Storage, Feed, and Containment

INTRODUCTION

Background

Water treatment chemicals are generally stored and fed in a concentrated form with many being strong acids or bases. While these chemicals are necessary to provide a safe potable water, mismanagement of the chemicals can have injurious consequences to the water consumer, company personnel, and the environment. In addition, many of these chemicals can damage company facilities if the proper equipment and safeguards are not provided.

Scope

This Standard covers the design of liquid chemical storage, feed, and containment facilities. The standard is meant to be used by engineers and other experienced personnel in the basic design and modification of liquid chemical systems. Selecting materials of construction and sizing of components are two examples where technical expertise is required. Guidelines for prioritizing improvements to existing chemical storage and feed systems are presented.

The contents of the Standard go beyond the minimum requirements of Ten State Standards by providing increased protection to consumers, company personnel, water company facilities, and the environment.

Purpose

An engineering standard is necessary to accurately demonstrate the required features of liquid chemical systems to consultants and water company staff involved in maintaining, modifying, and installing such systems. The Standard's goal is to minimize risk to consumers, workers, and the environment by presenting a standardized, proven method of storing, feeding, and containing liquid chemicals. Alternative designs must be carefully evaluated against the Standard before implementation and must not increase the risk of accidental chemical release, or increase the likelihood of human or environmental exposure to the chemical.

REFERENCE

1. Recommended Standards for Water Works (Ten State Standards)

TECHNICAL CONTENTS

Liquid Chemical System Elements

1. Materials of Construction
2. Safety Requirements
3. Bulk Tanks
4. Transfer Pumps
5. Day Tanks
6. Metering Pumps
7. Special Valves
8. Feeding from Drums
9. Inventory Monitoring
10. Secondary Containment
11. Dilution Water
12. Leak Detection
13. Continuous Analyzers

Appendix A - Bulk Liquid Chemical System Standard Schematic Diagram

Appendix B - Low Capacity Chemical System Standard Schematic Diagram

Appendix C - Guidelines for Prioritizing Improvements to Existing Chemical Systems

Description of Liquid Chemical System Elements

1. Materials of Construction

Materials used in chemical systems for tanks, piping, fittings, gaskets, hoses, protective coatings, in-situ instrumentation, etc. must be appropriately selected for each chemical. Material selection charts, chemical suppliers, and equipment vendors are a good source of chemical resistance information. Some water treatment chemicals may be mixtures, or may contain impurities that can increase corrosivity.

2. Safety Requirements

Identification of tanks, piping, and other equipment is necessary to make operators, maintenance personnel, and other workers aware of the chemicals being handled. Identification of chemicals and availability of material safety data sheets (MSDS) is an Occupational Safety and Health Act (OSHA) requirement as well as a state requirement in many cases.

Storage tanks and tank fill lines must be identified with signage identifying the usable capacity of the tank, contents of the tank, chemical hazards, and recommended safety gear.

Access to the fill connection for bulk tanks must be restricted to prevent unintentional filling. Suggested hardware includes uniquely keyed locks through the fill connection flange or locked covers over the connection.

Piping is to be color coded according to Ten State Standards and identified with labels indicating the chemical with arrows pointing in the normal direction of flow. Pumps are to be identified to avoid possible confusion during operation or maintenance.

Eyewashes and/or emergency showers are to be provided for all liquid chemicals, and located adjacent to the chemical equipment. Proper protective clothing such as aprons, gloves, and eye protection must be provided.

3. Bulk Storage Tanks

Bulk storage tanks are provided where the chemical consumption justifies bulk storage over drum storage, or where the chemical being handled is particularly corrosive and handling of drums would be a safety hazard. Bulk storage tanks are generally sized for 31 days of storage at a maximum dose and average treated water flow, or average dose and maximum treated water flow, whichever is larger. Alternatively, for smaller facilities sizing is to be 125 - 150 % of a bulk shipment of chemical. Sizing for larger facilities should consider the normal delivery quantity and the local time required for delivery. Federal, state, and local regulations governing chemical storage may also be a factor in sizing bulk storage tank capacities.

Bulk storage tanks shall be constructed of high density cross linked polyethylene (HDXLPE) or be an appropriately lined steel tank. Fittings for HDXLPE tanks shall be bolted through the wall style with appropriate bolt and gasket materials. Storage tanks are to be equipped with a fill line, vent line, overflow, and discharge connection. Other accessories include nozzles for continuous level measurement, high level indication, and gasketed hatch. The function of the hatch is primarily for tank inspection, rather than tank entry. A means of access to the hatch, such as a ladder, should be provided.

A near-instantaneous means of determining tank level is to be provided. It is recommended that low level and high level alarms should also be provided. An independent high level switch indicating imminent tank overflow is required with local audible alarms that can be heard at the filling station. The high level switch, independent of the continuous level monitor, is required because of concern for the potential for miscalibration of the continuous level system resulting in a chemical overflow.

Tank overflow must be directed to secondary containment. In cases where the chemical has suspected corrosive or injurious vapors or mists such as hydrofluosilicic acid, ammonium hydroxide, and sodium hypochlorite, the overflow pipe must be fitted with a low headloss, vaportight check valve (flap valve, or Red Valve Series 33 Tide Flex Valve) to allow overflow while preventing the discharge of vapors.

All chemicals with the potential for corrosive or injurious vapors or mists are to be vented to the exterior. In general, this includes hydrofluosilicic acid, ammonium hydroxide, and sodium hypochlorite. The vent line shall not function as the overflow.

It is recommended a remotely actuated valve be installed on or near the tank outlet to allow the bulk tank to be safely isolated in the event of a leak. Without such a valve, personnel would be required to enter the containment area to operate a manual isolation valve which could expose personnel to considerable safety hazards.

4. Transfer Pumps

Transfer pumps are to be provided to deliver chemical from bulk tanks to day tanks or batch tanks. Transfer pumps provide control and safety in the transfer process as flow can be halted electrically from outside of the containment area. Transfer pumps may be of several types; centrifugal, positive displacement, drum pumps for small systems, etc. Redundant installed pumps are required for disinfectants and primary coagulants, and recommended for other chemicals. A single installed transfer pump is allowed for disinfection and primary coagulants if the production facility can be taken off line for repairs or replacement. Where only one transfer pump is installed, a second pump is to be held in inventory as a spare. A bypass around the transfer pump is not allowed, as it defeats the purpose of the transfer pumps.

Continuous local operator supervision of the transfer process is preferred. Typically, this is accomplished with a hold-to-run (momentary contact) push button switch. Transfer pumps are typically sized to fill the day tank within two minutes to avoid operator fatigue.

For day tanks larger than 100 gallons, a two minute fill period would require high capacity transfer pumps. High capacity transfer pumps have an inherent safety concern because of the rate of transfer, and are expensive. For day tanks larger than 100 gallons, automatic shutoff of the transfer pumps may be employed if the following conditions are met: 1) secondary containment is provided, 2) a high level sensor, a critical high level sensor, and a spill sensor are provided and interlocked with the transfer pump to provide at least three levels of overfill protection. With automatic shutoff, transfer pumps are to be sized to complete the transfer operation within 30 minutes.

Automatic start of the transfer pumps is not allowed under Standard T-2. Any deviation from the manual fill procedures outlined above must be developed through System Engineering.

Discharge piping from the transfer pumps is to be configured to prevent gravity flow or siphonage from the bulk tank. The fill piping downstream of the siphon break must be sized for gravity flow. See the schematic in Appendix A for the recommended piping configuration.

Direct piping from the bulk tank, through the transfer pumps, to the day tank, without an air break is permitted only for viscous chemicals such as polymers.

5. Day Tanks

A day tank is a refillable storage vessel smaller than a bulk storage tank, which directly supplies metering pumps. Day tanks serve two purposes: (1) to allow accurate determinations of

chemical use, and (2) to minimize the volume of chemical which can be accidentally discharged into the treated water.

Day tanks are required when bulk storage is provided.

Day tank sizing is to be based on 125% (including freeboard) of the daily volumetric requirements of the maximum dose for the average daily treated water volume, or the average dose for the maximum treated water volume. Where chemical doses have a wide range, resulting in large day tanks, day tanks may be downsized and refilled more than once per day when high chemical demands are experienced.

Day tanks are to be equipped with a vented fill line, vent line, overflow, drain, and discharge connection. Other accessories include continuous measurement of level or weight, and an independent high level switch or probe. With many chemicals it is beneficial to provide a sight glass which can be cleaned to indicate liquid level.

Day tanks may be constructed of any chemically compatible material. Care should be taken when piping the day tank overflow to not allow the liquid level to rise such that the hydrostatic head exceeds the tank's design rating.

All chemicals with the potential for corrosive or injurious vapors or mists are to be vented to the exterior. In general, this includes hydrofluosilicic acid, ammonium hydroxide, and sodium hypochlorite. Tank overflow must be directed to secondary containment. In cases where the chemical has suspected corrosive or injurious vapors or mists such as hydrofluosilicic acid, ammonium hydroxide, and sodium hypochlorite, the overflow pipe must be fitted with a low headloss, vaportight check valve (flap valve, or Red Valve Series 33 Tide Flex Valve) to allow overflow while preventing the discharge of vapors.

Continuous level or weight monitoring is recommended with alarms for high and low level in the day tank. An independent high level switch indicating imminent tank overflow is required, with local audible alarm.

The day tank fill line is to be piped and vented to prevent the possibility of gravity flow or siphonage from the bulk tank to the day tank. See the schematic in the Appendix A for recommended piping configuration. Direct piping is allowed only for viscous chemicals such as polymer.

6. Metering Pumps

Where facilities cannot be taken off line, redundant installed metering pumps are required for disinfectants and primary coagulants, and recommended for all other chemicals. Where only one pump is installed, a second pump is to be held in inventory as a spare.

A calibration cylinder is to be provided on the suction side of the metering pumps to permit accurate determination of the pump's delivery rate.

Metering pumps that have the ability to produce pressures higher than the piping system can withstand, such as motor driven positive displacement metering pumps, must have a pressure relief valve on the discharge of each pump head. No valve may be located between the pump and the pressure relief valve.

Where pumps are feeding against low pressure, a backpressure/anti-siphon valve must be provided to help the pump deliver accurately, and prevent siphoning or gravity flow through the metering pump.

7. Special Valves

Special valves are needed to prevent siphonage, maintain backpressure, and provide pressure relief.

Backpressure Valve

A backpressure valve maintains a steady backpressure against a metering pump to ensure accurate delivery. A second function of this valve is to help prevent siphonage or gravity flow of chemicals from the day tank through the metering pump.

The backpressure valve consists of an adjustable spring loaded diaphragm and seat. The anti-siphon action is lost if the seat becomes fouled. Therefore the backpressure valve requires preventive maintenance and periodic testing.

Pressure Relief Valve

Where positive displacement metering pumps capable of pipe bursting pressure are used, a pressure relief valve is to be used upstream of the first valve on the metering pump discharge. The discharge of the pressure relief valve is to be directed to the day tank or drum. Some pressure relief valves also have a bypass feature to assist in priming the pump.

Anti-Siphon Valve

Anti-siphon protection is required for all liquid chemical discharge lines, regardless of normal operating pressure. Negative pressures can be produced in normally pressurized lines due to power failures, draining of lines, inadvertent valve operation, etc. and anti-siphon protection is particularly vital during upset conditions.

The surest means of providing anti-siphon protection is a physical siphon break as shown below. However, this arrangement is practical only for negative head or low head conditions. This arrangement is not suitable for chemicals that may plug feed lines.

Where the physical siphon break cannot be used because of discharge pressure, an anti-siphon valve is necessary. The anti-siphon valve consists of a spring loaded diaphragm and seat

and is similar to a back pressure valve. The anti-siphon action is lost if the seat becomes fouled. Therefore, the valve requires preventive maintenance including periodic testing.

For low pressure conditions where the physical siphon break cannot be used, the anti-siphon valve will be used in series with a backpressure valve which also provides anti-siphon action. The intent is to use these devices to provide at least two barriers to siphoning or gravity flow of chemical from the day tank through the metering pump.

A review of several accidental releases revealed the releases occurred through the metering pumps while the metering pumps were off. A solenoid valve, linked to the metering pump starter, may be used as a secondary means of providing anti-siphon protection.

Four-Way Valve

Several vendors manufacture a four function valve which provides anti-siphon, backpressure, priming, and pressure relief action. The valve can replace separate pressure relief and backpressure valves. This valve is limited to low capacity metering pumps.

Valve Testing

The capability of back pressure and antisiphon valves to prevent siphoning is dependent upon the integrity of the valve's diaphragm and seat. It is imperative that the integrity of the seal be checked on a regular basis.

One testing method utilizes monitoring the pressure variations upstream of these valves with a permanently installed pressure gauge (and isolation diaphragm). When system pressure is less than the valve's pressure setting, the upstream pressure should not fall below the valve's pressure setting. Where system pressure is above the pressure setting of a back pressure or antisiphon valve, system pressure must be valved off and the pressure monitored while the metering pump delivers to a holding vessel or to the day tank.

Another method allows a portable vacuum pump and reservoir to be connected downstream of each valve to be tested which would collect leakage from a faulty valve. Any leakage through the valve must be trapped in the receiver as the liquids would damage the vacuum pump.

8. Feeding From Drums

In low capacity systems where both bulk tanks and day tanks are not used, the chemical may be fed directly from a non-refillable drum. A weighing scale or reliable level monitoring device shall be used to monitor the quantity of material remaining in the drum. It is recommended the system be equipped with a low weight alarm.

As with day tanks, it is prudent to limit the volume of chemical directly connected to the water supply in case of accidental release. A day tank is to be used if the drum represents more than a seven day average flow-average dose supply.

Adequate ventilation must be provided for drum feed areas. Separate rooms may be necessary for fuming chemicals such as hydrofluosilicic acid because drum systems cannot be sealed and vented as well as bulk and day tank systems.

The weight of drums typically presents safety concerns in handling. Where drums are used, it is recommended drum handling equipment be provided to minimize the risks associated with moving drums. Such equipment includes hoists, pallet trucks, and dollies. It is recommended that training be provided on the proper operation of this equipment.

See the secondary containment requirements for drums in Item 10.

9. Inventory Monitoring

A reliable and accurate means of monitoring inventory is required for bulk tanks, day tanks, and drums. Typically, a continuous level probe is used for this purpose in tanks. However, in a manned station, a sight glass may be sufficient for this purpose. In all cases, a means of physically verifying liquid level is required to perform physical inventory, and calibrate level instrumentation.

Weighing scales may be used for monitoring inventory. States may require day tanks for fluoride be placed on scales. Some disadvantages of scales are that scale platforms are typically placed within the containment area and are susceptible to chemical spills. The use of weighing scales also requires flexible connections for all piping connections. Additionally, a tare weight for the tank must be used to show net weight.

10. Secondary Containment

Primary containment is defined as the container holding the chemical. Secondary containment is the structure designated to hold spillage or leakage.

Secondary containment is to be provided for all bulk tanks, day tanks, batch tanks, metering pumps, and transfer pumps. Experience has shown that pipe connections to tanks and equipment are most prone to leakage. The function of secondary containment is to keep the spilled chemical within a confined area isolated from other processes and chemicals where it can be cleaned up. Therefore, a common or directly interconnected containment area is recommended for all components of a chemical feed system.

Minimum secondary containment volume is to be determined based on 110 percent of the largest storage tank capacity within the containment area. Freeboard should be added to the calculated minimum containment volume.

The secondary containment structure must be protected with a coating or liner if the chemical is corrosive to the containment structure.

Secondary containment is to be provided for all drums. The containment volume must hold 110 percent of the contents of the largest drum.

Secondary containment is to be provided for buried chemical solution lines to minimize the potential for accidental releases to the environment. Secondary containment is not required for lime slurry or powdered activated carbon slurry. Secondary containment systems include double wall pipe, or tubing or hose within a carrier pipe.

11. Dilution Water

Any water supply connected to a chemical system must have proper backflow protection. For filling of batch tanks, an air gap may be used. For direct connection to batch tanks or chemical piping, reduced pressure zone type backflow preventers must be used.

Continuous dilution water is sometimes recommended to improve dispersion at the feed point, to dilute the concentrated chemical to a more practical concentration, or where the chemical output is very low. Dilution water flow must be controlled as variations in flow will cause variations in feed rate. Also, the flow of dilution water must be known to enable setting a desired dilution rate. It is recommended that a solenoid valve be placed on the water supply line that would close if a leak was detected to prevent filling a containment area with dilution water.

12. Leak Detection

It is recommended that both manned and unmanned chemical feed systems be equipped with a sump equipped with a level switch to signal the occurrence of a leak. It is important that personnel be alerted of a leak as soon as possible. Further, it is recommended the leak sensor be electrically interlocked with the isolation valve on the bulk storage tank, the transfer pumps, and solenoid valves on the chemical feed water supply. Upon detection of a leak the valves should close and pumps should stop, until the leak condition is locally acknowledged.

13. Continuous Analyzers

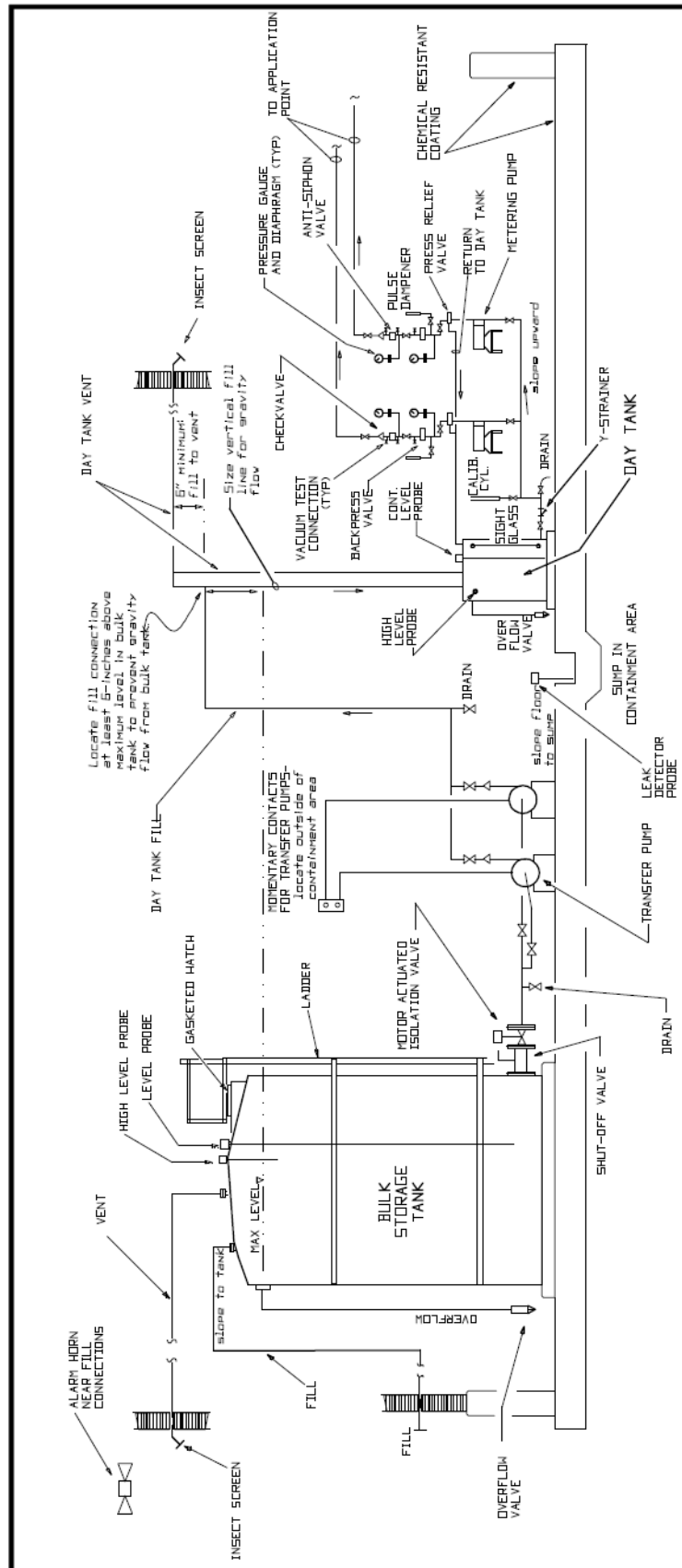
An important facet of protecting the consumer from accidental chemical releases is monitoring of the water quality downstream of the chemical addition point. For strong acids and bases, continuous pH monitoring can warn of an excessive chemical feed. Chlorine residual can be monitored to ensure a correct disinfectant concentration is present.

In a manned station, as a minimum, alarms from these analytical devices should warn the operator so appropriate countermeasures can be taken. In an unmanned facility, the alarms are to be provided for an appropriate action such as shutting off a well pump, or isolating the chemical feed system.

Chlorine residual analyzers are to be provided wherever chlorine or chlorination chemicals are added. Continuous pH monitoring is necessary where caustic soda is fed for post-filtration pH adjustment.

Appendix A - Bulk Liquid Chemical System Standard Schematic

Appendix B - Low Capacity Chemical System Standard Schematic



1. This schematic diagram is an appendix to AMERICAN WATER SYSTEM ENGINEERING STANDARD T-2 for LIQUID CHEMICAL STORAGE, FEED, AND CONTAINMENT. Refer to the Standard for specific requirements.

APPENDIX A

BULK LIQUID CHEMICAL SYSTEM STANDARD SCHEMATIC

REVISIONS

ENGINEERING STANDARD T-2

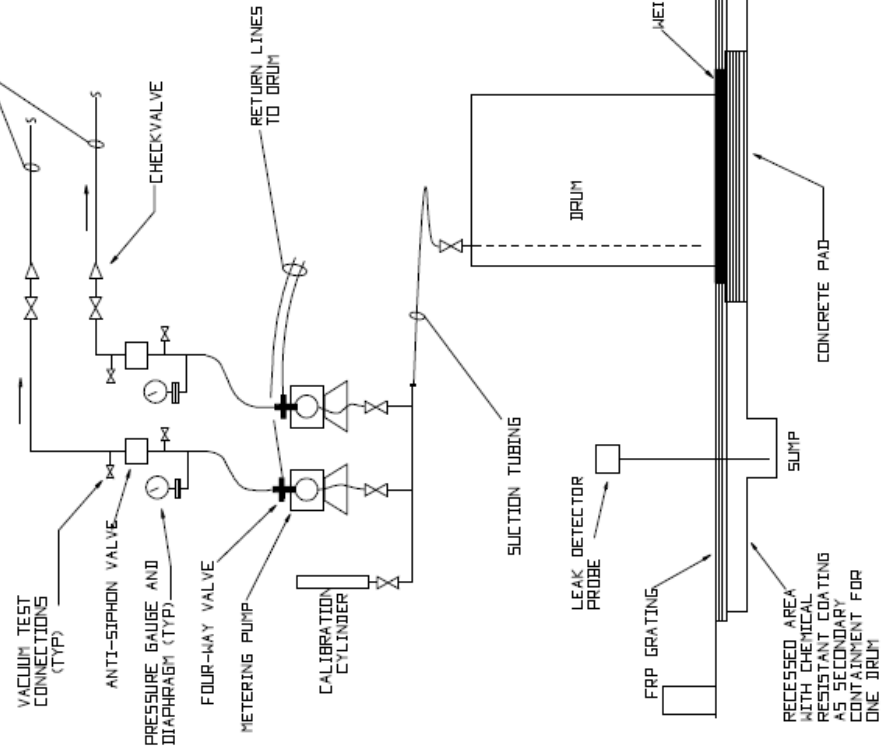
AMERICAN WATER WORKS SERVICE COMPANY, INC.
SYSTEM ENGINEERING

VORHEES, N.J. 08843

DRAIN BY SEC
PROJECT ENGR
APPROVED

USE APPROVED DRAWINGS ONLY

TO APPLICATION POINT



NOTES:

1. This schematic diagram is an appendix to AMERICAN WATER SYSTEM ENGINEERING STANDARD T-2 for LIQUID CHEMICAL STORAGE, FEED, AND CONTAINMENT. Refer to the Standard for specific requirements.

CONTAINMENT CURBS, RAMPED WHERE APPROPRIATE, ARE AN ALTERNATIVE TO THE RECESSED AREA AS A MEANS OF SECONDARY CONTAINMENT

REVISIONS 1. Added pressure gauge. See 3/10/78	APPENDIX B LOW CAPACITY CHEMICAL SYSTEM STANDARD SCHEMATIC
ENGINEERING STANDARD T-2	
AMERICAN WATER WORKS SERVICE COMPANY, INC. SYSTEM ENGINEERING	
DESIGNED BY PROJECT ENGINEER APPROVED	DATE 4-18-78 PROJECT SCALE NONE
WORKSHEET NO. 1000000000	USE INDICATING ONLY FOR CONSTRUCTION PURPOSES

APPENDIX C

GUIDELINES FOR PRIORITIZING IMPROVEMENTS
to
EXISTING CHEMICAL SYSTEMS

Discussion

The primary intent of the Engineering Standard for Liquid Chemical Storage, Feed, and Containment is to present a design basis for new installations. However, guidelines are needed for assigning priorities in upgrading existing facilities.

The following is an outline of the Standard which assigns priorities to the Standard's requirements. A HIGH priority is assigned to features that impact safety for consumers or personnel. A MEDIUM priority includes features that would prevent spills within secondary containment. Medium priority items should be evaluated on a chemical and site specific basis. A LOW priority is assigned to items that are desirable but not essential.

1. Materials of Construction

It is a HIGH priority that tubing, piping, hoses, gaskets, etc. must be compatible with the chemical being handled.

2. Safety Requirements

It is a HIGH priority that all safety requirements be met.

3. Bulk Tanks

Modification of existing bulk storage capacity to comply with the Standard is a LOW priority. Existing storage tanks which are in good condition should not be changed out to comply with the Standard. Fiberglass Reinforced Plastic (FRP) tanks containing hydrofluosilicic acid have a higher than average failure rate, and replacement of the tanks is a MEDIUM priority.

For non-fuming chemicals, the hatch of an existing tank can serve as the overflow, provided the hatch is loosely covered. Installation of a permanent ladder is a LOW priority.

Installation of a near-instantaneous means of determining tank level is a HIGH priority. The addition of a critical high level switch and alarm indicating imminent overflow is a MEDIUM priority.

It is a HIGH priority that overflow from the bulk tank be directed to secondary containment. It is a HIGH priority that tanks containing ammonium hydroxide, hydrofluosilicic acid, or sodium hypochlorite have vaportight check valves on the overflows to prevent the escape of vapors to enclosed areas. Likewise it is a HIGH priority that these chemicals be vented to the exterior.

The need for a remotely actuated valve located on the bulk tank discharge has a LOW priority because spills would be contained within secondary containment. It is important that an emergency response plan be instituted that outlines how spills within secondary containment will be handled.

4. Transfer Pumps

The addition of transfer pumps to an existing gravity day tank fill system is considered a MEDIUM priority, because spills would be held within secondary containment. Where gravity systems are employed, at least two bulk tank shut-off valves should be accessible from outside the containment area.

Where transfer pumps are installed, it is a HIGH priority that redundant pumps be installed in disinfection or primary coagulant systems unless the production facility can be shut down. Bypass around transfer pumps is not allowed.

Where transfer pumps are operated with a push to run switch, it is a HIGH priority that the pumps have the capability to fill the day tank within two - five minutes. Experience has shown that personnel become mentally and physically fatigued if the time to fill the tank exceeds five minutes.

Where transfer pumps are installed, it is a HIGH priority that the pump discharge piping conform to the schematic in Appendix A to prevent unintentional flow into the day tank. Direct piping is allowed for viscous chemicals such as polymers.

5. Day Tanks

The need to install day tanks in existing post-chemical bulk storage systems is a HIGH priority. Installation of day tanks for pretreatment chemicals such as primary coagulants and polymers is a MEDIUM priority because an accidental release will be held within the confines of the treatment plant. For post-treatment chemicals, the sizing of existing day tanks should be reviewed with oversized tanks either replaced or operating procedures instituted to limit the volume of chemical within the tank.

A near-instantaneous means of determining tank level, or weight is a HIGH priority. The addition of a critical high level switch and alarm indicating imminent overflow is a MEDIUM priority.

It is a HIGH priority that overflow from a day tank be directed to secondary containment. It is a HIGH priority that tanks containing ammonium hydroxide, hydrofluosilicic acid, or sodium hypochlorite have vaportight check valves on the overflows to prevent the escape of vapors to enclosed areas. Likewise it is a HIGH priority that these chemicals be vented to the exterior.

6. Metering Pumps

It is a HIGH priority that redundant metering pumps be installed in disinfection and primary coagulant feed systems where a production facility outage cannot be tolerated. The installation of calibration cylinders is a LOW priority.

7. Special Valves

The installation of pressure relief valves on feed systems with the capability of producing pipe bursting pressure is a HIGH priority.

The installation of backpressure/anti-siphon valve, in series with a second anti-siphon valve is a HIGH priority in low pressure systems (<30 psi). The installation of a single anti-siphon valve is a HIGH priority in higher pressure systems. The installation of valve testing fittings is a HIGH priority.

8. Feeding From Drums

It is a HIGH priority that the weight, or level of an on-line chemical drum be monitored. The inclusion of a low weight alarm is a LOW priority.

The upgrading of existing ventilation systems for drum feed areas is a MEDIUM priority and must be evaluated on a site and chemical specific basis.

9. Inventory Monitoring

It is a HIGH priority that a near-instantaneous means of determining tank level or weight be provided for bulk tanks, day tanks, and feed drums.

10. Secondary Containment

It is a HIGH priority that secondary containment be provided not only for the bulk tank and day tank, but also for the transfer pumps and metering pumps and the interconnecting piping. It is a HIGH priority that the minimum secondary containment volume is 100 percent of the largest tank within containment. It is a HIGH priority that secondary containment be provided for drum storage areas.

The need for a protective coating, or liner on the secondary containment structure is a MEDIUM priority. In evaluating the need for a coating, the effect of corrosive

chemicals on structural components such as walls, columns, and surrounding areas must be considered.

The need to provide secondary containment for buried chemical piping is a MEDIUM priority. The effect of long term leakage on ground water quality, or the effect of a sudden release to the environment must be evaluated in determining the need for secondary containment.

11. Dilution Water

It is a HIGH priority that proper backflow protection be provided for chemical dilution water. The installation of a meter to monitor dilution water flow for each chemical is a LOW priority, as is a solenoid valve to stop dilution water flow in the event of a spill into secondary containment.

12. Leak Detection

The installation of a leak sump and sensor within secondary containment is a MEDIUM priority for existing systems. The utility of a leak sensor is higher for unmanned systems than for manned facilities.

13. Continuous Analyzers

The installation of continuous pH monitoring downstream of post-filtration caustic soda feed point is a HIGH priority. The installation of chlorine residual monitoring is a MEDIUM priority. The health effects of an accidental release should be considered in the site specific evaluation.

APPENDIX 2 – ATTACHMENT 2

RAW WATER QUALITY CONDITIONS FOR BASIS OF DESIGN

Raw water quality measurements made for nearby projects were reviewed, along with calculated seawater constituent concentrations based on three years of salinity measurements taken in Monterey Bay. A complete summary of raw water quality data from these sources is presented and discussed in a Technical Memorandum entitled “Raw Water Characterization for the MPWSP” found in the Background Documents for this RFP. The sources of these data are listed below:

- (1) Desalination pilot studies conducted along the California coast—Moss Landing (MWH, May 2010) and Santa Cruz/Soquel Creek (CDM, April 2010),
- (2) The Santa Cruz/Soquel Creek Watershed Sanitary Survey (Archibald Consulting et al., July 2010),
- (3) Monterey Bay salinity and temperature data reported by the Central & Northern California Ocean Observing System (2013), and salinity and temperature data from the Santa Cruz Wharf reported by Southern California Coastal Ocean Observing System (2013)
- (4) Vertical monitoring well data in the 180-Aquifer, from Well DMW-2, collected as part of the Regional Water Supply Project, and
- (5) Source water well data for the Sand City Desalination Plant, screened in the shallow Sand Dune Aquifer.

The slant wells serving as the intake for the Project are expected to pull approximately 3% brackish groundwater from the shallow Sand Dune Aquifer and/or 180-Aquifer. The Owner will be constructing a test slant well in the vicinity of the proposed well field for the Project. Due to environmental constraints, it is anticipated that the test well will not be available until the 1st Quarter of 2014. While the well is operating, samples will be taken and analyzed and this data will be made available to the Design-Builder. However, even this water may not be an exact representation of the water that will be produced when the entire well field has been in operation for some time.

Since slant well data are not yet available, Table 1 was prepared which contains water quality data that the Design-Builder shall use as a basis for design. The data in Table 1 are a best estimate of the raw water conditions for the MPWSP. Facility design shall be based on the Design Maximum values in Table 1. Both the average and maximum values will be used during Acceptance Testing of the RO system, discussed in Appendix 7.

Additionally, proposers are free to seek approval on their own and obtain their own ocean and or shallow dunes aquifer samples in advance of the test well. California American Water will also provide a limited amount of raw source water to proposers from the Sand City Desal plant.

Table 1 –Raw Water Quality Conditions for Basis of Design

Parameter	Units	Design Value ^{1, 2} (mg/L seawater)	
		Average	Design Maximum
Applicable for the Pretreatment System			
Color	color units	-	9
Turbidity	NTU	-	10
Total Organic Carbon	mg/L	-	4
Iron, total	mg/L	-	2
Manganese, total	mg/L	-	0.2
Applicable for the Reverse Osmosis System			
Salinity	PSS	33.57	37.00
Temperature	°C	12	8 to 20
Chloride	mg/L	19,030	21,000
Sodium	mg/L	10,604	11,700
Sulfate	mg/L	2,667	2,900
Magnesium	mg/L	1,262	1,400
Calcium	mg/L	405	500
Potassium	mg/L	392	570
Bicarbonate	mg/L	105	150
Carbonate	mg/L	16	-
Bromide	mg/L	71	110
Silica	mg/L	1.3	30
Barium	mg/L	0.013	0.16
Strontium	mg/L	7.81	15
Fluoride	mg/L	1.28	2
Boron	mg/L	4.8	5.4
pH	mg/L	8	8.3

¹ Design of the RO system, including high-pressure feed pumps, 2nd pass feed pumps, and SWRO and BWRO membranes, shall be based on the maximum design values.

² Acceptance Testing of the RO system shall be based on computer model projected future performance after 5 years, for both average concentrations and maximum concentrations, taking into account increased salt passage over time as the membranes age.

References

Archibald Consulting, Palencia Consulting Engineers and Starr Consulting (July 2010).
Proposed scwd2 Desalination Project Watershed Sanitary Survey.

CDM (April 2010). Seawater Reverse Osmosis Desalination Pilot Test Program Report.

Central & Northern California Ocean Observing System (2013).
<http://www.cencoos.org>.

MWH (May 2010). Coastal Water Project Pilot Plant Report.

Southern California Coastal Ocean Observing System. (2013). "<http://www.sccoos.org>."

APPENDIX 2 – ATTACHMENT 3

FINISHED WATER QUALITY BASIS OF DESIGN STANDARDS AND WATER QUALITY ACCEPTANCE STANDARDS AND REQUIREMENTS

Finished water quality standards and requirements and Acceptance Standards and Requirements that will be used as the basis of design and acceptance testing are shown in Table 2, for the pretreatment effluent (RO feed stream), the combined RO permeate, and the Finished Water after stabilization for corrosion control and disinfection with chlorine. The bidder shall design the facility to meet the water quality standards and requirements shown in Table 2. Acceptance test procedures and requirements are discussed in Appendix 7 of the Design-Build Agreement. During Acceptance Testing, all treatment systems will be monitored in accordance with the requirements of Appendix 7 to demonstrate continuous successful treatment as stipulated by the treated water Acceptance Standards and Requirements shown in Table 2 below. Acceptance Testing of the RO system shall also be based on computer model projected future performance after 5 years, for both average and maximum raw water design concentrations (refer to Appendix 2, Attachment 2), taking into account increased salt passage over time as the membranes age.

Table 1 – Treated Water Basis of Design Standards and Acceptance Standards and Requirements

Parameter	Units	Pretreatment Effluent		Combined RO Permeate		Finished Water After Stabilization	
		Maximum Average Concentration ^{1, 2}	Not to Exceed Concentration ³	Maximum Average Concentration ^{1, 2}	Not to Exceed Concentration ³	Maximum Average Concentration ^{1, 2}	Not to Exceed Concentration ³
General and Inorganic							
Total Dissolved Solids (TDS)	mg/L						300
Turbidity	NTU	0.15 ⁴	1.0	0.1 ⁴	0.5	0.5 ⁴	1.0
Silt Density Index (SDI)	min ⁻¹	2 ⁴	4 ⁵				
Boron	mg/L			0.5	0.7	0.5	0.7
Chloride	mg/L			60	100	60	100
Bromide	mg/L			0.3	0.5	0.3	0.5
Sodium	mg/L			35	60	35	60
Iron, total	mg/L	0.02	0.04				
Manganese, total	mg/L	0.01	0.02				
Product Water Stabilization ⁶							
Hardness, total ⁷	mg/L as CaCO ₃					40 to 100	–
pH ⁷	pH units					7.7 to 8.7	–
Alkalinity, total ⁷	mg/L as CaCO ₃					40 to 100	–
Langelier Saturation Index (LSI) ⁷	–					0 to 0.2	–

Parameter	Units	Pretreatment Effluent		Combined RO Permeate		Finished Water After Stabilization	
		Maximum Average Concentration ^{1,2}	Not to Exceed Concentration ³	Maximum Average Concentration ^{1,2}	Not to Exceed Concentration ³	Maximum Average Concentration ^{1,2}	Not to Exceed Concentration ³
Calcium Carbonate Precipitation Potential (CCPP) ⁷	mg/L					0 to 5	-
Orthophosphate ⁷	mg/L as PO ₄					Set by Owner within the range of 1.0 to 3.5 mg/L	3.5
Disinfection and Disinfection Byproducts (DBPs)							
Total Chlorine Residual	mg/L as Cl ₂					Set by Owner for a target of 2 mg/L, within the range of 1.5 to 2.5 mg/L	3.5 mg/L
Trihalomethanes, total (TTHM) ⁸	µg/L					40	64
Haloacetic Acids, total of 5 (HAA5) ⁸	µg/L					30	48
Total Nitrosamines ^{8,9}	ng/L					5	8
Bromate	µg/L					5	8

¹ The **average** of the measured concentrations shall be below the Maximum Average Concentration at all times. This footnote does not apply to (a) turbidity or SDI, or (b) finished water total hardness, pH, alkalinity, LSI or CCPP; separate footnotes apply to these parameters.

² Maximum Average Concentration cannot be exceeded during the applicable period, which shall be (i) daily for continuous samples and samples collected every 15 minutes; and (ii) for the duration of the Acceptance Test, for samples collected daily or weekly.

³ No measurement shall exceed this value, at any time.

⁴ Measured values must be less than the “maximum average” concentration 95% of the time.

⁵ The maximum SDI limit applies unless more stringent requirements apply based on the SWRO membrane supplier warranty.

⁶ The Owner will set the conditions for product water stabilization to minimize corrosion in the existing distribution system. Conditions will likely not be set for all of these parameters concurrently.

⁷ Finished Water shall be within the “target range” at all times, where the target range is the target concentration set by the Owner, plus or minus the allowed variance shown in Appendix 7..

⁸ TTHM, HAA5, and total nitrosamine concentrations shall be determined using the Simulated Distribution (SDS) test method in Standard Methods (Method 5710C). Samples of the finished water where it enters the distribution system shall be collected, with no adjustment of chlorine residual or pH, and held at the temperature of the finished water at the time of collection (±2°C) for a 48-hour holding time.

⁹ Total Nitrosamines includes the 6 nitrosamine compounds on the EPA’s UCMR2-List 2; NDEA, NDMA, NDPA, NDPA, NMEA and NPYR.

APPENDIX 2 ATTACHMENT 4

TYPICAL EQUIPMENT MANUFACTURERS (not including Electrical)

1. GENERAL (applies to more than one area of the plant)

Equipment Description	Manufacturers
Ductile Iron Pipe	American Ductile Iron Pipe Griffin Pipe Products United States Pipe and Foundry
HDPE Pipe	CPChem Performance Pipe KWH Pipe Ltd.
Butterfly Valves w/Electric Operators	DeZurik Henry Pratt Company
Butterfly Valves w/Manual Operators	DeZurik Henry Pratt Company Clow Valve Company
Resilient Seat Gate Valves	Mueller Company Clow Valve Company United States Pipe and Foundry American Flow Control
Plug Valves	DeZurik Keystone Valve Company
Check and Air Valves	Golden Anderson Cla-Val APCO Val-Matic M&H
Electric Valve Actuators 208 VAC, 3 phase	Auma Actuators, Inc. Rotork EIM Beck (for modulating service)
Electric Valve Actuators – Light Duty 120 VAC	Flowserve Worcester Apollo Electra
Pneumatic Valve Actuators	Kinetrol
Bronze Ball Valves	Conbraco Industries Nibco Watts Regulator Company
Reduced Pressure Zone (RPZ) Backflow Preventers	Ames Company, Inc. Watts Regulator Company
Hoists and Cranes	Harrington Yale Shaw-Box ACCO
Air Blowers or Compressors	Ingersoll-Dresser Pump Company Roots Blower
Paint/Coatings	Carboline Paint Company M.A. Bruder and Sons (MAB) Sherwin Williams Company Tnemac Company, Inc.

2. PRESSURE FILTERS

Equipment Description	Manufacturers
Pressure Filters	Roberts Filter Group WesTech Hungerford and Terry

3. REVERSE OSMOSIS MEMBRANE SYSTEM

Equipment Description	Manufacturers
Cartridge Filters	Fil-Trek Parker Pentair
Thin Film Composite (TFC) Spiral Wound Reverse Osmosis Membranes	Toray Hydranautics Dow/Filmtec
FRP Pressure Vessels	Pentair Codeline Bekaert Progressive Composites
Energy Recovery Devices	Energy Recovery, Inc Flowserve
High Pressure Pump	Afton Goulds Flowserve Sulzer

4. FINISHED WATER PUMPING

Equipment Description	Manufacturers
Vertical Turbine Pumps	Flowserve Goulds Peerless
Horizontal Splitcase Centrifugal Pumps	Flowserve Goulds Peerless
Variable Frequency Drives	See Electrical Equipment
Pump Discharge Control Valves – Resilient Seated Ball Valve	Henry Pratt Company GA Industries

5. CHEMICAL STORAGE AND FEED

Equipment Description	Manufacturers
XLHDPE Chemical Storage Tanks	Poly Processing Company
Steel Chemical Storage Tanks	Highland Tank Southern Tank Steel Structures, Inc
Diaphragm Metering Pumps	Milton Roy Company Pulsafeeder
Peristaltic Tube Pumps	Watson Marlow
Peristaltic Hose Pumps	Watson Marlow Verder
Magnetic Drive Centrifugal Transfer Pumps	March Manufacturing Inc. Iwaki Walchem
Batch Tank Scales	Force Flow Equipment Eaton Scales
PVC and CPVC Piping	Certainteed Corp. Pipe and Plastics Group
Chemical Ball Valves-Manual	Chemtrol Hayward Asahi
Chemical Ball Valves – Actuated	Nil-Cor

6. OTHER PUMPING EQUIPMENT

Equipment Description	Manufacturers
Sample Pumps – Centrifugal with Flooded Suction	Little Giant March Iwaki
Sump Pumps	Hydromatic KSB Weil ABS
Sludge/Wastewater Pumps	Flygt Hydromatic Yeomans ABS Weil ABS KSB Wemco Sulzer
Electric Motors	See Electrical Equipment

7. INSTRUMENTATION

Equipment Description	Manufacturers
Magnetic Flow Meters	Rosemount Siemens Krohne Endress Hauser ABB
Point Level Switch – RF Admittance	Drexelbrook ABB Endress Hauser
Ultrasonic Level Transmitters	Endress Hauser Drexelbrook Siemens
Radar Level Transmitters	Endress Hauser Ohmart-Vega Siemens Magnetrol
Turbidimeters	Hach
pH Analyzers	Hach Rosemount
Chlorine Residual Analyzers	Wallace & Tiernan/Siemens Depolox, Hach CL-17
Desktop Personal Computers	IBM Dell Hewlett-Packard
Laptop Personal Computers	IBM Dell Hewlett-Packard
Printers	Hewlett-Packard Epson
Modems	AMP (Allied Signal) Manmarc
Fiber Optic Modems	Hirshman
Microwave Radios	GE/Microwave Data Systems
Uninterruptable Power Supply	Best, APC
Human–Machine Interface Software	Iconics, GE Intellution IFIX
PLCs	Allen Bradley
PLC Cabinets	Hoffman, Rittal Saginaw Controls

APPENDIX 2 - ATTACHMENT 5

[RESERVED]

APPENDIX 2 ATTACHMENT 6

Typical Electrical Equipment Manufacturers

Equipment Description	Manufacturers
MV Switchgear – Vacuum Breaker, Draw-Out	Cutler-Hammer Siemens General Electric Square D
Medium Voltage Automatic Transfer Switchgear (Circuit Breaker Transfer Equipment – Manual or Automatic)	Cutler-Hammer Siemens General Electric Square D Or Acceptable Manufacturer from above provided by Generator Equipment Manufacturer (subject to Owner approval)
MV Fusible Switchgear	Cutler-Hammer Square D (<i>Note - HVLcc Type Equip Not Accepted</i>) Siemens General Electric S&C
MV Switchgear – SF6 Type	<i>Not Preferred Equipment</i>
MV Motor Control Equipment, MC Lineups (FVNR, RVSS Equipment)	Cutler-Hammer Siemens General Electric
MV Variable Frequency Drives	Toshiba Cutler-Hammer Siemens/Robicon
LV Power Distribution Equipment – (Swgr, Swbds, Panelboards, Circuit Breakers, etc)	Cutler-Hammer Square D Siemens General Electric
Transformers – Dry Type, VPI, VPE Insulation	Cutler-Hammer Square D/Sorgel Siemens ABB
Transformers – Cast-Coil	Square D/Sorgel ABB
Transformers – Liquid-Filled	<i>Not Preferred Equipment</i>
Protection Relays & Monitoring Relays for Voltage, Current, Phase Loss, Etc.	SEL (Schweitzer Engineering Laboratories) <i>Other acceptable manufacturers may include the following (subject to prior approval by AW Engr / Owner) All to be provided with Fiber-Optic Communications over Ethernet / Modbus TCP/IP</i>
Power Quality Metering, Motor Monitoring & Feeder Protection Relays	SEL 735, SEL 710, SEL 751A Other SEL devices as applicable for the design of the power distribution system. All to be provided with Fiber-Optic Communications capability Ethernet / Modbus TCP/IP
Low Voltage Motor Control Centers	Cutler-Hammer Square D Siemens

	General Electric
Full Voltage Motor Starters	Cutler-Hammer Square D Siemens General Electric
Reduced Voltage (Solid-State, Soft Start) Motor Starters	Cutler-Hammer Square D Siemens General Electric Danfoss Benshaw
Low Voltage Variable Frequency Drives – Stand Alone Applications (Free-Standing or Wall Mounted Units)	<u>Free-Standing – Wall or Floor Mounted</u> Toshiba ABB Siemens/Robicon Danfoss Benshaw Yaskawa <u>NEMA 4X Type (where required)</u> Yaskawa T B Woods <i>(Power distribution equip manufacturers equipment with Owner acceptance only)</i>
Low Voltage Variable Frequency Drives – Part of MCC Lineup/Equipment	Cutler-Hammer Square D General Electric Seimens
Low Voltage Automatic or Manual Transfer “Switches”	Cutler-Hammer ASCO 7000 Series (unless otherwise suitable) GE/Zenith Russelectric
Low Voltage Service Entrance Rated Automatic Transfer Equipment (Circuit Breaker Transfer Equipment – Manual or Automatic)	Cutler-Hammer/Eaton Russelectric Switchgear General Electric ASCO 7000 Series
Uninterrupted Power Supplies	APC Powerware General Electric Mesta Liebert MCG
Surge Protective Devices (UL-1449, Rev 3 Compliant and Listed/Labeled)	APT – Advanced Protection Technologies MCG APC
Lighting Fixtures – T-8 lamps, Program-Start Ballasts, Indoor Enclosed and Gasketed Fluorescent for Damp and Wet Locations (Process and Chemical Rooms)	EPCO GFF Series w/SS Latches Simkar EN 2 or 3 w/SS Latches Holophane ERS Series Lithonia FSW or FHE Series Others as accepted by Owner

	<i>(Note – the use of fixtures similar to Lithonia DMR Series, Columbia LUN Series, Simkar OV450, etc are generally prohibited due to on-going physical / performance issues associated with this type of design (limited latches retaining sealed integrity of the assembly)). Fixture selection is to take into consideration lamp output, lumen maintenance, and environmental factors associated maintainability of the overall system.</i>
Lighting Fixtures – T-8 lamps, Program-Start Ballasts, Indoor dry applications	Day-Brite, Benjamin, Keene, Lithonia and Others as accepted by Owner
Lighting Fixtures – T-8 lamps, Program-Start Ballasts, Indoor Hazardous Locations	Appleton Crouse-Hinds Killark Others as accepted by Owner
Lighting Fixtures – Outdoor	Holophane Infranor Devine Others as accepted by Owner
Lighting Control - Occupancy Sensors	Sensor Switch (High Humidity / Low Temperature Type) – process & chem. Areas Leviton, Hubbell, P&S along with others mfgs and products to be provided as determined suitable for the location and environment where installed. <i>NOTE: Technology (passive IR, ultrasonic, or dual) to be based on location where installed.</i>
Lighting Control – Daylight Harvesting and/or Special Function and Dimming	Lutron Wattstopper Day Light Controls Others as accepted by Owner
Control and Timing Relays (“Ice-cube” relay style)	Diversified Potter Brumfield Syrelec Allen Bradley Square D Cutler-Hammer Seimens Releco Others as accepted by Owner
Push Buttons, Selector Switches & Pilot Lights (30 mm minimum size devices, NEMA 4X style preferred and high-intensity LED pilot lamps)	Cutler-Hammer Square D Seimens Allen Bradley Kraus & Naimer
Definite Purpose Relays and Contactors	Cutler Hammer Square D Siemens Allen Bradley
Industrial Plugs & Receptacles (Generators)	Meltric Corp. Hubbell Leviton Others as accepted by Owner

PVC Coated Rigid Steel Conduit	Ocal Robroy
Power Generation Equipment – (Diesel engine driven units)	Onan/Cummins Caterpillar Kohler Others only as determined accepted by Owner

APPENDIX 2 ATTACHMENT 7

GENERAL ELECTRICAL DESIGN CRITERIA

1. Basic Electrical Materials and Raceways:

- a. All materials shall be suitable for the location and environment where installed.
- b. Control panels and related enclosures shall generally be non-metallic type with non-metallic hardware; NEMA 12 minimum or 4X in corrosive areas unless otherwise accepted. The use of Stainless Steel enclosures should be limited to areas not exposed to a chlorine gas or fluoride areas / environments.
- c. All feeders (and branch circuits rated 100 amps and larger) shall be provided in RGS conduit. Other building areas to utilize raceway materials as outlined herein (see 2 below) unless otherwise indicated. Exposed exterior locations may utilize rigid aluminum conduit where determined suitable for the application. The use of IMC is prohibited.
- d. All conduit fittings to utilize gasketed screw covers; clip-type cover fastening type fittings are prohibited. Provide "Myers hub" type connectors associated with exterior and wet location enclosures.
- e. Raceway penetrations into below grade located equipment / enclosures shall not enter the top; they shall enter the bottom side and be provided with a means for draining moisture from the raceway and sealed between the raceway and the enclosure with duct-seal material. These enclosures shall be provided with a vapor corrosion inhibitor (Cortec, or equivalent) sized appropriately for the interior volume of the cabinet.
- f. Receptacles and switches to be heavy-duty rated, 20 ampere minimum rated; material type and configuration to be suitable for the application.
- g. Control Station devices should be NEMA 4X rated where available; all devices to be 30 mm minimum size for gloved operation. All pilot lights are to be high intensity LED type; red for "run", green for "off". Other colors to be coordinated with the Water Company; generally in accordance with NFPA-79, Table 10.3.2.

2. Raceway material and general applications:

The following general criteria are to be used for raceway material selection and installations. This listing is not intended to address all applications and/or specific equipment requirements which may be outlined elsewhere on the Engineer's Drawings or indicated in the Specifications.

a. Industrial Buildings and Related Type Facilities or Areas

1) Chemical Storage and Dispensing (non-hazardous materials)

1. Exposed from Finished Floor to 8'-0" AFF
 - a. PVC Coated RS Conduit and Liquidtight Flexible Metal Conduit
 - b. Outlet and Junction Boxes - PVC Coated, Cast Type, FD capacity for use with the PVC Coated RS Conduit
 - c. All outlet cover plates to be "in-use", weather-protected type and gasketed
2. Exposed 8'-0" AFF and above within the room
 - a. PVC Schedule 40 Conduit may be used in lieu of PVC Coated RS Raceways. Where provided, the Contractor shall include the use of expansion and axial connectors as recommended by the non-metallic raceway Manufacturer (not just at building expansion points)
 - b. Junction Boxes - PVC, FD capacity for use with the PVC Conduit System
3. **NOTE:** No "in-floor" conduit or floor penetrations are permitted within chemical containment areas.

Engineers NOTE - Potentially, a listing or some other form for identifying which chemicals / areas require the use of seal-offs will need to be determined and included in the Contract Documents (below)

- 2) Transitions from Chemical Storage and Dispensing Areas to other building areas shall utilize PVC Coated RS Conduit within the area and transition to RGS material where extending to a non-chemical area. Provide seal-off fittings and appropriate sealing material (as specified) to prevent vapor transmission through the raceway system at this transition point inside the chemical area.
- 3) Hangers, Supports and Fasteners
 1. FRP Threaded Rod with non-metallic FRP channel supports and fasteners. In areas other than Chlorine and Fluoride environments, the use of 316 Stainless Steel threaded rod and fasteners also is permitted. Where the weight of the installation exceeds that permitted by the FRP materials, the use of 316 SS channel supports and threaded rod will be considered acceptable. PVC Coated steel channel supports is not accepted.

Engineers NOTE - "Damp" and "Wet" terms will need to be defined and included in the Contract Documents

- 4) *GENERAL NOTE: Raceways are not permitted to be installed concealed in water-bearing walls. All equipment, devices and raceways shall be installed on the dry-side wall surface using nominal 7/8" non-metallic channel support stand-offs installed vertically to all ventilation air to pass behind equipment and raceways. Fastening hardware to be 316 Stainless Steel*
 - 5) "Damp" Areas, including those where the ambient temperature of the space is to be maintained at less than 65 degrees F
 1. Rigid Galvanized Steel (RGS) Conduit and fittings
 2. Liquidtight Flexible Metal Conduit
 3. Exposed outlets - Cast Type, FD capacity
 4. Recessed Outlets (where permitted) - one-piece galvanized steel (expandable metal outlets not permitted)
 5. Coverplates - type as specified and/or indicated on the Drawings
 - 6) "Wet" Areas, including those where the ambient temperature of the space is to be maintained at less than 65 degrees F
 1. Rigid Galvanized Steel (RGS) Conduit and fittings or PVC Coated RS Conduit and PVC Coated fittings as indicated on the Drawings
 2. Liquidtight Flexible Metal Conduit
 3. Exposed outlets - Cast Type, FD capacity (PVC Coated where coated raceway systems are indicated on the Drawings)
 4. Recessed Outlets (where permitted) - one-piece galvanized steel (expandable metal outlets not permitted)
 5. All outlet coverplates to be "in-use", weather-protected type and gasketed
 - 7) Electrical, Mechanical (HVAC) and General Equipment Storage Rooms
 1. Rigid Galvanized Steel (RGS) Conduit and fittings
 2. Flexible Metal Conduit - Lighting Fixtures and similar type equipment
 3. Liquidtight Flexible Metal Conduit - motor (and similar equipment involving close proximity to water and/or oil) connections
 4. Exposed outlets - Cast Type, FD capacity
 5. Recessed Outlets (where permitted) - one-piece galvanized steel (expandable metal outlets not permitted)
 6. Coverplates - companion type as specified and/or indicated on the Drawings
- b. Administrative Buildings and Related Type Facilities or Areas

- 1) All areas within conditioned rooms (those spaces where heating and/or air conditioning/ventilation is provided to maintain a nominal ambient temperature of 68 degrees and higher)
 - 2) General Installations
 1. Electrometallic Tubing (EMT) for concealed raceways with compression fittings (set-screw fittings are NOT permitted)
 2. Rigid Galvanized Steel (RGS) Conduit and fittings for exposed raceways
 3. PVC Conduit is NOT to be used for any application other than for approved in-floor (or other encased in concrete) applications as outlined by these Documents.
 4. Flexible Metal Conduit - Recessed Lighting Fixture connections and similar type equipment terminations
 5. Liquidtight Flexible Metal Conduit - motor (and similar equipment involving close proximity to water and/or oil) connections
 6. Exposed outlets - Cast Type, FD capacity
 7. Recessed Outlets - one-piece galvanized steel (expandable metal outlets not permitted)
 8. Coverplates - companion type as specified and/or indicated on the Drawings
 - 3) In-floor (or other encased in concrete) Installations
 1. PVC Schedule 40 for 120 volt and greater general power / branch circuits; transition to metallic raceway system for continuation in or on wall as identified above. (Note - refer to VFD cabling installation requirements for special installation considerations)
 2. EMT for Data, Instrumentation and low voltage signal (less than 50 V) circuits; transition to metallic raceway system for continuation in or on wall as identified above.
 3. All transitions from "in-floor" to above floor in any area or room where water is also supplied in the room shall utilize PVC Coated RS Conduit sweeps to provide corrosion / physical protection; extend PVC Coated raceway minimum 6" AFF.
- c. Underground and Similar Raceway Applications
- 1) Encased in Concrete Raceway Installations - (Ductbanks, Equipment Bases, etc) as identified on the Drawings
 1. Conduits 2" in diameter and smaller- PVC Schedule 40 Conduit with PVC Schedule 40 sweep radius horizontal bends and PVC Coated RS Conduit sweep radius bends for vertical transitions to above grade or concrete surface.
 2. Conduits greater than 2" in diameter - PVC Schedule 40 Conduit with RGS sweep radius horizontal bends and PVC Coated RS Conduit sweep radius bends for vertical transitions to above grade or concrete surface.
 3. Note - Refer to VFD cabling installation requirements for special installation considerations that may alter the criteria outlined above
 4. Conduit supports, spacing and concrete / reinforcement to be as specified
 - 2) Direct Burial Raceway Installations - Ductbanks, Branch Circuits and Feeders as Identified on the Drawings
 1. Conduits 2" in diameter and smaller- PVC Schedule 40 Conduit with PVC Schedule 40 sweep radius horizontal bends and PVC Coated RS Conduit sweep radius bends for vertical transitions to above grade or concrete surface.
 2. Conduits greater than 2" in diameter - PVC Schedule 40 Conduit with RGS sweep radius horizontal bends and PVC Coated RS Conduit sweep radius bends for vertical transitions to above grade or concrete surface.
 3. Note - Refer to VFD cabling installation requirements for special installation considerations that may alter the criteria outlined above
 4. Conduit spacing and protective concrete cover to be as specified or detailed on the Drawings. Note, Direct Burial installations do not use conduit "chairs" or separators; embedment is provided by screening material only.

5. Transitions from underground to building or other structure to be provided as Detailed on the Drawings
3. *Lighting Systems*: Fluorescent lighting systems shall be used in the design for the interior of the buildings; HID lighting (HPS) shall be acceptable for exterior use. Illumination levels to be as recommended by IES for the space and tasks being performed. Lighting fixtures types are to be suitable for the environments where installed and shall be located (serviceable and accessible) for routine maintenance. Provide calculations and fixture catalog data/specification sheets for review and acceptance by the Water Company.
 - a. Night-lighting / means of egress lighting fixtures shall be incorporated in the normal lighting layout / scheme to ensure that all passages and exits remain illuminated in the event of a power failure. These fixtures may be switched providing they include the lighting transfer device integral with the fixture. Separate battery-powered emergency lighting units shall also be provided to augment this system and provide Code required egress lighting in the event of a power failure on the Stand-By Power System. These units are to be powered from the local areas night-lighting circuits and wired ahead of any switching. This pass-thru/night lighting should be un-switched; other lighting in the area or room to be controlled by means of suitable occupancy sensors.
 - b. Where otherwise required by the authority having jurisdiction , provide means of egress and emergency lighting systems in conformance with NFPA 101 (the Life Safety Code)
 - c. Illuminated Exit Signs: IF REQUIRED by CODE, provide LED type and placed inside the facility per the latest requirements of NFPA 101 (the Life Safety Code) as applicable.
4. *Cables*: Those rated for 480V and below shall be listed as XHHW, XHHW-2 for general underground, damp and wet locations and other similar areas. In addition, only XHHW-2 insulated conductor material is to be used with any variable frequency drive application. Dual-rated THHN/THWN type is for use ONLY in interior, (*Administrative Buildings and Related Type Facilities or Areas as previously defined*) dry locations. Insulation shall be UL listed for at least 90 degrees centigrade but applied at its 75 degree ampacity rating (maximum). Provide specific information in the Documents outlining where each type of conductor insulation material for review and acceptance by the Water Company.
5. *Grounding*: The electrical system and equipment will be grounded in compliance with the National Electrical Code. A buried grounding grid should be provided for the new switchgear and generators. Conductors shall be No. 3/0 AWG copper, minimum, for interconnecting ground rods and for connection to transformers and MCC's and other major electrical equipment. Electrical equipment, devices, panelboards, and metallic raceways will be connected to the ground conductors.
6. *Medium Voltage Switchgear*:
 - a. Type of Equipment: Tin-plated copper buss (phase and ground), 5 KV, 3-phase, 3-wire plus ground operating at 60 Hz. Draw-out vacuum circuit breakers. All components are U.L. listed. Switchgear equipment shall consist of standardized, freestanding structures bolted together for form a single dead-front panel assembly containing circuit breakers, control devices, protective relay and metering units and all interlocking and miscellaneous control / interface devices.
 - b. In general, Metal-Enclosed Switchgear is considered acceptable. Provide Metal-Clad Switchgear type design where required due to specific design and/or Utility considerations.
7. *Medium Voltage Motor Controllers*:

- a. Type of Equipment: Tin-plated copper bus (phase and ground), 5 KV, 3-phase, 3-wire plus ground operating at 60Hz. All components are U.L. listed. MCC equipment shall consist of standardized, freestanding structures bolted together for form a single dead-front panel assembly containing combination motor control units; feeder units; metering, relaying, and interlocking and miscellaneous control devices.
- b. Starters: Full-Voltage NEMA rated fusible switch / contactor type combination controllers as required. The use of IEC rated controller is prohibited. Solid-state reduced voltage motor starters shall be utilized where required due to power utility requirements, process control of hydraulic transients, and/or engine-generator sizing considerations. The Engineer shall coordinate starter types with the Water Company.

8. Low Voltage Motor Control Centers/Motor Controllers:

- a. Type of Equipment: Tin-plated copper bus (phase and ground), 600V, 3-phase, 3-wire plus ground operating at 60Hz; provide a neutral bus only in those MCC assemblies where required. All components are U.L. listed. MCC equipment shall consist of standardized, freestanding structures bolted together for form a single dead-front panel assembly containing combination motor control units; feeder units; metering, relaying, and interlocking and miscellaneous control devices and will be of the per definitions in the latest edition of NEMA ICS 3 and UL 845.
- b. Starters: Full-Voltage NEMA rated (Size 1 minimum) combination magnetic starters shall be utilized as required. The use of IEC rated starters is prohibited. Solid-state reduced voltage motor starters may be utilized where required due to power utility requirements, process control of hydraulic transients, and/or engine-generator sizing considerations. The Engineer shall coordinate starter types with the Water Company.
- c. Circuit Breaker Compartments and Circuit Breakers: Control center disconnects shall be three-pole, single-throw, 600-volt, molded-case circuit breakers. Circuit breakers of combination starters shall be magnetic motor circuit protector type where appropriate. Feeder circuit breakers shall be thermal-magnetic type and shall be manually operated with quick-make, quick-break, trip-free toggle mechanism.
- d. Enclosure Type: Match existing NEMA ratings in equivalent areas of the plant. Engineer shall also propose modifications to the NEMA rating if appropriate for intended service.

9. Power Monitoring: Provide microprocessor based SEL 735 metering unit on main incoming feeder circuit breaker. Unit shall compute voltage, amperes, power factor, kilowatt-hour, etc. Communications will be via fiber-optic cable back to a port on a plant remote terminal unit (RTU). Provide SEL 710 motor protective units motor loads larger than 100 horsepower wired to plant RTU for monitoring, trending and archiving. Other SEL protective relays to be provided as determined through the design; reviewed and accepted by the Owner.

10. Miscellaneous Power Distribution:

- a. Panelboards and Switchboards: Circuit breakers will be of the "Bolt-On" type;"Push-On" / "Plug-On" type circuit breakers are not allowed. Use plated copper type bus and ensure U.L. labeling of entire system.
- b. Provide a transient voltage surge suppresser on the main of each power distribution panel where applicable. For more specific requirements for the protection of sensitive electronic instrumentation, see Instrumentation section.
- c. Lighting and Power Transformers: Dry type to limit maintenance items. A minimum of (2) taps will be provided above rated voltage (in 2.5% increments) and a minimum of (2) taps will be provided below rated voltage (in 2.5% increments). Open type transformer cases are not allowed. All units located in wet or chemical areas will be of sealed type construction. Provide open ventilated type enclosures for other general dry, environmentally ventilated/conditioned

spaces. All transformers to utilize copper windings; 115 degree C rated. The Engineer shall examine the need to install transformers with a higher than average Basic Impulse Level (BIL) that is not normally required in the 480V class.

APPENDIX 2 ATTACHMENT 8

POWER SYSTEM STUDY REQUIREMENTS

SHORT-CIRCUIT, PROTECTIVE COORDINATION AND ARC FLASH ANALYSIS/EVALUATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all items of labor, materials and equipment necessary for investigation, development, evaluation and report generation of the work described in this Section. The entire power distribution system, new and existing equipment which is to remain, is to be included in the Study being provided for this Project.
- B. Visit the site to determine actual conditions, equipment and settings and related elements necessary to prepare a complete oneline diagram of the entire power distribution system. This oneline diagram shall include the equipment (loads/ratings), cable and raceway information and other data associated with the installations (new and existing) to allow evaluation and calculation of the various Studies to be provided in the Report outlined herein. Field work shall be coordinated with the Owner and shall follow all applicable safety standards for the activities required. The Contractor shall review / compare the Owner's operational and safety standards with his own and provide adequate PPE for those involved in any data gathering activities as outlined by applicable Regulatory Agencies. Failure to sufficiently determine existing conditions and equipment ratings / settings shall not be considered grounds for additional compensation.
- C. Furnish a complete Short-Circuit, Protective Coordination and Arc Flash Hazard Analysis Study per the requirements set forth in the criteria established for the Project, the criteria outlined herein this document, and as identified in the current version of NFPA 70E -*Standard for Electrical Safety in the Workplace*. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584, the IEEE *Guide for Performing Arc-Flash Calculations*; modified as hereinafter identified. Temporary Arc-Flash labeling of the electrical equipment shall be provided upon acceptance of the pre-final study/report for equipment being transferred to the Owner for operational acceptance during the construction effort. Final Arc-Flash Labeling shall be provided as indicated after all field start-up / acceptance testing and adjustments have been made to the over-current protective and solid-state devices; these revisions are to be included and incorporated to the oneline modeling based on final "as-built" conditions.
- D. Studies shall be provided to the Owner in the Report submittals as indicated herein this Section. The Final (Record) Report shall address all final adjustments and modifications/changes provided during the construction and acceptance start-up of the equipment provided.
- E. Drawings and Material Data Sheets / Product Information provided by the Owner is considered as generally indicative of Power System but is not to be considered as matching actual site conditions. Modifications/field changes may have occurred which were not recorded; therefore, provide field verification as necessary to validate the Power System as Work under this project in preparation of the Short-Circuit, Protective-Coordination and Arc-Flash Study and Analysis.
- F. The approach to the evaluation and analysis work included in this assignment shall include, but not be limited to the following minimum level of effort;

1. Collect system and “as-installed” data associated with all electrical equipment, feeders, and devices associated with this Study/Report. This effort shall also include obtaining the necessary load-history and available fault current from the serving Power Utility Company.
2. Determine system modes of operation by conducting interviews with Owner’s Operational Staff
3. Determine bolted short-circuit and arc fault currents
4. Determine protective device characteristics and duration of arcs
5. Document system voltages and classes of equipment
6. Evaluate existing equipment short circuit ratings against computed available fault currents.
7. Arc Flash Hazard Analysis to select working distances as outlined herein, determine incident energy for all equipment and determine flash-protection boundary zones for all affected equipment

1.02 REFERENCES

- A. ANSI - American National Standards Institute, Inc.
 1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
 4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- B. ASTM - American Society for Testing and Materials
- C. IEEE - Institute of Electrical and Electronic Engineers
 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
 4. IEEE 1584, Latest Edition -Guide for Performing Arc-Flash Hazard Calculations
- D. IPCEA - Insulated Power Cable Engineers Association
- E. NEMA - National Electrical Manufacturers Association
- F. NESC - National Electrical Safety Code
- G. NFPA - National Fire Protection Association
 1. NFPA 70 -National Electrical Code, latest edition
 2. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition

1.03 STUDY REQUIREMENTS

- A. The Work associated with this assignment must comply with all Federal and State, municipal or other authority's laws, rules and/or regulations. The Contractor shall enlist the services of a qualified, licensed Professional Engineer (hereinafter referred to as Engineer and/or Engineer-of-Record) to conduct the actual analysis, evaluation and development of the Report and Arc Flash labeling.

- B. As previously stated, the Power System Study / Analysis shall include All (*new and existing that is to remain*) Electrical Equipment; evaluations / analyses shall be conducted by a licensed Professional (Electrical) Engineer in the State where the Project is being provided; hereinafter referred to as the Engineer-of-Record or EOR during the detailed design phase of the Project to coordinate equipment selections, evaluate / select Over Current Protective (OCP) devices and settings for coordination and potential arc flash mitigation where appropriate and determined to provide a cost/benefit.
1. In general (not limited to) and starting at the Utility, all electrical equipment including the main service transformer, Utility OCP device and system ratings shall be evaluated and included in this Study.
 2. All medium voltage equipment, motors, transformers (primary and secondary) shall be included as well as all 480 VAC low voltage equipment, motors nominally 25 HP and larger, safety disconnect switches 100 amps and above, panelboards, transformers (primary and secondary locations). 120/208-240 VAC equipment shall be included in the Study in accordance with IEEE / NFPA criteria. Where this equipment is served from transformers smaller than 125 KVA, the Study shall include the reporting data and labeling based on the acceptable criteria; labeling of this equipment is still required.
 3. Refer to other criteria and reporting requirements are outlined elsewhere in this Document.
- C. The Report(s) / calculations must be supplied to the Water Company before final equipment and specifications are considered accepted or approved. The EOR shall provide documentation for all assumptions related to machine impedances, cable impedances (both resistance and inductance), transformer impedances and other equipment values used to complete the computations where obtaining actual data is not available. The EOR shall develop fault conditions under minimum, maximum, and average power consumption scenarios based on the way the plant is to be operated. The Engineer shall also develop fault scenarios with standby power generators where included and used instead of the electric utility source. Where applicable, Load Flow calculations and Reports are to be provided as outlined in the Design Criteria for differing operational scenarios or otherwise required for the Project. Arc Flash Hazard analysis and equipment evaluations to be provided as hereinafter indicated.
- D. All oneline diagrams included in the Study / Report shall utilize naming conventions and identifiers matching the Design Documents; generic identifiers are not considered appropriate. Coordinate equipment naming / identifiers with the Owner during the design development phase of the project taking into account the existing terminology used.
1. Provide annotated onelines for the Power Distribution System identifying all equipment and naming conventions as stated above.
 2. Provide annotated onelines identifying the available short-circuit current at each piece of equipment; include this in the Section of the Report associated with this topic.
 3. Provide annotated onelines identifying the Incident Energy and Arc Flash Hazard Level at each piece of equipment; include this in the Section of the Report associated with this topic.
 4. All onelines shall be legible and readable with a minimum 10 point font size; coordinate drawing size (not to exceed 22" x 34") accordingly. Provide sleeved drawing holders where printed size is larger than 11" x 17".
- E. Short Circuit, Protective Coordination and Arc Flash Hazard Analysis Study
1. A short circuit, protective coordination and arc flash hazard analysis study shall be made for the entire distribution system in accordance with ANSI/IEEE C37.10 & C37.13, IEEE Std. 141, 242 and 399 beginning at Utility connections and ending at the largest feeder from each motor control center or panel as applicable for the system and analysis being conducted. Actual Utility data including system and equipment impedances, X/R Ratios, OCP device(s) and other applicable ratings are to be obtained by the EOR; include this

- data as provided by the Utility Company in the Report provided.
2. The protective coordination study shall consist of the following:
 - a. All protective devices contained in the scope of work shall be evaluated to provide the best possible coordination and protection where possible. The coordination study shall include computer generated log-log plots of phase overcurrent and where applicable, ground overcurrent protection devices on log-log time-current characteristic paper. Complete plots of these devices will be accurately plotted through their operating range. A oneline sketch shall be included on each plot sheet showing the device identifications and ratings. Attempts are to be made by the Engineer to obtain complete coordination on every portion of the system where possible. Appropriate maximum fault levels, transformer inrush currents, conductor insulation withstand curves and transformer damage curves / withstand points shall be plotted on each coordination plot sheet to assure adequate component protection and maximum system reliability.
 - b. Each current transformer shall be checked for saturation to insure that they accurately translate all fault currents which may be available on the system.
 - c. A complete and thorough discussion of each coordination curve sheet shall be prepared. This discussion will describe the areas where coordination is effective, as well as any instances where a lack of coordination exists. All protective relay and solid-state device settings; fuse sizes; and low-voltage circuit breaker settings shall be tabulated. Recommendations for equipment and/or conductor changes which may be necessary to improve protection and/or coordination shall also be provided in a section of the completed coordination study. The recommendations should include discussion on additional devices/replacements and adjustments to existing equipment.
 - d. A complete set of coordination curves (complete with device settings indicated on the TCC) are to be prepared starting with the Utility Company's OCP device(s) and the main distribution devices protecting the Owner's service down through and including all on-site services, feeders, sub-feeders, transformers and secondary main and branch circuit devices, shall be included in the Study. These shall be arranged to provide a uniform approach to the review and device coordination for the system and shall include a snap-shot/annotated oneline diagram on each TCC sheet outlining the devices included. Provide sufficient overlap on the TCC evaluations included to demonstrate "upstream / downstream" coordination.
 - e. The final selection and setting of overcurrent devices shall be based on this protective coordination study; coordinate these settings with overcurrent relays or primary fuses associated with the Power Company's up-stream protective devices and relative devices provided by the switchgear manufacturer
 - f. The EOR conducting the Study shall also coordinate ground fault protection provided in conjunction with the project where applied. Provide Time Current Characteristic (TCC) curves for all GFI equipment protection as outlined above.
 - g. Motor starting voltage profiles for all large motors (over 25 HP or as otherwise determined and accepted by the Owner) shall be provided based on the starter type being provided; other motors to be configured as combined loads as applicable to the application
 - h. Tabulations shall include a listing of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings. This tabulation shall also include indication of acceptability or, in the event of a noted deficiency, provide recommended solution for corrective action.
 - i. Points of non-coordination shall be brought to the attention of the Owner, along with recommendations by the EOR based on the manufacturer's equipment involved.
 - j. The Study shall include all existing and new equipment as included in the Scope of

Work for this assignment. The use of documentation and record information as may be provided by the Owner shall not be construed as providing all data necessary; the EOR shall be responsible to conduct or obtain field verification necessary to determine / obtain all required data in establishing the power distribution one-line diagram for the system being evaluated.

- k. Submissions and approval of this study are required as outlined below in Article 1.06 of these specifications.
- 3. Arc Flash Hazard Analysis
 - a. The arc flash analysis shall include the incident energy and flash boundary calculations.
 - 1) Unless otherwise specified or approved in writing by the Owner, the EOR shall utilize a Working Distance of 18 inches for ALL voltage levels (low & medium voltage values); not the 18" or 24" typical distances for low voltage systems and/or 36" for medium voltage systems as otherwise permitted under NFPA-70E / IEEE.
 - 2) Calculations shall be provided for both line and load sides of all transformers and the overcurrent protective devices served from these transformers or other separately derived sources and labeling developed to identify both Incident Energy / PPE sets of values. Equipment Arc Flash Hazard labeling to be provided indicating both Incident Energy and PPE Levels associated with these analyses to properly identify and notify workers to the hazards present.
 - b. The EOR shall furnish an Arc Flash Hazard Analysis Study per the latest edition of NFPA 70E - *Standard for Electrical Safety in the Workplace*, reference Article 130.3 and as indicated in Annex D to these specifications.
 - c. The analysis shall utilize the appropriate short-circuit and clearing times associated with the over-current protective devices. Where this information is not available, alternative methods for similar devices shall be identified and submitted in the study for review and comment by the Owner.
 - d. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (I.E. transformers, switchboards, switchgear, motor-control centers, panelboards, busways and other associated power equipment) where work (including inspection activities) may be performed on energized parts. [i.e. infrared scanning / thermal-imaging of terminations]
 - e. The Arc-Flash Hazard Analysis shall include all medium voltage where applicable, 480/277 volt locations as well as those locations associated with the 240 volt and 208 volt systems fed from transformers greater than 112.5 KVA. Where the arc-flash energy is calculated to be a value below the PPE 0 level (or 1.2 cal/cm²) of protection, the Analysis shall provide indication; however, electrical equipment shall still be labeled as part of the Work associated with this project.
 - f. Safe working distances shall be identified for calculated fault locations based upon a calculated arc flash boundary considering an Incident Energy level of 1.2 cal/cm²; (the distance at which the incident heat energy density would be 1.2 cal/cm²). Working distances shall be based on paragraph 3.a.1 above and in accordance with the general criteria as outlined in IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
 - g. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude (based on the available fault-current values, not the AIC ratings of the equipment). The minimum calculation shall assume that the Utility contribution is at a minimum and shall assume a minimum motor load contribution from the Facility. Conversely, the maximum calculation shall assume a maximum contribution from the Utility and shall assume motors to be operating under full-load operating conditions. The calculations shall include all motor and other sources that can contribute to the available fault current. The Arc-

Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

- h. As previously noted, Arc flash computations shall include both line and load side of “main” breaker calculations. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. In general, AW does not consider the use of this IEEE Exception to be appropriate. However, where the EOR proposes using a maximum clearing time of 2 seconds (*based on IEEE 1584, Appendix B.1.2*), the Study Report shall include the EOR’s supplemental evaluation & documentation regarding the physical conditions of the area, the type of equipment involved and the work tasks anticipated in making this recommendation for consideration and acceptance by the Owner. Where it is deemed not physically or readily possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, the maximum clearing time based on the specific location shall be utilized unless otherwise proposed by the EOR through the evaluation of the area and tasks as outlined above.
- i. Results of the Analysis shall be submitted in tabular form, include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and the arc flash incident energy levels determined. In addition, the Study shall include the EOR’s recommendations for possible reduction in the arc flash energy as well as other possible provisions for improving operation, maintenance and safety of personnel.
- j. The Report shall also include identification of the Personnel-Protective Equipment (PPE) Classes and identify minimum PPE required for each location.
- k. Arc Flash Labeling of Electrical Equipment: Provide copies of the Arc Flash Labels (Article 3.03 below) in the Report for documentation of the information being identified on the equipment in a separately tabbed section of the report. Include in this section definitions of the terms and distances outlined along with information on the various PPE equipment classifications indicated.

1.04 SHORT CIRCUIT, PROTECTIVE COORDINATION AND ARC FLASH ANALYSIS STUDY QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled (*minimum of 10 years of demonstrated experience in conducting power systems studies; provide qualifications upon request*) in performing and interpreting the power system studies. The final report, including copies of the Arc Flash Labels, shall be sealed and signed by the EOR.

1.05 ENGINEERING STUDY / REPORT SUBMISSIONS

- A. Submit the following Reports for AW Engineering Review and Comment.
 - 1. Preliminary – Report to contain field verified and annotated One-line Power Riser Distribution Diagram with OCP devices, device settings and cable feeders (conductor size/type and raceway size/type) identified.
 - a. As part of this Preliminary effort, consideration related to new equipment selections shall include type of device, and features needed to assure adequate withstand suitability and over-current protective features needed for protective coordination with other elements of the power distribution system and loads served. Provide initial discussion and/or indication related to proposed equipment for Owner consideration and comment.

- b. Include the overall oneline diagram along with a oneline diagram indicating the initial short-circuit values anticipated based on Utility and simplified computer modeling approach. This information will provide basic evaluation for the equipment short-circuit / withstand ratings initially being considered / developed.
2. Pre-Final - Provide a written response to Owner comments provided regarding Preliminary Study Report. Advance the Preliminary Report, providing all calculations associated with Short-Circuit AIC values and Equipment suitability, initially identified Protective Coordination settings, and preliminary Arc-Flash Hazard Analysis Report with proposed / typical ANSI Z535.* label information (**current edition*) documentation. Where considered appropriate, this report is to be presented with a Recommendations Section (supplement to the Executive Summary) identifying any proposed modifications or other changes associated with reduction of fault current, improved protective coordination and mitigation of arc-flash energy being considered / recommended by the EOR. Preliminary PPE ratings will be clearly identified in the Report for each piece of equipment to assist in Owner's review. Recommendations for any modifications and/or changes shall include estimated costs related to the materials, installation/construction, and design/engineering.
 - a. Included in this Report, Oneline Drawings for the overall Power Distribution Power Riser diagram, an annotated oneline outlining the Short-Circuit ampacity values calculated, and an annotated oneline showing the Arc Flash Incident Energy and PPE Levels calculated. Each of these oneline diagrams shall be included in their appropriate Sections of the Report.
 - b. In addition, a copy of the oneline diagram with the OCP devices indicated shall be included with the Protective Coordination TCC's. Each TCC shall include the partial oneline drawing associated with the protective coordination elements being evaluated and included.
3. Final - Provide a written response to Owner comments provided regarding Pre-Final Study Report. Finalize the information associated with the Pre-Final Report; update data, settings and other appropriate information including any accepted Recommendations and/or Modifications.
 - a. Provide three hard-copies of each submission Report as well as editable Word electronic formatted Report document with the Final submission. Power Distribution Riser Diagrams shall be provided for all analysis configurations conducted including, but not limited to, short-circuit models for minimum and maximum operational scenarios and arc flash hazard models. Include hardcopies of equipment reports and calculations performed.
 - b. Submit an electronic copy of the final Arc Flash Hazard Analysis and One-line Power Riser Diagram, complete with all associated equipment databases formatted with the engineering software used and as outlined herein.
 - c. The report shall include the following sections:
 1. Executive Summary including Introduction, Scope of Work and Results/Recommendations
 2. Short-Circuit Methodology Analysis Results and Recommendations
 3. Short-Circuit Device Evaluation Table
 4. Protective Device Coordination Methodology Analysis Results and Recommendations
 5. Annotated and revised oneline diagrams (all) as outlined in "2" above shall be provided with the Final Report.
 6. Protective Device Settings Table
 7. Time-Current Coordination Graphs and Recommendations
 8. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.

9. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as actual copies of the label images.
10. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.
4. Upon acceptance of the Final Report, provide labeling of the power distribution equipment in accordance with ANSI Z535.4– Product Safety Signs and Labels; label size to be 4" x 6". Labels to be provided as outlined in Article 3.03 below. Label materials furnished to be suitable for either the interior or exterior locations where they are to be applied; provide samples for review and approval by the Owner along with data sheets from the Manufacturer outlining these applications.

1.07 COMPUTER ANALYSIS SOFTWARE

- A. The studies shall be performed using ETAP power systems software as provided by OTI, or SKM Systems Analysis Power Tools for Windows (PTW) software program.
- B. Provide a final electronic file copy of all data, reports and the oneline diagram in electronic engineering database (ETAP or SKM) format to the Owner prior to final acceptance of the Project. This information is to be validated by the EOR as representing "As-Built" conditions including all over-current protective devices and their settings, feeder conductors and raceway information and load data; including inductive, resistive and combination loads. The files shall contain all Reports (in Microsoft Word) conducted including Short-Circuit evaluations, Protective Coordination and Load Flow Studies as well as the Arc Flash analysis values determined as well as copies of the Arc Flash labels. The EOR for the Study shall attest to this validation in writing when submitting the final electronic copy of the project.

PART 2 – PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.01 FIELD INVESTIGATION / DATA COLLECTION

- A. Continuity of Service:
 1. If any service or system must be interrupted, the Contractor / Engineer shall request permission in writing stating the date, time, etc. the same will be interrupted and the areas affected. This request shall be made in sufficient time (approximately 1 week minimum in advance) for proper arrangements to be made. Written permission shall be obtained from the Owner before any interruption to electrical power is permitted.
- B. Lock-Out / Tag-Out Procedures
 1. The Contractor shall provide his own lock-out / tag-out equipment in coordination with the Owner's program; coordinate with the Owner's field operational and maintenance staff.
 2. The Contractor shall have in effect a written safety program that includes a lock-out / tag-out safety program in accordance with OSHA under Part 1910, Subpart S.
- C. Electrical Safety Program

1. The Contractor shall review the Owner's Electrical Safety Program and take the necessary precautions, in conjunction with his own safety program for employee protection.
 2. The Contractor is to have in effect a written electrical safety program that includes all applicable provisions of the NFPA-70E which has been adopted by OSHA under Part 1910, Subpart S.
- D. The Contractor shall provide written documentation indicating that his employees, those working on American Water projects, have been trained and certified on all provisions applicable to B and C above upon request from the Water Company.
- E. The Contractor's employees shall follow all provisions of Band C above including, but not limited to, the use of personal protective equipment (PPE), establish protective barriers, approach boundaries and documentation for such activities. Provide a written statement attesting to the above requirements prior to the start of the Field Investigation / Data Collection activities.

3.02 FIELD ADJUSTMENT

- A. The Contractor shall adjust protective devices settings based on the final accepted Study/Report provided by the Engineer; settings to be listed in a table format and submitted as part of the final O&M Manual for the equipment / system.

3.03 ARC FLASH WARNING LABELS

- A. The electrical equipment supplier or independent study engineer shall provide an ANSI Z535.4 compliant (size 4 in. x 6 in.) thermal transfer type two color die-cut arc flash label as provided by DuraLabel or Brady for each work location analyzed and included in this project. Material type to be suitable for the locations; IE indoor, outdoor, chemical resistively, etc.
- B. If the equipment will be energized prior to the application of the final labels, provide temporary labels until the final labels are applied. Temporary labels do not need to be of the materials specified above. Temporary labels shall be suitable for the environment (example 110 pound paper or 30 pound paper in a plastic "page protector"). [Note: label information to meet required criteria outlined herein for permanent labeling. Once final labels are available, remove temporary labeling and provide permanent labels as indicated.]
- C. The label shall have either an orange header with the wording, "**WARNING, ARC FLASH HAZARD**", or a red header with the wording, "**DANGER, ARC FLASH HAZARD**". The Danger signal wording shall be provided for all incident energy values calculated greater than 40 cal/cm²; Warning to be used for all values calculated below 40 cal/cm². These labels shall include the following information:
1. Location designation
 2. Nominal voltage
 3. Flash protection boundary
 4. Hazard risk category including PPE Classification
 5. Available Fault Current at this equipment location (*SS Value from study*)
 6. Incident energy
 7. Working distance
 8. Engineer, report number, revision number and issue date

Refer to Appendix for Sample Label and Information to be included

- D. Labels shall be machine printed, with no field markings
- E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended over-current device settings. Coordinate the data provided with the Arc Flash Study results and the ANSI labeling requirements. Quantities outlined below are considered minimum quantities necessary; provide additional labeling as may be required by Regulatory or Inspection Agencies at no additional cost to the project.
 - 1. For each transformer, 480 and applicable 240 and/or 208 volt panelboard, individually-mounted circuit breaker and safety disconnect device, one arc flash label shall be provided
 - 2. For each motor control center, one arc flash label shall be provided (*see footnote below*).
 - 3. For each low voltage switchboard, one arc flash label shall be provided (*see footnote below*).
 - 4. For each low or medium voltage switchgear, one arc flash label shall be provided (*see footnote below*).
 - 5. For medium voltage switches one arc flash label shall be provided (*see footnote below*).
 - 6. For each motor power terminal box, 25 horsepower and larger, one arc flash label shall be provided
 - 7. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

(Footnote – where control center, switchboard, or switchgear assemblies are dual-fed, provide on arc flash label at each main entrance device or section as well as at any “Tie” device location. For equipment that is front and rear accessible, provide the same labeling on the rear sections as outlined above.)

- F. Refer to the Appendix to this Section for examples of required labels.
- G. Labels shall be field installed by the (Contractor or Engineer) at the conclusion of the project after acceptance by the Owner.
- H. Provide written maintenance procedures and guidelines in accordance with NFPA-70E; Latest Edition

APPENDIX 2 - ATTACHMENT 9

[RESERVED]

APPENDIX 2 ATTACHMENT 10

CHEMICAL STORAGE ANALYSIS

POST TREATMENT CHEMICAL STORAGE ANALYSIS						
	Avg Pre MGD 24.0	Max Pre MGD 28.0	Avg 2nd Pass MGD 4.1	Max 2nd Pass MGD 4.1	Avg Post MGD 9.6	Max Post MGD 11.2
	Sodium Hydrox Post 50%	Sodium Hydrox 2nd Pass 50%	Zinc Ortho Phosphate 32.5%	Sodium Hypochlorite to Filters 0.8%	Sodium Hypochlorite to Post 0.8%	Sodium Hypochlorite Total 0.8%
Active Ingredient Concentration Units Form Density Deliv. (lb/gal)	6.4 lb/gal Liquid Neat 12.76	6.4 lb/gal Liquid Neat 12.76	3.8 lb/gal Liquid/ Neat 11.68	On-Site Hypo Gener. 0.07 lb CE/gal Liquid 8.34	On-Site Hypo Gener. 0.07 lb CE/gal Liquid 8.34	On-Site Hypo Gener. 0.07 lb CE/gal Liquid 8.34
Dose	Dose, (mg/L) as Active Ingredient					
Minimum Average Maximum	2.0 3.0 5.0	5.0 10.0 20.0	0.5 1.0 3.0	0.50 2.00 3.00	1.00 1.50 2.50	
Dose	Average Flow - Pounds per Day of Active Ingredient					
Minimum Average Maximum	160 240 400	171 342 684	40 80 240	100 400 600	80 120 200	180 520 801
Dose	Maximum Flow - Pounds per day of active ingredient					
Minimum Average Maximum	187 280 467	171 342 684	47 93 280	117 467 701	93 140 234	210 607 934
	Average Flow Feed Rate - Volumetric Basis					
Dose Minimum Average Maximum	gal/day 25 38 63	gal/day 27 54 107	gal/day 11 21 63	gpm 1.0 4.2 6.3	gpm 0.8 1.3 2.1	
	Maximum Flow Feed Rate - Volumetric Basis					
Dose Minimum Average Maximum	gal/day 29 44 73	gal/day 27 54 107	gal/day 12 25 74	gpm 1.2 4.9 7.3	gpm 1.0 1.5 2.4	
Storage Units	gals	gals	gals	SALT: 3 lbs/Chlorine Equivalent		
Max. Dose x Avg. Flow x 30 days	1,882	3,216	1,899	54,043	18,014	72,058
Avg. Dose x Max. Flow x 30 days	1,318	1,608	738	42,034	12,610	54,644
Avg. Dose x Avg. Flow x 30 days	1,129	1,608	633	36,029	10,809	46,837
Storage Volumes	Bulk Delivery 3,448 gal			Bulk Delivery 44,000 lbs SALT Bulk Tank 2		
Bulk Delivery 3,768 gal						
Bulk Tank 1 5,653						
Delivery Size						
Storage Number						
Min Volume Each, gal						
Notes	1					
NOTES						
Note (1) Bryneer Model 10-15 to receive 25 ton delivery						

PRETREATMENT CHEMICAL STORAGE ANALYSIS

Average Flow, MGD: 24.0 Filter Waste Flow, MGD 1.2 2nd Pass Inlet, MGD 4.1
 Max Flow:, MGD 28.0 Filter Waste Flow, MGD 1.4 2nd Pass Inlet, MGD 4.1

	Coagulant Ferric Chloride 40%	Sodium Bisulfite 38%	Sulfuric Acid 50%		Polymer Non-Ionic to Waste 35.0%	Threshold Inhibitor Pre 100%	Threshold Inhibitor to 2nd Pass 100%
Active Ingredient	4.7	4.2	5.83		3.1	10.4	10.4
Concentration	lb/gal	lb/gal	lb/gal		lbs/gal	lb/gal	lb/gal
Units	Liquid	Liquid	Liquid/		Liquid Emulsion	Liquid	Liquid
Form	Neat	Neat	Neat		Neat	Neat	Neat
Density Deliv. (lb/gal)	11.68	11.09	11.66		8.8	10.4	10.4
Dose	Dose, (mg/L) as Active Ingredient						
Minimum	2.0	1.5	5.0		0.2	2.0	2.0
Average	3.0	3.0	10.0		0.2	3.0	3.0
Maximum	5.0	6.0	30.0		0.8	6.0	6.0
Dose	Average Flow - Pounds per Day of Active Ingredient						
Minimum	400	300	1,001		2	400	68
Average	600	600	2,002		2	600	103
Maximum	1,001	1,201	6,005		8	1,201	205
Dose	Maximum Flow - Pounds per day of active ingredient						
Minimum	467	350	1,168		2	467	68
Average	701	701	2,335		2	701	103
Maximum	1,168	1,401	7,006		9	1,401	205
	Average Flow Feed Rate - Volumetric Basis						
Dose	gal/day	gal/day	gal/day		gal/day	gal/day	gal/day
Minimum	86	71	172		0.65	38.4	7
Average	129	142	343		0.65	57.6	10
Maximum	214	285	1,030		2.60	115.2	20
	Maximum Flow Feed Rate - Volumetric Basis						
Dose	gal/day	gal/day	gal/day		gal/day	gal/day	gal/day
Minimum	100	83	200		0.76	44.8	7
Average	150	166	401		0.76	67.2	10
Maximum	250	332	1,202		3.03	134.4	20
Storage							
Units	gals	gals	gals		gals	gals	gals
Max. Dose x Avg. Flow x 30 days	6,429	8,548	30,899		240	3,456	592
Avg. Dose x Max. Flow x 30 days	4,500	4,986	12,016		70	2,016	296
Avg. Dose x Avg. Flow x 30 days	3,857	4,274	10,300		19	1,728	296
Storage Volumes							
Delivery Size	Bulk Delivery 3,768 gal	Bulk Delivery 3,967 gal	Bulk Delivery 3,774 gal		Drum, 55 gal 55	Bulk Delivery 4,221 gal Bulk Tank 1 6,331	
Storage Number	Bulk Tank 1	Bulk Tank 1	Bulk Tank 1		Drum 1		
Min Volume Each, gal	5,653	5,950	10,000		or 10 PAILS @ 5 GAL		
Notes	Note 1						

NOTES

1 - Excludes feed to Filter to Waste or Brine Discharge

APPENDIX 2 ATTACHMENT 11

CAD STANDARDS

CAPTIAL IMPROVEMENT PROJECTS

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Software

1. AutoCad software is the preferred drawing software. The most recent version of AutoCad should be used.

Drafting Procedures

EXTERNALLY REFERENCED DRAWING

1. Begin a new drawing with the Awwborder template file, **AWWBORDER.DWT**.

AutoCAD Template Files

FILENAME	DESCRIPTION
AWWMODEL.DWT	This template is to be used for all full-scale (real world) Model Space drafting.

2. Draw all items in real world measurements in model space. Ex: a pipe that is 100 feet long shall be drawn at 100 feet.
3. Save Drawing as per AWW file naming procedure (page 2) for externally referenced drawing using the normal save command icon.

Layering Convention

All layer names shall follow the AIA National CAD Standard layering standard. Absolutely **NO** numbers will be used as layer names.

Color Scheme

Colors shall determine the line weight of the object being drawn; the color scheme shall be as follows with the first color being the heaviest and the last being the lightest. **CYAN (4), GREEN (3), RED (1), BLUE (5), WHITE (7), YELLOW (2).** Color **MAGENTA (6)** shall be used for all existing objects. The appropriate color will correspond with the discipline of the dwg. Ex: A concrete foundation will be color (4) Cyan on the structural dwgs but will be color (7) white on the mechanical dwgs for new items. All non specific discipline items will be color (7) white. Text and dimensions shall always be color yellow (2). All bold text shall be color cyan (4). All new hatch patterns will be color 253 on all disciplines except if that item is being described or detailed then you would use a heavier color such as blue or red (new items). The color will be changed on the contract dwg (layout) to agree with the discipline of that dwg. All discipline driven items shall be color (4) cyan or color (3) green or color (1) red or color (5) blue depending on the complexity of the individual detail and its viewport scale. EX: If a detail shows information regarding a complex steel detail and if cyan was used, the detail bleeds into other items after it was plotted, then you would use color green or red to clearly show the information after it has been plotted. This will be at the user's desecration. Typically, cyan is used for the discipline driven item. All non-discipline items will always be color (7) white. All existing items on all disciplines will

always be color (6) magenta. The Standard .ctb file will be supplied by AW for plotting to follow the above color scheme.

File Naming Procedure

Externally Referenced (XREF) Drawings

Xref drawing files should conform to an eight.three (XXXXXXXXX.DWG) naming structure and should identify the objects being drawn as clearly as possible. The following procedure shall be used to name and save Xref drawings:

First Character	=	X
Second & Third Characters	=	Location/Building Designation AV = Altitude Valve Vault BW = Backwash Tank CB = Chemical Building CW = Clearwell ET = Elevated Tank FB = Filter Building GE = Generator GS = General Site GST = Ground Storage Tank LM=Location Map OF = Office OFS = Outfall Structure PS = Pump Station RWI=Raw Water Intake SB = Sed Basin TP=Treatment Plant WW = Washwater Tank
Fourth Character	=	Dash (-)
Fifth Character	=	Discipline code A = Architectural C = Civil/Site work E = Electrical D = Process I = Instrumentation M = Mechanical (HVAC, Plumbing, Fire Protection) R = Removals S = Structural
Sixth & Seventh Characters	=	Drawing Type DT = Detail EL = Elevation FP = Floor Plan PR = Profile RP=Roof Plan SC = Section SH = Schematic

Externally Referenced (XREF) Drawings (cont'd)

Eighth Character = Floor Level or Revision (if necessary, otherwise don't use)
Could also be the Section Number (1,2) or Elevation Direction (N, S, E or W)

For Example:

XCB-MFP1.DWG would be the Chemical Building, Mechanical first floor plan.

XAV-SSCA.DWG would be the Altitude Vault, Structural Section "A".

XFB-AE.DWG would be the Filter Building, Architectural Elevation.

Contract or Sheet Drawings

1. Begin a new drawing with the paper space template file, **AWWBORDER.DWT**. The **AWWBORDER.DWT** shall be used for all disciplines. **The AWWBORDER.dwt shall never be exploded, revised, renamed or scaled. Also, the AWWBORDER.dwt will not be xreferenced into a drawing, a new drawing shall be started each time using the AWWBORDER.dwt. Sheet sets will be acceptable.** The limits will remain at 0,0 & 36,24 and be plotted at 1:1. All attributes inside the AWWBORDER.DWT will be filled out according to AWW naming convention for new drawings. AWW uses a document management program and it is **VITAL** that the border template and block remain as is.

AutoCAD Template Files

TEMPLATE NAME	DESCRIPTION
AWWBORDER.DWT	This template is to be used for all layouts and annotation in the Paper Space environment. This template is to be used for all drawings slated to be xrefs once the title block information is deleted.

2. Enter necessary information into the AWW title block with DDATTE icon.
3. Save the drawing as per the AWW File Naming Procedure for Contract Drawings. See attached .pdf file.
4. Toggle to Model Space. Attach the required xref's.
5. Toggle back to Paper Space and create all necessary viewports with the MVIEW command while on the appropriate layer.

6. All dimensions and annotation shall be on the model space of the xref drawing following the Autocad normal standard procedure for dimensions and annotation. All text will be annotative and follow the AWW Text Style guide.

7. All contract Dwgs shall be plotted at a scale of 1:1. They will include a graphic scale and north arrow.

8. The title block shall contain all required pertinent information related to the project such as project title, location, engineer of record, date, WBS number, drawing number, sheet numbers and revision dates. In the case of CAD files the file path shall be placed on the drawing along with the plot date using AutoCAD's plot stamp.

9. Generally all drawings shall be aligned with project north to the top of the drawing sheet. A north arrow shall be placed on the drawing in a prominent location.

10. Each drawing shall display project notes in a tabular format when required. Notes shall be project specific as determined by the Project Manager or Designer. Drawing notes shall consist of, but not be limited to, items such as construction/restoration specification, reference map information, utility information etc.

If the drawing contains topographic information the drawing shall include a vertical datum note, which shall indicated the vertical datum utilized on the plan. It will also include surveyor information. Where a specific horizontal datum is utilized, a horizontal datum note shall be shown on the plan.

11. All drawing revisions made after official release of the drawing shall be dated and noted in the revision block. An Autocad generated plot stamp will be used on all plotted drawings.

12. All drawings that are issued outside of E&TS shall be updated in the title block as follows:

- (a) "Preliminary" – used for issue of any drawing prior to approval of Final Design. Drawings issued for permitting purposes shall not be stamped.
- (b) "Permit Set" – used for the issue of any drawing intended for permits.
- (c) "Bid Set" – used for the issue of any drawing intended for bidding.
- (d) "Issued for Construction" – used for issue of any drawing intended for construction.
- (e) "Record Drawing" – used for as-built drawings.

13. Standard survey note shall be added to the topo graphic sheet and read as follows: “All survey information is taken from a survey information is taken from a survey prepared by (name), (city), (state), registered card surveyor, (number #), prepared (date) for (water company)”.

14. All drawing sets shall include cover sheet with drawing index, logo, water co. name, project title, aww engineering name, and month/year.

IF the contractor uses their own title block/border due to their document management sytem, they shall insert the block named Awwblock.dwg and fill out all attributed information according to the AWW Standarads outside of the contractors border. This will allow the AWW document management tracking to take place.

File Naming Procedure

Contract Dwgs

- Design contract drawings are assigned numbers, which are based on a 3 to 4 digit company number, a 3 to 4 digit series number and a 2 to 4 digit discipline sheet number (A = Architectural, G = General, E = Electrical, H = HVAC, I = Instrumentation, M = Mechanical, P = Process, PL = Plumbing, R = Removal, S = Structural).

- For Example:

A drawing prepared for New Jersey American Water Company, Lakewood District, and is an Architectural Dwg would be 350-1234-A1, a Mechanical Dwg would be 350-1234-M1. The following sheets in the discipline would be consecutive, M2, M3, M4 etc.

- Drafting personnel in the AWW Corporate Engineering Office will assign drawing numbers. A detailed list is kept for all districts within a Water Company. Since all projects are unique, each drawing set must also have a unique number. To avoid any confusion or duplication of drawing numbers, please contact AWW Corporate Engineering for all drawing numbers. Please provide the following information when calling in: Project Name & Station (location), BP Number, Name of Consultant (if one is used), and approximate number of drawings in the set. System Engineering drafting personnel will then issue a drawing number for the contract drawings and the sequential number for manufacturer's information drawings.

- The project design engineer prior to the start of drafting should prepare a drawing development schedule. The development schedule will provide the title of the project (line 1) and the discipline, location and type of drawing information (lines 2, 3 and 4) required to complete the title block of each drawing. Drawings should be numbered in accordance with this list.

- The electronic drawing filename will conform to an eight or nine.three (XXXXXXXXX.DWG) naming structure and **WILL EQUAL** the AWW drawing number but

without the dashes. Call AWW Corporate Engineering Cad Department for numbers (856)-727-6133

- For Example:

A drawing prepared for New Jersey-American Water Company, Lakewood District whose assigned drawing number is 350-1234-A1, would be electronically filed and saved as 3501234A1.DWG.

IF the contractor uses their own numbering system, all files shall be renamed electronically to follow the AWW standard listed above for final acceptance. The AWW design group will receive a CD containing all electronic drawing files numbered according to the AWW numbering system, including any xrefs, image files and .ctb files.

The table below lists the standard AWW text styles that are to be used when annotating drawings.

AutoCAD Text Styles

TEXT STYLE NAME	FONT	HEIGHT	DESCRIPTION
ROMANS	Roman Simplex	.1	Leaders & Notes & Dimensions
ROMAND	Roman Duplex	.15	Room Names, General Notes Title
ROMANDLG	Roman Duplex	.2	Headings, Titles
STANDARD*	Txt	N/A	Not Used

*AutoCAD Default Style – not used on AWW drawings.

AutoCAD Dimension Styles

Dimensions shall conform to the normal practices as set forth by Autocad for dimensions in model space, xrefs and viewports. All settings within the dimension variables will produce the final size in the viewports, text = .1, text style = Romans, arrow size = .125. Dimension layers shall conform to the AIA Layering standard.

HATCH PATTERNS

Standard Hatch Patterns

PATTERN	SCALE	ANGLE	DESCRIPTION
Steel			Sections through Steel Members
ANSI-37			Plans & Sections of Block Walls
AR-B816C			Elevations of Block Walls
ANSI-31			Plans of Brick Walls
AR-BRSTD			Sections of Brick Walls
BRICK			Elevations of Brick Walls
AR-CONC			Sections through Concrete
EARTH		<u>45</u>	Grade - New or Existing
INSUL			Sections through Wall Insulation
INSUL			Sections through Roof Insulation (other than batt)
GRATE			Grating - FRP or Aluminum
HOUND			Select fill (under slabs)
AR-SAND			Sand (i.e. Filter Media, Sub-base Material)
Aggregate			Broken Stone (under footers)
Sqshngle			Roof Shingles (elevation view)
Chainlnk			Chain link Fence (elevation view)
Chkdl			Checkered Plate (double line)
Chkds			Checkered Plate (single line)

NOTE: Scale of the hatch pattern shall be left up to the cad operator.

Design Drawing Development Schedule

AMERICAN WATER SYSTEM ENGINEERING DEPARTMENT IN-HOUSE DESIGN DRAWING DEVELOPMENT SCHEDULE

1ST LINE: PROJECT TITLE AS INDICATED IN BP MEMORANDUM

	2ND LINE	3RD LINE	4TH LINE
GENERAL	COVER SHEET		
CIVIL	CIVIL	LOCATION & VICINITY	PLANS
	CIVIL	SITE WORK & GRADING	PLANS
	CIVIL	SOIL EROSION & SED. CONTROL	PLANS
	CIVIL	SITE WORK	MISCELLANEOUS DETAILS
	CIVIL	OUTSIDE PIPING	PLANS
	CIVIL	OUTSIDE PIPING	PROFILES
REMOVALS	REMOVALS	LIMITS OF CLEARING	PLAN
	REMOVALS	PARTICULAR STRUCTURE	PLANS (at several elevations)
	REMOVALS	PARTICULAR STRUCTURE	SECTIONS
ARCHITECTURAL	ARCHITECTURAL	PARTICULAR STRUCTURE	PLANS (at several elevations)
	ARCHITECTURAL	PARTICULAR STRUCTURE	ELEVATIONS
	ARCHITECTURAL	PARTICULAR STRUCTURE	WALL SECTIONS
	ARCHITECTURAL	PARTICULAR STRUCTURE	DETAILS & SCHEDULES
STRUCTURAL	STRUCTURAL	PARTICULAR STRUCTURE	PLANS (at several elevations)
	STRUCTURAL	PARTICULAR STRUCTURE	SECTIONS
	STRUCTURAL	PARTICULAR STRUCTURE	DETAILS
MECHANICAL	PROCESS	OVERALL PLANT	SCHEMATIC
	PROCESS	OVERALL PLANT	HYDRAULIC PROFILE
	MECHANICAL	INTAKE/PUMP STATION/	PLANS (at several elevations)
	MECHANICAL	INTAKE/PUMP STATION/	SECTIONS
	MECHANICAL	CLARIFIER/FILTER BLDG./	DETAILS
	CHEMICAL PIPING	CLEARWELL/PUMP STATION	SCHEMATICS
	CHEMICAL PIPING	ETC.	PLANS (at several elevations)
	CHEMICAL PIPING	ETC.	SECTIONS & DETAILS
	PLUMBING	ETC.	PLANS
	PLUMBING	ETC.	SECTIONS
	PLUMBING	ETC.	DETAILS
ELECTRICAL	INSTRUMENTATION	OVERALL PLANT	PROCESS & INST. DIAGRAM
	INSTRUMENTATION	OVERALL PLANT	MOUNTING DETAILS
	ELECTRICAL	OVERALL PLANT	LEGENDS
	ELECTRICAL	OVERALL PLANT	MISCELLANEOUS DETAILS
	ELECTRICAL	OVERALL PLANT	SITE PLAN
	ELECTRICAL	OVERALL PLANT	ONE LINE DIAGRAM
	ELECTRICAL	OVERALL PLANT	SCHEMATIC DIAGRAMS
	ELECTRICAL	PARTICULAR STRUCTURE	PLANS (at several elevations)
	ELECTRICAL	PARTICULAR STRUCTURE	SECTIONS & DETAILS
	ELECTRICAL	PARTICULAR STRUCTURE	CONDUIT SCHEMATIC
	ELECTRICAL	PARTICULAR STRUCTURE	CABLE & CONDUIT SCHEDULE

NOTES:

Water Company No's.
Contact AWWSC Engineering for Drawing Prefixes
(856)-727-6133

Miscellaneous Procedures

Addendum Sketches

Addendum Sketches are 8 1/2" x 11" (A-size) drawings that are prepared during the bid phase to inform all potential contractors of a change in design. The need for such sketches usually arises during the contractors' review and bid preparation for a project. The Design Engineer for the specific project usually provides input for the Addendum Sketch.

An 8 1/2" x 11" attributed title block has been created and saved as 81-2X11A.DWG and should be inserted **into** a modified or newly prepared plan, section or detail. The size of the sketch has been selected for ease in faxing to the contractors. If a large area of an original drawing is affected by the change/clarification, the entire D-size sheet will be revised and reissued to the all bidding contractors. All clarifying plans, sections or details must also be added to the original bid set of documents for incorporation into the As-built or Record set. Each affected bid set drawing should be updated in a timely manner and the revision should be noted in the Revision block of the title block. Annotation should include: the Addendum number, the drafter's initial, and the current date. Leave space for the approving engineer to initial the revision.

The Addendum Sketch title block contains the following information: Title of Sketch (4 lines), Drafter's Initials, Project Engineer's Initials, Date Sketch was prepared, Project BP Number, Scale of Sketch, Addendum Sketch Number, Sketch Revision Date, and Reference Drawing Number. The Reference Drawing Number is the drawing number of the original design drawing in the bid set where the plan, section or detail was drawn. The Addendum Sketches are assigned drawing numbers in the following format: ADD-001, ADD-002, ADD-003, etc. Senior Drafting Personnel will assign drawing numbers. The original sketch will be filed with the Senior Design Drafter and a copy will be sent to the Approving Engineer for further markup or development.

Working Sketches

Working Sketches are 8 1/2" x 11" (A-size) drawings that are prepared after the project has gone to bid and has been awarded to a contractor. The need for such sketches usually arises during construction and should provide answers to the contractor's questions regarding field changes to the original design. The Design Engineer and/or the Construction Engineer for the specific project usually provide input for the Working Sketch.

An 8 1/2" x 11" attributed titleblock has been created and saved as N:\ACADCOM\BORDERS\81-2X11W.DWG and should be inserted **into** a modified or newly prepared plan, section or detail. The size of the sketch has been selected for ease in faxing to the contractor. If a large area of an original drawing is affected by the change/clarification, the entire D-size sheet will be revised and reissued to the contractor. All clarifying plans, sections or details must also be added to the original bid set of documents for incorporation into the As-built or Record set. Each affected bid set drawing should be updated in a timely manner and the revision should be noted in the Revision block of the title block. Annotation should include: a description of the change, the drafter's initial, and the current date. Leave space for the approving engineer to initial the revision.

The Working Sketch title block contains the following information: Title of Sketch (4 lines), Drafter's Initials, Project Engineer's Initials, Date Sketch was prepared, Project BP Number, Scale of Sketch, Working Sketch Number, Sketch Revision Date, and Reference Drawing Number. The Reference Drawing Number is the drawing number of the original design drawing in the bid set where the plan, section or detail was drawn. The Working Sketches are assigned drawing numbers in the following format: WS-001, WS-002, WS-003, etc. Senior Drafting Personnel will assign drawing numbers. The original sketch will be filed with the Senior Design Drafter and a copy will be sent to the Approving Engineer for further markup or development.

Redlining Procedure For **Contract Drawings**

Check prints of design contract drawings should be reviewed by the drafting group as well as by the engineering group before they are sent to external agencies for their review, comments or action. The following should be used as a guideline for redlining these drawings in a concise and consistent manner.

- Red Ink - should be used to indicate all revisions and corrections to a drawing
- Green Ink - should be used to indicate any desired deletions to a drawing
- Yellow Ink - should be used to indicate that any new or revised work has been done correctly
- Blue Ink - should be used by drafting personnel to indicate that a redlined item has been incorporated into the drawing. This will also assist personnel when reviewing the updated check print.

- Pencil - should be used to indicate notes or directions to drafting (things that drafting should do, but not things that should appear on the final drawing - i.e. "Move this electrical cabinet over 3 feet to the right").

Appendix A

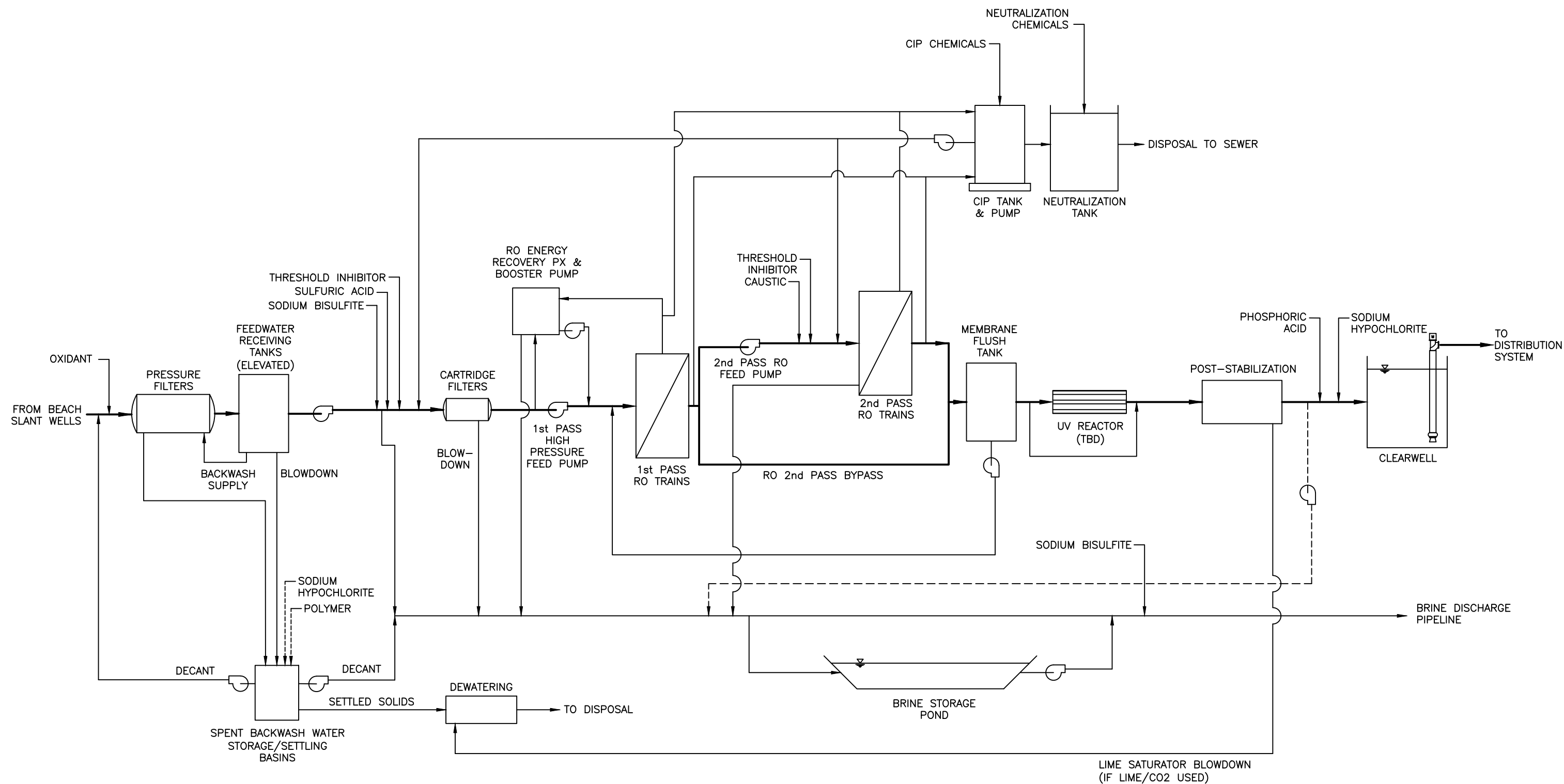
AWW Abbreviations

<u>Abbreviation</u>	<u>Description</u>
A.B.	Anchor Bolt
ADJ	Adjacent
ALUM.	Aluminum
ANSI	American National Standards Institute
APPROX.	Approximate
ARCH.	Architectural
AMP	Ampere
ASME	American Society of Mechanical Engineers
ASSY	Assembly
ASTM	American Society for Testing and Materials
UTO.	Automatic
AUX.	Auxiliary
AVG	Average
BLDG	Building
B.O.M.	Bill of Material
B.O.C.	Bottom of concrete
B.O.S.	Bottom of steel
BR	Bronze
BR	Brass
BTM	Bottom
C	Channel
°C	Centigrade, or Celsius
C to C	Center to Center
CFM	Cubic feet per minute
CHKD	Checked/Checkered (as in plate)
CI	Cast Iron pipe
CL.	Clearance
CM	Centimeter
COL.	Column
C.O.	Cleanout
CONC.	Concrete
CONSTR.	Construction
CONT.	Continued
CPLG	Coupling


CU.	Cubic
DEG(°)	Degrees
DIA.	Diameter
D.I.P.	Ductile Iron Pipe
DIM.	Dimension
DISCH.	Discharge
DN	Down
DPI	Differential Pressure Indicator
DWG	Drawing
E	East
EA.	Each
EA	Exhaust Air
E.F.	Each face
EL.	Elevation
ELL	Elbow
EQUIP.	Equipment
E.S.	Each Side
E.W.	Each way
EXIST.	Existing
EXPAN.	Expansion
F	Fan
°F	Fahrenheit
FD	Floor drain
FIG.	Figure
FL.	Floor
FLG	Flange
FLGD	Flanged
FPS	Feet per second
FS	Far side
FT(')	Foot or feet
FTG	Fitting
GAL.	Gallon(s)
GALV.	Galvanized
GPM	Gallons per minute
GND	Ground (as in electrical)
H	Height
HB	Hose Bibb
HEX	Hexagon(al)
HORIZ.	Horizontal
HP	Horsepower
HVAC	Heating, ventilation, and air conditioning
HZ	Hertz (frequency)
I.D.	Inside Diameter
IN.(")	Inches
INV.	Invert (inside bottom of pipe)
JT.	Joint
KG	Kilogram

KVA	Kilovolt amperes
KW	Kilowatts
L	Length
LBS	Pounds
LR	Long Radius (of elbow)
M	Meter
MATL	Material
MAX.	Maximum
MCC	Motor Control Center
MECH.	Mechanical
MFR.	Manufacturer
MH	Manhole
MJ	Mechanical Joint (Pipe)
MIN.	Minimum
MISC.	Miscellaneous
MM	Millimeter
MVA	Megavolt amperes
N	North
N/A	Not applicable
NC.	Normally Closed
N.O.	Normally Open
NO.	Number
NOM.	Nominal
NPS	National pipe size
NPT	National pipe thread
NS	Near Side
NTS	Not to scale
OA	Outside air
O.D.	Outside Diameter
OH	Overhead
OPN'G.	Opening
ORIG.	Original
O.S.D.	Open Site Drain
P&ID	Process & Instrumentation Diagram
PE	Plain End (Pipe, etc.)
PERP.	Perpendicular
PL	Plate
PRESS.	Pressure
PRV	Pressure reducing/regulating valve
PSI	Pound per square inch
PSIA	Pound per square inch absolute
PSIG	Pound per square inch gauge
PVC	Polyvinyl chloride
QTY	Quantity
QUAD.	Quadrant
RED.	Reducing/Reducer
REINF.	Reinforcing/Reinforcement

REQ'D.	Required
REV.	Revision
RPM	Revolutions per minute
S	South
SCH or SCHED.	Schedule
SHT	Sheet
SLV	Sleeve
SQ.	Square
SR	Short Radius (of elbow)
S.S.	Stainless Steel
STD	Standard
STRUCT.	Structure/Structural
SUCT.	Suction
TEMP.	Temperature
THRU	Through
T.O.C.	Top of concrete
T.O.P.	Top of pipe
T.O.S.	Top of steel
TYP.	Typical
UG	Underground
UH	Unit heater
V	Volts
VERT.	Vertical
W	Watts
W	West
W	Width



APPENDIX 2 EXHIBIT 1

VERSION 4 4/29/2013	Monterey Peninsula WSP		 Draft Process Flow Schematic
	Drawn by E. Y. Idica, P.E.	Apr 2013	
	Design by C. C. Trussell, P.E.	Apr 2013	
	Design by S. Creel, P.E.	Apr 2013	
	Review by R. R. Trussell, P.E.	Apr 2013	

CONCEPTUAL DESIGN
OF POWER
DISTRIBUTION SYSTEM
RISER DIAGRAM
(SHEET 1 of 2)

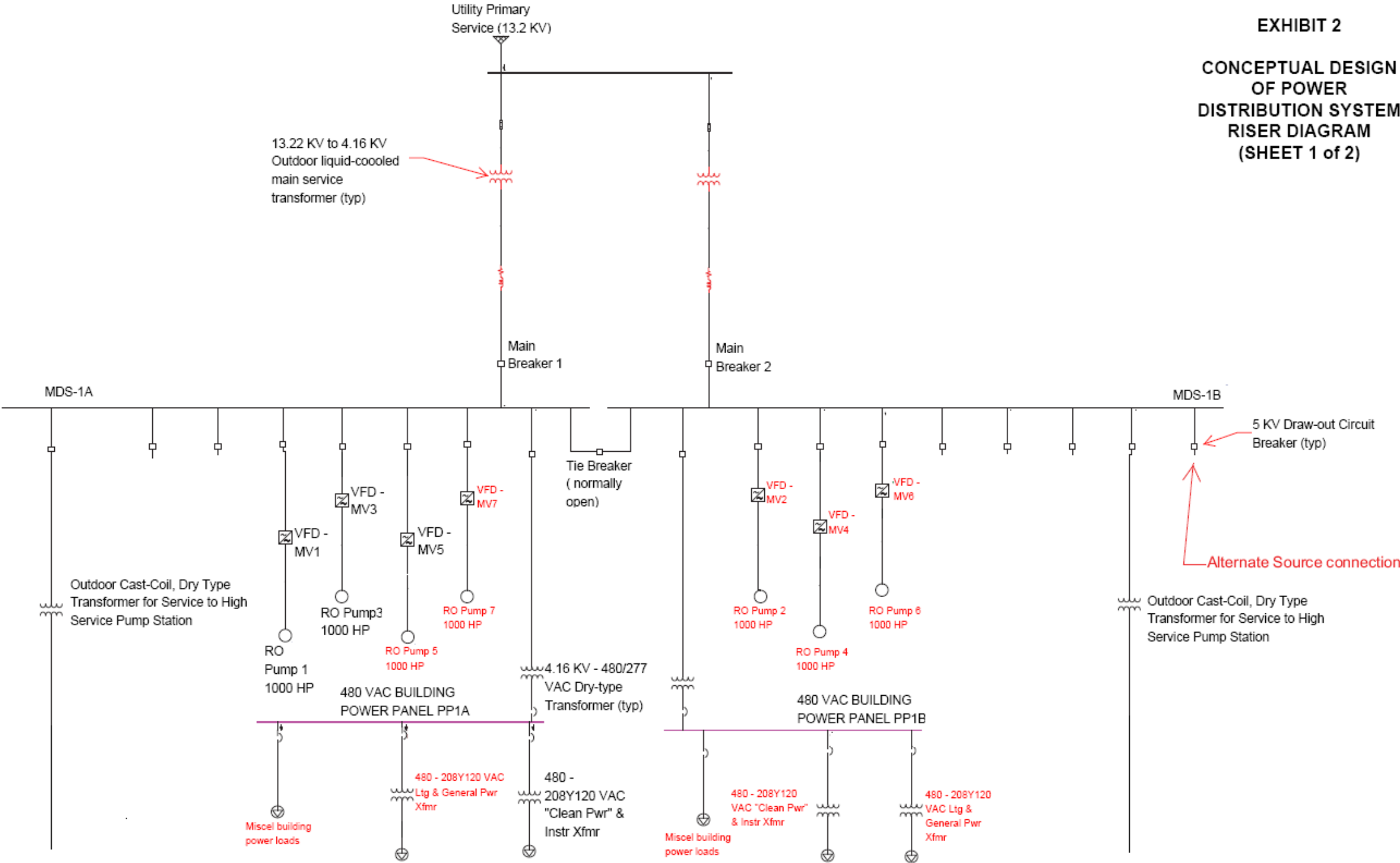
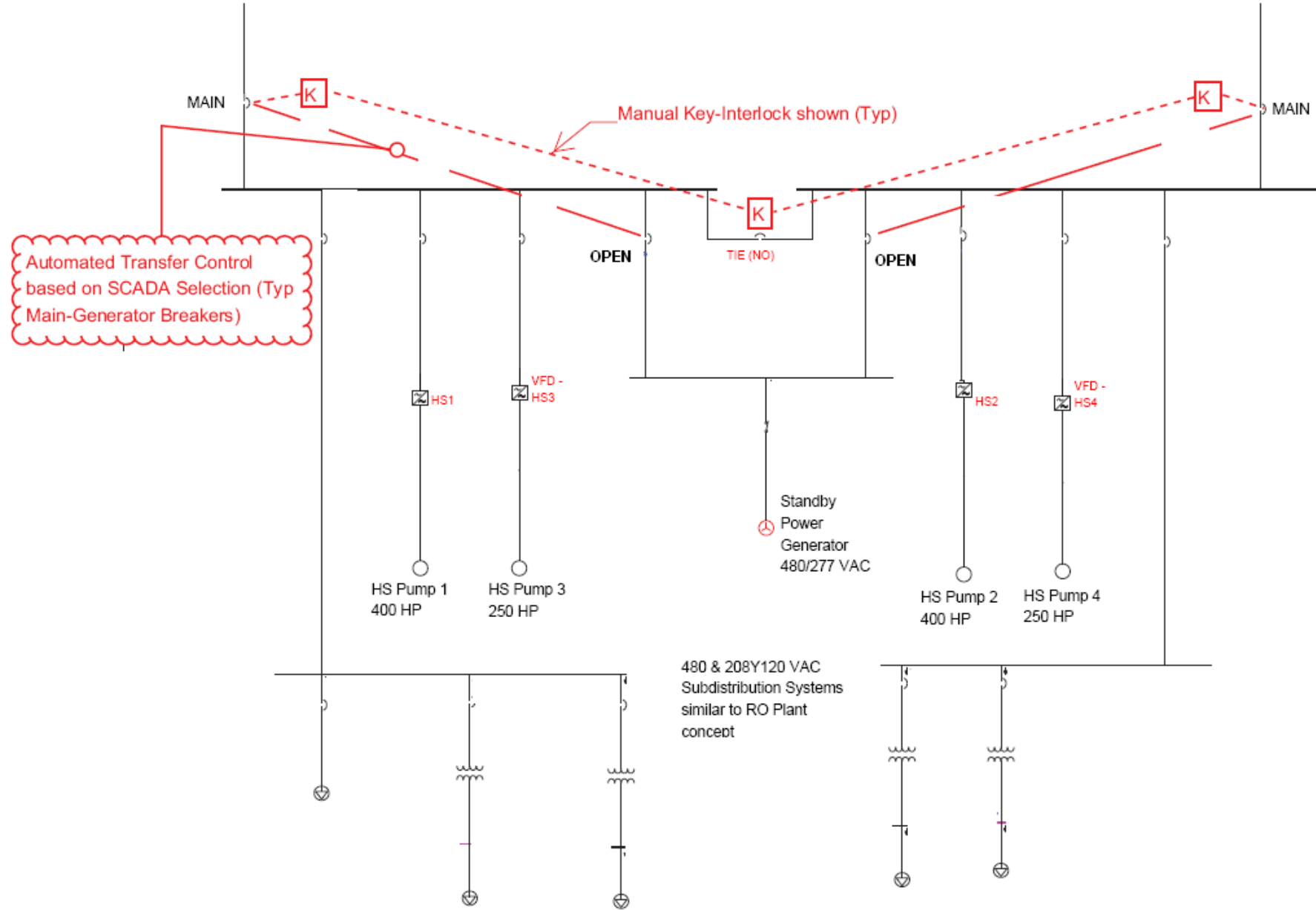


EXHIBIT 2

CONCEPTUAL DESIGN
OF POWER
DISTRIBUTION SYSTEM
RISER DIAGRAM
(SHEET 2 of 2)



Automated Transfer Control
based on SCADA Selection (Typ
Main-Generator Breakers)

Filtered Water Feedwater Pumps
not shown; Other loads such as
backwash pumps and UV
disinfection not shown.

HIGH SERVICE PUMP STATION - ONELINE DIAGRAM

Appendix 3

Governmental Approvals

Appendix 3

Governmental Approvals

3.1 Purpose and Objectives

The purpose of this Appendix is to provide a preliminary outline of the Governmental Approvals that are expected to be required for the design, construction and operation of the Project. Section 3.2 of this Appendix identifies Owner-designated Governmental Approvals. Section 3.3 identifies Governmental Approvals that are expected to be required to be obtained by the Design-Builder for the performance of the Design-Build Work. Notwithstanding the preliminary listing of Governmental Approvals in Section 3.3 of this Appendix, the Design-Builder shall be responsible for identifying and obtaining all Governmental Approvals (other than the Owner-designated Governmental Approvals) necessary for the performance of the Design-Build Work.

The Design-Builder shall be responsible for complying with the terms and conditions of all Governmental Approvals, including the Owner-designated Governmental Approvals.

3.2 Owner-Designated Governmental Approvals

Table 3-1 sets forth the Owner-designated Governmental Approvals that Owner shall be responsible for obtaining in connection with the Project. The Design-Builder's obligations with respect to assisting the Owner in obtaining the Owner-designated Governmental Approvals are set forth in Section 3.6 of the Design-Build Agreement.

Table 3-1

CAW-Designated Governmental Approvals

Federal Agencies	
Regulatory Agency	Regulatory Permit, Authorization or Approval
U.S. Fish and Wildlife Service (USFWS), Ecological Services Branch	Biological Opinion or letter of concurrence and Incidental Take Statement as a result of coordination under Section 7 Endangered Species Act, (ESA)
	Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; ch. 55; 48 stat. 401)
National Oceanic & Atmospheric Administration (NOAA)	Consultation under Section 305(b), Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. Section 1855(b))

National Oceanic & Atmospheric Administration (NOAA), National Marine Sanctuary Program (NMSP), Monterey Bay National Marine Sanctuary (MBNMS)	Authorization under the MBNMS Management Plan and the National Marine Sanctuary Program (15 Code Fed. Regs. Part 922)
U.S. Army Corps of Engineers (USACE)	Individual or Nationwide Permit in accordance with Section 404 Clean Water Act (33 U.S.C. Section 1344)

State Agencies	
-----------------------	--

Regulatory Agency	Regulatory Permit, Authorization or Approval
California Public Utilities Commission (CPUC)	Certificate of Public Convenience and Necessity (PUC Article 1)
California State Lands Commission	Land Use Lease (Right-of-Way Permit) (Pub. Res. Code Section 6000 et seq.; 14 Cal. Code Regs. Section 1900 et seq.)
California Department of Fish and Game (CDFG)	Incidental Take Permit in accordance with the California Endangered Species Act (CESA) (Fish & Game Code Section 2081)
California Coastal Commission (CCC)	Coastal Development Permit in accordance with the California Coastal Act (Pub. Res. Code Section 30000 et seq.)
California Department of Parks and Recreation Office of Historic Preservation	Coordination under Section 106 of the National Historic Preservation Act (NHPA) (16 USC 470 et seq.)
Regional Water Quality Control Board for the Central Coast Region	National Pollutant Discharge Elimination System (NPDES) permit in accordance with Clean Water Act Section 402 (33 U.S.C. Section 1342)

Local/Regional Agencies	
--------------------------------	--

Regulatory Agency	Regulatory Permit, Authorization or Approval
Monterey County	Coastal Development Permit (See CCC Above)
Monterey Peninsula Water Management District (MPWMD)	Water System Expansion Permit in accordance with Ordinance 96 of the MPWMD Board of Directors

[Note: To be finalized based on successful Proposal. If the Proposer's design requires any modification to these Governmental Approvals, the Proposer shall assume the risk and responsibility with respect to obtaining such modifications and the appropriate Governmental Approvals will be moved to Table 3-2]

3.3 All Other Governmental Approvals

Table 3-2 identified Governmental Approvals that are expected to be required to be obtained by the Design-Builder for the performance of the Design-Build Work. The Design-Builder shall prepare and make all filings, applications and reports and take all other action necessary to obtain and maintain, and shall obtain and maintain, all Governmental Approvals set forth in Table 3-2.

Table 3-2

Governmental Approvals

Federal Agencies	
Regulatory Agency	Regulatory Permit, Authorization or Approval
State Agencies	
Regulatory Agency	Regulatory Permit, Authorization or Approval
Regional Water Quality Control Board (RWQCB)	National Pollutant Discharge Elimination System (NPDES) General Permit For Storm Water Discharges Associated With Construction Activity (WQO No. 2009-0009-DWQ)
	Waste Discharge Requirements (WDR) per Porter-Cologne Water Quality Control Act. (Water Code Section 13000 et seq.)
	Water Quality Certification in accordance with Section 401 Clean Water Act (33 U.S.C. Section 1341)
California Department of Public Health (CDPH)	Permit to Operate a Public Water System (Health & Safety Code Section 116525)
Local/Regional Agencies	
Regulatory Agency	Regulatory Permit, Authorization or Approval
Monterey County	Encroachment Permit (Monterey County Code Title 14 Chapter 14.040)
	Use Permit (Monterey County Code Chapter 21.74)
	Combined Development Permit Process (Monterey County Code Chapter 21.76)
	Grading Permit (Monterey County Code Chapter 16.08)
	Erosion Control Plan (Monterey County Code Chapter 16.12)

Monterey Bay Unified Air Pollution Control District (MBUAPCD)	Permit to Construct Desalination Treatment Facilities (Monterey County Code Chapter 10.72)
	Protected Tree Removal Permit (Monterey County Code Chapter 16.60)
	Authority to Construct in accordance with Local Rule 3.1
	Permit to Operate in accordance with Local Rule 3.2

3.4 Additional Information

Additional information on required Governmental Approvals can be found in the January 9, 2013 Memorandum from RBF Consulting titled Permitting Status Update, and in the California American Water Company Coastal Water Project Final Environmental Impact Report, October 30, 2009, including Section 3.7 Permits, Approvals, and Regulatory Requirements, and Table 3-14, Potential Permits and Approvals for the CWP. The January 9, 2013 Memorandum from RBF Consulting is included as **Attachment 1** to this Appendix 3.

3.5 Proposal Requirements

In its Proposal, the Design-Builder has provided an updated version of Tables 3-1 and 3-2 to identify each applicable Governmental Approval the Design-Builder expects to be required for the performance of the Design-Build Work. The updated listing of Governmental Approvals was included in Section E of the Technical Proposal as described in Section 4.5.3 of the RFP.

Appendix 3 - Attachment 1

Memorandum from RBF Consulting

MEMORANDUM

To: Richard Svindland, California American Water
From: Kevin Thomas and Paul Findley, RBF Consulting
Date: January 9, 2013
Subject: Permitting Status Update

Background

Since July 2004, CAW has been working with the regulatory community and other stakeholders to develop the most environmentally sound and technically feasible project. This included an extensive Permit Coordination Center and public outreach program that was conducted when the Project was known as the Coastal Water Project, with over 50 public meetings and a series of regulatory agency workshops. CAW successfully obtained all necessary regulatory permits for the Moss Landing Desalination Pilot Plant, which operated for 12 months through late 2009. In 2011, nearly all discretionary permits were submitted or obtained for the prior, similar "2010 Monterey Regional Desalination Project". In 2010 and 2012, Final Environmental Assessment/Finding of No Significant Impact (EA/FONSI) NEPA documents were submitted to the U.S. Army for the Monterey Presidio Pipeline Crossing (March 2012) and the Aquifer Storage and Recovery Facilities (September 2010) at Fort Ord.

Monterey Peninsula Water Supply Project Permitting

The prior permitting work noted above provides CAW with a good foundation for regulatory permitting of the proposed Project. Current regulatory permitting activities include:

- 1) The CPUC CEQA process includes regulatory agency scoping as part of the Notice of Preparation (NOP) and related agency discussions to better understand and respond to permitting concerns. The December October 2012 NOP Scoping included written comments from key regulatory agencies and related environmental stakeholder organizations;
- 2) The CPUC CEQA process will include various technical studies that, together with a certified Subsequent EIR, will be essential components of the full-scale regulatory permitting process;
- 3) The list of regulatory permits and permitting agencies that were identified in the Coastal Water Project EIR is attached. It is anticipated that this list will be updated as part of the Subsequent EIR currently underway, and that permitting activities will be guided by that list and by the recommendations of that EIR;
- 4) CAW has been meeting with stakeholders and regulatory agencies since 2004, and most recently has met with key interest groups toward resolving Salinas Basin water rights concerns;
- 5) CAW has successfully obtained landowner consent from CEMEX for the test well, and continues negotiations with CEMEX regarding full-scale lease and access;

- 6) CAW has successfully closed escrow on acquiring the desalination plant site;
- 7) CAW is substantially complete with obtaining lease approvals from the U.S. Army for the Monterey Presidio Pipeline easement and for the ASR wells at Fort Ord;
- 8) CAW has had discussions with the City of Seaside and FORA concerning permitting and acquisition of a site or sites to accommodate the Terminal Reservoir and ASRPS.
- 9) Since May 2012, CAW has been exploring various design and siting options for the proposed test well, to demonstrate technical, environmental and permit feasibility of the subsurface slant well intake concept, generally located in north Marina at the CEMEX property.
- 10) Specific test well permitting activities have included the following:
 - a. Evaluation of test well sites from south of Reservation Road to north of Salinas River, including several potential locations and configurations at CEMEX, resulting in the currently proposed test well concept;
 - b. Several regulatory agency briefings for the proposed test well (held in September and October 2012);
 - c. Regulatory permit applications are in process for the following agencies and anticipated permits/approvals:
 - i. California Coastal Commission – Coastal Development Permit
 - ii. City of Marina – Coastal Development Permit, CEQA Lead Agency (for test well)
 - iii. County of Monterey – Coastal Development Permit (potential, depending on HDD launch and staging area on back side of dunes)
 - iv. State Lands Commission – lease
 - v. U.S. Army Corps of Engineers – Clean Water Act Section 404 compliance, Rivers and Harbors Act Section 10 Permit, NEPA Lead Agency
 - vi. Regional Water Quality Control Board – Central Coast Region – NPDES/WDR Permit, and Clean Water Act Section 401 Certification
 - vii. Monterey Bay National Marine Sanctuary – authorization and/or consultation as part of Coastal Act and Clean Water Act compliance
 - viii. U.S. Fish and Wildlife Service – Section 7 consultation through the U.S. Army Corps of Engineers
 - ix. California Department of Fish and Wildlife – consultation through the City of Marina CEQA compliance process
 - x. County of Monterey – Well Construction Permit (ministerial)
 - xi. State Historic Preservation Officer – consultation through the U.S. Army Corps of Engineers

Monterey Bay Regional Desalination Project Permitting Matrix

Agency or Department	Permit or Approval	Contact Information	CAW-only	Test Wells	Regional Desalination Project											Status / Notes (Date Updated: 10-28-11)	
					Brackish Source Water Wells	Brackish Source Water Pipeline	Desal Plant	Brine Discharge Pipeline	Product Water Pipeline	MCWD Tie-in Pipeline	Transmission Pipeline	Monterey Pipeline	Seaside Pipeline	Terminal Reservoir	ASR Pipeline and Wells		
FEDERAL AGENCIES																	
U.S. Environmental Protection Agency (USEPA)	Class V Underground Injection Control Program (Part C, Safe Drinking Water Act)		✓												X		
U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act compliance (ESA Section 7 consultation)															Not required	
	Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; ch. 55; 48 stat. 401)															Not required	
National Oceanic & Atmospheric Administration (NOAA) – Fisheries	Endangered Species Act compliance (ESA Section 7 consultation or ESA Section 10 approvals)	Jacqueline Pearson Meyer 777 Sonoma Ave, Room 325, Santa Rosa, CA 93941															
Monterey Bay National Marine Sanctuary	Review and coordination for all RWQCB 404, Section 10 and NPDES permits	Brad Damitz MBNMS Main Office, 299 Foam St. Monterey 93944			X	X	X	X	X	X	X	X	X	X	X	Consultation only; permitting through other state and federal agencies. Started coordination; conducted meeting. Submitted draft authorization permit application to MBNMS on 5/23/11.	
	Authorization Permit				X?												
Presidio of Monterey	Coordination for Rights of Entry	Darcy Brewer, U.S. Army Presidio of Monterey 1759 Lewis Road, Suite 210, Monterey, CA 93944	✓									X			X		
Fort Ord Reuse Authority / Army (FORA)	Coordination with FORA for Right of Entry (FOST/FOSL)	Stan Cook 100 12th St, Bld 2880, Marina, CA 93933	✓										X	X	X	No FORA right of entry required for MCWD facilities; only required for Seaside Pipeline, Terminal Reservoir and ASR wells and Pipeline	
U.S. Army Corps of Engineers (ACOE)	Nationwide Section 404 Permit (CWA, 33 USC 1344)		✓													No impacts to Waters of the U.S.	
	Section 10, Rivers and Harbors Act Permit (33 USC 403)															No impacts to Waters of the U.S.	
Federal Aviation Administration	Form SF 7460-1, Notice of Proposed Construction and Alteration for Airport Airspace Aeronautical Study															Permit only required if structures > 73 feet tall	
STATE AGENCIES																	
California Public Utilities Commission	Certificate of Public Convenience and Necessity (PUC Article 1)	Andrew Barnsdale 505 Van Ness Ave. San Francisco, CA 94102	✓									X	X	X	X	Completed	
State Water Resources Control Board, Central Coast Regional Water Quality Control Board	General Construction Activity Storm Water Permit (WQO 99-08-DWQ)	Mike Higgins - mhiggins@waterboards.ca.gov, 805-542-4649		X	X	X	X	X	X	X	X	X	X	X	X	Use State General Permit for construction; started coordination	
	401 Water Quality Certification (CWA Section 401)															Not required; no 404 Permit required	
	Waste Discharge Requirements. (Water Code 13000 et seq.)			X	X	X	X	X	X	X	X	X	X		X	Use low-threat General Permit for test well and pipeline testing; started coordination.	
	National Pollutant Discharge Elimination System (NPDES) Permit (CWA Section 402)						X	X								Started coordination. Met with RWQCB and MRWPCA to discuss NPDES requirements.	
	Facility Operations Stormwater Permit						X?									Use State General Permit for industrial sites	
California State Lands Commission	Rights-of-Way (Land Use Lease) (California Public Resource Code Section 1900); Lease amendment	Jane Smith - jane.smith@slc.ca.gov, 916-574-1892 100 Howe Ave., Ste 100-South.							X?							Coordinating with SLC for jurisdiction determination.	
California Coastal Commission	Coastal Development Permit (Public Resources Code 30000 et seq.)			X	X	X	X	X	X	X	X	X	X			Submitted Coastal Development Permit for the Monterey Bay Regional Desalination Project on April 1, 2011. Acquired all letters of concurrence from Local Coastal Programs. Submitted response to CCC Notice of Incomplete for RDP on 5/31. Submitted CDP for the Test Well Program on April 14, 2011. CCC continued the Test Slant well application at the August 2011 meeting. Continued coordinating with CCC.	
California Department of Fish and Game (CDFG)	Streambed Alteration Agreement (California Fish and Game Code Section 1602)											X				Alignment requiring permit has been deleted	
	California Endangered Species Act Section 2081 Incidental Take Permits (CESA Title 14, Section 783.2)	7329 Silverado Trail, Napa, CA 94558	✓											X			
	California Endangered Species Act Section 2081 Incidental Take Permits (CESA Title 14, Section 783.2) - Letter of Concurrence re: no permit required			X	X	X	X	X	X	X	X	X				No take required for any areas EXCEPT the Terminal Reservoir site.	
California Department of Public Health (CDPH)	Permit to Operate a Public Water System (California Health and Safety Code Section 116525)	Jan Sweigart 11 Lower Ragsdale, Bdg 1, Ste 120, Monterey, 93940			X	X	X	X	X	X	X	X	X	X	X		
California Department of Transportation (Caltrans)	Encroachment Permit (Streets and Highway Code Section 660)	Steve Senet - 805-549-3206 Steve.senet@dot.ca.gov 50 Higuera St, San Luis Obispo 93401				X			X	X	X	X				Submitted information package to Steve Senet at Caltrans on 3/4/11. He has provided a new contact, Peter Hendrix, to begin coordinating with. A meeting will be set up in Fall 2011.	
California Department of Parks and Recreation	Encroachment, easement, or property acquisition for any project component	Ken Gray - 831-649-2862 kgray@parks.ca.gov 2211 Garden Road, Monterey 93940							X	X	X	X	X			Right of Entry permits and encroachment permits will be required. Info package submitted to Ken Gray 5/23/11.	
California State Historic Preservation Office (SHPO)	Section 106 Consultation; National Historic Preservation Act (16 USC 470)			X	X	X	X	X	X	X	X	X	X	X	X		

Monterey Bay Regional Desalination Project Permitting Matrix

Agency or Department	Permit or Approval	Contact Information	CAW-only	Test Wells	Regional Desalination Project										ASR Pipeline and Wells	Status / Notes (Date Updated: 10-28-11)	
					Brackish Source Water Wells	Brackish Source Water Pipeline	Desal Plant	Brine Discharge Pipeline	Product Water Pipeline	MCWD Tie-in Pipeline	Transmission Pipeline	Monterey Pipeline	Seaside Pipeline	Terminal Reservoir			
LOCAL AGENCIES																	
Monterey County Public Works Department	Encroachment Permit (Monterey County Code (MCC) Title 14 Chapter 14.040)	Laura Lawrence - lawrence1@co.monterey.ca.us, 831-755-5148 168 W. Alisal St, 2nd Floor Salinas, CA 93901			X?	X?	X	X?	X?							Submitted information package to John Ford on 3/17/11. Coordinating with Laura Lawrence to confirm permit requirements from all Monterey County departments.	
Monterey County Health Department, Environmental Health Division	Well Construction Permit (MCC, Title 15 Chapter 15.08, Water Wells)			X	X											X	Started coordinating with Department for well requirements.
	Hazardous Materials Business Plan (Health and Safety Code Chapter 6.95)						X										Submitted general information package to Monterey County 3/17/11; John Ford provided Laura Lawrence as the new County contact.
	Hazardous Materials Inventory (Health and Safety Code Chapter 6.95)						X										Submitted draft application November 2009. Met with the County Health Department.
	Permit to Construct & Operate Desalination Facility (MCC Chapter 10.72)						X										
Monterey County Planning and Building Inspection Department	Hazardous Material/Waste Permit						X										
	Variation on Monterey County Noise Ordinance (MCC Chapter 10.72)																Need for this permit is currently uncertain
	Use Permit (MCC Chapter 21.72 Title 24)																MCWRA/MCWD exempt from having to acquire Use and Building Permits from local agencies.
Monterey Peninsula Regional Park District	Grading Permit (M.C.C., Grading and Erosion Control Ordinance, Chapter 16.08 – 16.12)				X	X	X	X	X								
	Erosion Control Permit (MCC, Grading and Erosion Control Ordinance, Chapter 16.08 – 16.12)				X	X	X	X	X								
Monterey Peninsula Regional Park District	Encroachment Permit; Right of Entry	Tim Jensen 60 Garden Court, #325, Monterey 93940							X	X	X	X	X				
Monterey Regional Water Pollution Control Agency	Easement						X	X									
Monterey Regional Waste Management District	Participation agreements / Sewer Connection Permit						X	X									On-going coordination
	Electric Power Purchase Agreement						X										On-going coordination
Monterey Bay Unified Air Pollution Control District (MBUAPCD)	Construction Easement					X											Required if pipeline is in Charlie Benson Lane.
	Authority To Construct. (Local district rules, per Health and Safety Code 42300 et seq.)	Jean Getchell - 831-647-9411 x227 jgetchell@mbuapcd.org 24580 Silver Cloud Ct, Monterey, 93940			X?	X?	X?	X?	X?	X?	X?	X?		X?	X?		Confirm that permit is not required; get letter of concurrence
	Permit To Operate. (Local district rules)						X?										Confirm that permit is not required; get letter of concurrence
Transportation Agency of Monterey County	Easement	Debra Hale 55-B Plaza Circle, Salinas 93901							X	X	X	X?	X?				
City of Marina	Grading Permits				X												Started coordination with the City of Marina.
	Encroachment Permit				X	X			X	X?							
	Use Permits																MCWRA/MCWD exempt from having to acquire Use and Building Permits from local agencies.
City of Sand City	Building and Grading Permits																MCWRA/MCWD exempt from having to acquire Use and Building Permits from local agencies.
	Encroachment Permit		✓								X						
City of Seaside	Building and Grading Permits		✓									X	X	X	X		ASR wells on federal lands; permit from Seaside not required.
	Encroachment Permit									X?		X	X	X	X		ASR wells on federal lands; permit from Seaside not required.
	Use Permit		✓												X	X	ASR wells on federal lands; permit from Seaside not required.
City of Monterey	Building and Grading Permits																
	Encroachment Permit		✓									X					
City of Pacific Grove	Building and Grading Permits																
	Encroachment Permit		✓									X					
Seaside Groundwater Basin Watermaster	Permit for injection/extraction		✓													X	
Monterey Peninsula Water Management District (MPWMD)	Water System Expansion Permit (MPWMD Board of Directors Ordinance 96)		✓								X	X	X	X	X		
Underground Services Alert (USA)	Utility clearance before subsurface work				X	X	X	X	X	X	X	X	X	X	X	X	Call 2 days before you dig.
CAW and Local Water Agencies	Participation/purchase agreements				X	X	X	X	X	X	X	X	X	X	X	X	
PRIVATE ENTITIES																	
CEMEX	Land use agreement			X	X												
Armstrong Family	Land use agreement			X	X	X	X										
Landowners	Land lease/sale; Easements and encroachment agreements				X	X	X	X	X	X	X	X	X	X	X	X	

Notes:
 1. Permits for brine discharge pipeline are for the construction and operation of a pipeline required to connect the desal plant with the SVWRP outfall. Revised permitting for new outfall discharges are not included.
 2. The cogen plant is a separate project. Power will be purchased from them and therefore no permitting is required for this aspect of the project.
 3. X? means we believe we need a permit but we don't yet know because design is not complete. During final design the X? will either go away or become X.

Appendix 3 - Attachment 1

Memorandum from RBF Consulting

Appendix 4

General Design-Build Work Requirements

Appendix 4

General Design-Build Work Requirements

4.1. SCOPE OF DESIGN-BUILDER SERVICES

In addition to the work identified in the Design-Build Agreement, the following services shall be provided by the Design-Builder:

A. SCOPE OF SERVICES DURING DESIGN

1. Preparation and maintenance of a progress schedule throughout the design phase. The schedule can be in either Gantt chart or CPM form and must include all work items as defined in the Request for Proposal. The schedule shall compare actual to scheduled activities and be updated monthly once an award of the Design-Build Agreement is made. As a minimum, the schedule must include specific dates for the following milestones:
 - a. Submission of information prior to review meetings. At least one week shall be allotted in the schedule for review of information by the Owner prior to any meeting.
 - b. Each specific review meeting.
 - c. Completion of permit applications for each specific permit.
 - d. Design phase completion.
 - e. Receipt of each specific permit. The Design-Builder shall ensure that the schedule reflects typical or legal review periods required by each respective regulatory agency to ensure receipt of permits by the required date.
2. Attendance at periodic meetings including all design phase and construction progress meetings with the Owner at their offices located in Pacific Grove, California, or at the Project Site. Information shall be provided to Owner at least seven (7) working days prior to any meeting. It is expected that, at a minimum, monthly design meetings will be required during the design phase including an initial Project meeting. The initial Project meeting will be coupled with a partnering meeting mentioned below. Other design phase meetings include progressive review of design documents (15%, 30%, 60%, and 90% complete) and preparation of permit applications.
3. Within thirty (30) days after the Contract Date, a one day partnering conference will be held in accordance with Appendix 6.
4. Performance of a constructability and value engineering review by the Design-Builder with participation of Owner. The value engineering review shall review each element of construction work with consideration given to feasible methods of construction,

constraints to construction (materials, labor, specialty construction, weather, plant operations, other, etc.), design details, time required to complete each element of work, and possible alternatives which would reduce costs. Pursuant to the Governance Committee Agreement, the value engineering process will be undertaken at the 30% design level.

5. All land survey work, including basic control as necessary to adequately complete the design and filter permit applications, and provide construction layouts. At a minimum, property lines, topographic information and location of existing above ground and underground features/structures are to be included.
6. All geotechnical investigations including soil borings, rock cores, and auger probing as necessary to provide a geotechnical report to adequately complete the design and to estimate and plan construction earthwork.
7. All environmental activities as necessary to adequately complete the design and to prepare permit applications.
8. Total interaction and coordination with all Utility companies to design and specify proper service for the proposed improvement and to coordinate the relocation of existing Utilities as required. The Design-Builder shall also determine if any additional capital or usage fees will be imposed by any specific Utility.
9. Determining which local, State, and federal permits are required for this Project, preparing necessary permit applications, and providing technical input as required in securing these permits. The Design-Builder shall also provide the Owner with information regarding the approximate length of review time for each permit, and any special requirements that could delay this process (e.g., public hearings). Except for extraordinary revisions required by regulatory agencies, the Design-Builder is expected to revise reports, plans, and specifications as necessary to secure permits as part of the basic lump sum proposal. The permit applications will be formally submitted and paid for by the Owner.
10. Preparation and maintenance of a "Design Memorandum". The Design Memorandum is a summary of design data presented in outline format along with other pertinent Project information. The primary intent of the memorandum is to allow the Owner to review and comment on the design early in the design schedule. The Design Memorandum shall be updated throughout the design, and resubmitted as necessary at each subsequent review meeting as well as being submitted with permit applications, where applicable. The Design Memorandum is often used as the Engineer's Report in permit applications. A summary of the information to be included in the memorandum is outlined in the Attachments.
11. Preparation of a narrative description of the operation of the proposed facilities to be used by plant operations personnel to familiarize themselves with the operation, capabilities, and limitations of the proposed improvements. The narrative shall be an extension of the process sections from the Design Memorandum, but in text format. It shall explain the

intent and function of each unit process in addition to the system as a whole, and it shall include the detailed written control strategies (functional descriptions) which were prepared for the Design Memorandum submission. Preparation of the narrative shall not begin until the Design Memorandum is finalized and accepted. The narrative shall be submitted as a separate document for review at the 60% Design Meeting. It shall serve as the foundation of the O&M Manual discussed in the Construction Administration section of this Appendix.

12. Preparation of a complete and coordinated set of design drawings for all Engineering disciplines with an adequate level of detail to allow for construction by a general contractor. Drawings used for permit applications and bidding require the signature and seal of a licensed professional Engineer in the applicable State. The drawing sets require segregation by major discipline: site, architectural, structural, mechanical, electrical, instrumentation, etc. Drawings shall not contain extensive notes and written instructions to the general contractor which are more appropriate for the Design-Build Agreement and the Appendices. Standard detail drawings shall exclude items which are not applicable to the current Project. CAD Standards shall be followed. CAD standards are included in Appendix 2, Attachment 11.
13. Prepare technical specifications, Divisions 2 through 16 (or Divisions 2 through 50) in the CSI Spec-Text format, and preparation of a master list of required shop drawings/submittals. Specifications shall reflect only the scope of work for this Project. Standard specifications shall be modified to exclude items not applicable to this Project.
14. Specifications shall be prepared using the most current version of Microsoft Word. If your standard specifications are in a format other than Microsoft Word, they must first be converted to Microsoft Word format, thoroughly checked to ensure that a complete conversion was accomplished (including all tables, charts, headers, footers, etc.), then edited for this Project as appropriate within Microsoft Word. The text shall be 12 point Times New Roman font. An electronic file name for each specification section shall include a descriptive name preceding a 5-digit specification section number followed by the Microsoft Word file extension (e.g., PROJECT 11500.doc).
15. Provide a total of twelve (12) sets of drawings, design memorandum, specifications, and reports in printed form and also in electronic form (PDF) for Owner review prior to review meetings.
16. Provide design notes and calculations at the end of the design phase in electronic (PDF) format.
17. Maintain electronic communication capabilities throughout the design, construction, commissioning, and acceptance phases of the Project. Maintain a web based Project management and file sharing service to allow the Owner to access Project data and documents including drawings, submittals, etc. Access shall be password protected and shall continue through the warranty period.

B. SCOPE OF SERVICES DURING CONSTRUCTION/TESTING & COMMISSIONING

1. Design professional shall attend construction progress meetings, shall participate in resolution of construction problems related to the design, and shall review and interpret the design.
2. Design professional shall perform Project Site inspections of the Design-Build Work in progress in order to certify that the Design-Build Work is proceeding in accordance with the Design-Build Agreement. Perform additional Project Site inspections as needed for startup/commissioning, Acceptance Testing, and troubleshooting. Provide the services of a California licensed Engineer as needed to complete construction certifications and satisfy other regulatory and local agencies closeout requirements.
3. Design professional shall perform shop drawing review and approvals including review and approval of resubmittals and maintenance of a shop drawing log indicating dates received, returned, status, date needed on-site, current responsible party, etc. A complete and comprehensive shop drawing log shall be prepared prior to procurement that shall be updated and distributed monthly. Long lead, critical and overdue items shall be highlighted.
4. Design professional shall be responsible for preparation of supplementary detailed working drawings, specifications, and written instructions as necessary through the construction period to interpret the documents and resolve changes that arise during construction and startup/commissioning.
5. Provide the services of an instrumentation and control (I&C) staff Engineer or Subcontractor to witness the factory Acceptance Test (FAT) of the assembled I&C system prior to the systems shipment from the factory to the Project Site. The FAT is anticipated to extend for an approximate three (3) day period to accomplish two separate goals. The first goal is to ensure that the system has been assembled properly and is in proper working order. This will include testing of each individual I/O point and should be witnessed by the I&C staff Engineer. The second goal is to simulate and test the control logic, and this portion of the FAT should be attended by the design Project manager/Engineer (the "Design Project Manager/Engineer") or someone familiar with the details of the process design and operation of the facility.
6. Provide the services of an I&C staff Engineer for at least four (4) site visits to review and inspect the instrumentation and wiring of field mounted instruments, resolution of problems, initial calibration and testing, and system startup. Trip reports shall be filed within 7 working days of each visit.
7. Provide services of the Design Project Manager/Engineer who will participate in and observe initial operation, startup/commissioning, and Acceptance Testing of each treatment process, equipment, system and review operation and performance tests required by the Design-Build Agreement and the Appendices. Written reports shall be authored by the Engineer after review of operation/performance data/reports. Provide any

additional Engineering services required for on-site startup and resolution of initial operating problems. Engineers from all disciplines shall be made available to resolve startup issues as required and to resolve problems which may arise during construction period. The Design Project Manager/Engineer will assist the Owner's Representative in the preparation of the punch list and recommend Acceptance of the Design-Build Improvements by the Owner.

8. Engineer shall prepare and submit electronic record drawings within two (2) months of startup or Substantial Completion, whichever is earlier. Record drawings shall be furnished in both PDF and .dwg formats. The record .dwg files shall confirm to American Water's CAD standards. If it is found that the final drawings do not conform to American Water's CAD standards, the Design-Builder shall revise the files at the Design-Builder's cost. Data, information, sketches and working drawings to be incorporated with the record drawings shall be provided to the Owner by the Design-Builder upon completion. The record drawings shall include all above and below grade changes from the original design drawings for all Engineering disciplines. Changes made to reflect the as-installed conditions shall be made in the same level of detail and to the same degree of drafting quality as the original design drawings. The I&C Engineer must review record drawings prepared by the wiring contractors to verify their accuracy prior to substantial completion, and shall document his review in writing.
9. Prepare Operation and Maintenance Manual (O&M Manual). The hardcopy O&M Manual is described in Section V, Item D of this Appendix.
10. At Final Completion, provide electronic Project file system using self running CD presentation menu software to provide rapid access to PDF files of submittals, operational narrative, control strategies, final Design Memorandum, Governmental Approvals, specifications, record drawings, equipment O&M manuals, and Project photographs. Autorun files shall require no license fees and shall require no other software. American Water has used CD Front End PRO by VisualVision on previous Projects. Provide six (6) electronic copies of the electronic Project file system on individual CD, DVD, or flashdrives. Format shall be collaboratively developed prior to implementation.
11. Design-Builder shall prepare standard operating procedures that include the operational narrative, schematics, one line diagrams, P&ID drawings and complete step by step description of the start up and shutdown procedure for all systems and processes. Engineer shall review and provide quality control for this effort.
12. Design-Builder shall prepare lock out – tag out procedures for the control of hazardous energy in mechanical, electrical, hydraulic, pneumatic, thermal and other energy sources in accordance with OSHA regulations and policies. Engineer shall review and provide quality control for this effort.
13. Design-Builder shall prepare maintenance data sheets for every piece of equipment furnished in accordance with the Owner's computerized maintenance management system (CMMS). Engineer shall review and provide quality control for this effort.

14. Design-Builder shall prepare a comprehensive and detailed Utility account estimate in accordance with the Owner's Utility and property unit accounting system. A list of the Utility accounts is provided in Appendix 3.
15. Design-Builder shall provide the services of the Design Project Manager/Engineer for a one (1) day inspection of the facilities approximately ten (10) months after they are placed into operation. The Design Project Manager/Engineer shall provide a written report summarizing warranty repairs that are necessary, and any operational modifications that are recommended to optimize performance.

4.2. SAFETY

A. SAFETY AND PROTECTION

1. Design-Builder shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Design-Build Work. Design-Builder shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - All persons on the Project Site or who may be affected by the Design-Build Work;
 - All Design-Build Work and materials and equipment to be incorporated therein, whether in storage on or off the Project Site; and
 - Other property at the Project Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, Utilities and underground facilities not designated for removal, relocation, or replacement in the course of construction.
2. Design-Builder shall comply with Applicable Law relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Design-Builder shall notify owners of adjacent property and of underground facilities and Utility owners when prosecution of the Design-Build Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

Design-Builder shall comply with the applicable requirements of Owner's safety program. The following Owner safety programs are applicable to the Design-Build Work:

American Water – Focus on Safety, Safety Bulletin dated October 2012, “Pipe Cutting Requirements – Update”, Application to Contractors and Subcontractors. (SEE ATTACHMENT 1)

Design-Builder shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Design-Build Work. If Design-Builder notices any conflicts, errors, ambiguities, or discrepancies with Owner's safety program, Design-Builder shall promptly give Owner written notice, and confirm written resolution thereof by Owner is acceptable to Design-Builder.

Design-Builder shall inform Owner of the specific requirements of Design-Builder's safety program with which Owner's employees and representatives must comply while at the Project Site.

3. All damage, injury, or loss to any property referred to in paragraph 1.a or 1.b caused, directly or indirectly, in whole or in part, by Design-Builder, any Subcontractor, supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Design-Build Work, or anyone for whose acts any of them may be liable, shall be remedied by Design-Builder.
4. Design-Builder's duties and responsibilities for safety and for protection of the construction shall continue until such time as all the Design-Build Work is completed and Owner has issued a notice to Design-Builder in accordance with Section 5.4 of the Design-Build Agreement that the Design-Build Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

B. SAFETY REPRESENTATIVE

Design-Builder shall designate a qualified and experienced safety representative at the Project Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

C. HAZARD COMMUNICATIONS PROGRAMS

Design-Builder shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Project Site in accordance with Applicable Law.

D. EMERGENCIES

In emergencies affecting the safety or protection of persons or the Design-Build Work or property at the Project Site or adjacent thereto, Design-Builder is obligated to act to prevent threatened damage, injury or loss. Design-Builder shall give Owner prompt written notice if Design-Builder believes that any significant changes in the Design-Build Work or variations from the Design-Build Agreement have been caused thereby or are required as a result thereof. If a change in the Design-Build Agreement is required because of the action taken by Design-Builder in response to such an emergency, a Change Order will be issued.

4.3. TESTING AND COMMISSIONING

A. DESCRIPTION

1. Design-Builder shall:
 - Provide assistance in connection with the start-up, testing, refining and adjusting of any equipment or system.

- Assist Owner in training staff to operate and maintain the Design-Build Work.
 - Assist Owner in developing systems and procedures for control of the operation and maintenance of and record keeping for the Design-Build Work.
2. This Section covers testing in accordance with the Design-Build Agreement and the Appendices, as shown on the drawings, and as necessary for a complete and satisfactory installation. Testing shall include equipment checkout, equipment and systems testing and startup, and equipment, systems and plant commissioning. Equipment shall be considered for this specification as any separate and individual equipment, component, part or structure.
 3. No equipment, system or subsystem shall be checked, started up or placed into service unless all components of that system or subsystem required to be available and in service, including instrumentation, safety and other ancillary and pre-requisite systems, are complete and operable as intended by the contract documents.
 4. Unless specified elsewhere in the contract documents, provide all labor, special tools, special testing devices or equipment, chemicals, lubricants, operating fluids, fuel, electricity, water, filters, and other expendables required for checkout, startup and commissioning.
 5. No equipment, system or subsystem shall be commissioned prior to the completion of training of the Owner's personnel, receipt by the Owner of applicable approved O&M Manuals, and receipt by Owner of applicable spare parts and special equipment required for the equipment, system or subsystem.

B. PIPELINES

All pipelines, valves, appurtenances, etc. installed per the Design-Build Agreement shall be tested in the manner described by the technical specifications. Unless otherwise stated, all pipelines shall be hydrostatically tested, with no leakage, at a pressure at least equal to the maximum operating pressure of the pipeline.

C. WATER CONTAINING VESSELS

Prior to backfilling around water containing vessels, fill said vessels with water for a period of at least 7 days in order to insure vessels are watertight. If any vessel leaks, it shall be repaired to the satisfaction of the Owner and retested until no leakage occurs.

D. LIQUID CHEMICAL STORAGE TANKS

Prior to filling bulk storage tanks, batch and day tanks with appropriate chemicals, each tank shall be filled with water for a period of at least 7 days in order to insure each tank is watertight. If any tank leaks, it shall be replaced or repaired by a factory-trained representative to the satisfaction of the Owner, and retested until no leakage occurs.

E. DAMPPROOFING AND PAINTING

During the application of dampproofing and painting, ensure that the manufacturer's representative check the dry mil thickness of each coating and certify to the Owner in writing that the thickness is in compliance with the Design-Build Agreement and the Appendices. If deficiencies in the dry mil thickness of any coat are found, correct by the application of an additional coat(s) to the said deficient area. The certificate shall also state that all surfaces were properly cleaned prior to the application of dampproofing and paint, specified meetings and inspections were made, the quantity of dampproofing and paint were applied in accordance with their recommendations, and all other requirements stated in the Design-Build Agreement and the Appendices have been satisfactorily completed.

F. HVAC SYSTEMS

Checkout, startup and commissioning of heating, ventilation and air conditioning systems are dependent upon the time of year that the checkout, startup and commissioning is initiated. Return to the Project Site with manufacturer's representatives at the beginning of the next appropriate season (whichever is applicable) to checkout and commission the systems.

G. EQUIPMENT CHECKOUT

Develop and maintain a detailed equipment checkout schedule. The schedule shall become a part of the overall Commissioning Plan. Check and certify with equipment supplier and/or manufacturer's representative, that all equipment is in accordance with the applicable technical specifications. The intent of equipment checkout is to certify that equipment has been properly installed and is functioning such that it may be safely operated to facilitate further equipment testing, system testing or other performed checkout and testing. If no specific requirements are specified, the check out and certify that the installation is complete, correct and meets the equipment manufacturer's installation requirements. Written certification shall be provided. Maintain all responsibilities for equipment until such equipment is commissioned and turned over to the Owner.

H. EQUIPMENT TESTING

Develop and maintain a detailed equipment testing schedule. The schedule shall become a part of the overall Commissioning Plan. Determine if equipment testing shall immediately follow checkout, or whether system testing or ancillary systems are required to be complete in order to properly complete equipment testing. The intent of equipment testing is to certify that equipment is operating and functioning within the performance requirements of the technical specifications. Equipment testing shall be completed and documented in accordance with the technical specifications and the manufacturer's requirements. Written certification shall be provided. All testing verifications and data shall be documented and attached to the certification. Maintain all responsibilities for equipment until such equipment is commissioned within a system and turned over to the Owner.

I. INSTRUMENTATION AND CONTROL TESTING

1. Factory Acceptance Test (FAT): Prior to scheduling the FAT, the system integrator shall determine through their own internal quality assurance program that the system is ready for shipment and will pass the FAT. The Owner and Design-Builder shall witness a complete FAT of the instrumentation and control system prior to its shipment to the Project Site. The Design-Builder shall provide written approval for shipment following acceptance of the FAT.
 - The purpose of the FAT is to verify the functionality, performance, and stability of the hardware and software.
 - The FAT shall be conducted by the system integrator using simulated inputs to assure all I/O are provided and all inputs, outputs and application software are functioning according to the intent of the plans, specifications, and Basis of Design Report. The test procedure shall include simulated system faults and failures. The factor test shall be staged in two parts: the first to review all I/O and hardware the second to demonstrate the functionality of the system, including each control loop.
 - The FAT shall demonstrate all graphics, report generation and alarm functions of the system.
 - Provide at least three (3) weeks notification to the Owner prior to the FAT. Provide a written FAT test plan to the Owner at least 7 days prior to the FAT.
2. Operational Ready Test (ORT): Following installation of the process control system components and prior to startup, the entire system shall be certified (inspected, wired, calibrated, tested and documented) that it is installed and ready for the ORT.
 - Each loop shall be checked for proper installation and calibration using prepared forms. The system integrator shall maintain the loop status reports at the Project Site and make them available to the Owner at any time.
 - Upon successful completion of the ORT, the system integrator shall submit a record copy of the test results to the Owner.
3. Functional Demonstration Test (FDT)
 - The FDT shall be witnessed by the Owner and shall consist of a loop by loop demonstration of the functionality and operability of the control system. Live field data shall be used to the extent possible. The test shall be scheduled and coordinated with Owner's staff to minimize the impact on plant operations.
 - Upon successful completion of the FDT, the system integrator shall submit a record copy of the test results to the Owner.

4. Site Acceptance Test (SAT)

- After completion of the ORT and FDT, the system shall undergo a 30-day SAT under conditions of full plant performance without a single non-field repairable malfunction.
- Owner shall have full use of the system. Only Owner's staff shall be allowed to operate equipment associated with live plant processes. Plant operations remain the responsibility of the Owner.
- Any malfunction during the SAT shall be analyzed and corrections made. Any malfunction during the 30 day test which cannot be corrected within 24 hours of occurrence, or more than two similar failures of any duration, will be considered as a non-field repairable malfunction.
- All database, process controller logic, and graphical interface system data points must be fully functioning.
- All reports must be functioning and providing accurate results.
- No software or hardware modifications shall be made to the system without prior approval.
- Following successful completion of the 30 day test, and subsequent review and approval of test documentation, the instrumentation and control system shall be considered substantially complete and the warranty period shall commence.

J. SYSTEM TESTING

1. Develop and maintain a detailed system testing schedule. The schedule shall become a part of the Commissioning Plan. The intent of system testing is to certify that all equipment within a system has been properly integrated and operate and function in concert with other equipment to meet the performance requirements for the entire system. As a minimum, verify and certify that all equipment and components within a system meet the technical specifications for materials of construction for the intended service, performance range and settings, and all equipment within a system has been checked out, tested and certified for further testing and startup. Where appropriate, water shall be used in lieu of the intended chemical or process fluid for the system. Equipment and devices shall be tested, calibrated and documented in accordance with the technical specifications and the manufacturer's requirements. Written certification shall be provided. All testing verifications, data and calibration results shall be documented and attached to the certification. Maintain all responsibilities for systems until such system is commissioned and turned over to the Owner.
2. Subsequent to individual system testing, operate systems to facilitate other testing and training of Owner personnel. Operate and maintain the equipment and systems, but said operation shall not constitute the acceptance of the systems or commencement of any warranty periods. Operation and maintenance of the systems shall not impact the Owner's continuing operations.

K. SYSTEMS START-UP

1. As part of the Commissioning Plan or in order to comply with a request by the Owner for partial utilization of any part of the Design-Build Work, start-up systems utilizing the appropriate chemical or process fluid. Prior to start-up of any system, confirm that all equipment and components within a system have been tested and certified, and that all pre-requisite systems, analyzers and safety systems and devices are functioning and available for service.
2. During system start up, chemical or process fluid shall be introduced to the system. Equipment shall be retested as appropriate and calibration verified. As defined elsewhere, individual systems shall be operated until acceptable to the Owner.

L. COMMISSIONING OF THE WORK

1. General
 - As a prerequisite to the Owner's issuance of the certificate of Substantial Completion, start up equipment and systems in a sequence and manner to place into service all the Design-Build Work. Conduct performance testing as described hereafter. Perform all tests with own forces and such equipment representatives and other experts as may be required by the Design-Build Agreement and the Appendices or necessary for a successful test. Provide sufficient technical and/or supervisory personnel to be fully responsible for all operations and coordination of the tests from their beginning to their satisfactory.
 - Include as a part of the Fixed Design-Build Price, all operating costs, until the Design-Build Improvements are put into operation by the Owner to deliver potable water. Operating costs shall be understood to include, but not be limited to, the costs of: labor, fuel, heating, electrical power and lubricants. Owner will be responsible for the costs of all purchased treatment chemicals. The Design-Builder will be responsible for maintenance during the testing period and for repair of any damage resulting from the testing procedure. At all times, have sufficient personnel to handle an emergency. Provide reimbursement to the Owner should he have to make repairs with his own forces for damage caused by the Design-Builder's actions or inactions.
 - Wages and salaries as may be required by any and all tests specified herein shall be paid for by the Design-Builder and included in the Fixed Design-Build Price. Such wages and salaries shall include any premium time costs incurred to complete the tests as scheduled or as required.
 - Dispose of all water used during the tests, in addition to wastes resulting from the tests. The method of disposing the water and wastes shall be in accordance with all Applicable Law and shall be subject to approval by the Owner. Pumping water for testing into the distribution system is not allowed until its quality meets requirements for public water supplies. Costs for the disposal of water and wastes shall be included in the Fixed Design-Build Price.

- Include costs for the above and below mentioned tests in unit and Fixed Design-Build Price for the Project.

2. Commissioning Plan

The Design-Builder shall prepare a detailed commissioning plan (the “Commissioning Plan”) and shall develop the general sequencing of the testing. In general the sequence shall focus on the testing of individual pieces of equipment prior to testing entire systems including automatic control systems.

3. Prior To Commissioning

At least 30 days prior to the proposed testing, Design-Builder shall conduct a meeting with the Owner to discuss the Commissioning Plan and to finalize roles, responsibilities, proposed schedules and required documentation of the tests. Such discussions shall in no way relieve the Contractor of the responsible of conducting the test expeditiously and with an adequate number of personnel to handle all emergencies. Subsequent to the meeting and before testing begins, make changes to the Commissioning Plan as determined at the meeting, and issue the final Commissioning Plan. No testing shall begin until the final Plan is issued to all parties.

4. Mechanical Performance Demonstration (MPD)

The Design-Builder shall provide the Owner at least 14 days written notice prior to the commencement of mechanical performance demonstration and training. Demonstrate to the Owner, that the manual and automatic controls, performance over full operative range, efficiency, safety items, alarms, etc., of each mechanical and electrical item of equipment will operate in accordance with the design intent as indicated by the Drawings and/or described in the Design-Build Agreement and the Appendices. At this time, continue to provide instruction and continue to train the Owner's personnel in the operation of all equipment, controls, safety devices, etc.

5. Initial Plant Performance Tests (IPPT)

After the mechanical performance demonstration has been successfully completed, in the opinion of the Owner, the Design-Builder shall commence the initial plant performance test. The test shall consist of a preliminary 24-hour operation test of the facility or subsystem. The 24-hour test shall commence after all Design-Build Work has been started up and operating integrally with all systems. If, in the opinion of the Owner, the results of the operational test are satisfactory, the Owner will give written notice to proceed with the final mechanical performance tests. If, in the opinion of the Owner, the results of the operational test are unsatisfactory, the Owner shall provide a written list of deficiencies requiring correction prior to retest. The Owner reserves the right to have any portion of or the entire operational test until, in the opinion of the Owner, the facilities are completely operational.

6. Run-In Plant Performance Tests (RIPPT)

Run-In Plant Performance Tests shall cover a continuous **14 day** period while the facility is in continuous normal operation and delivering potable water to the distribution system. Plant flows

shall be at least 50% of design capacity for seven (7) days, and at least 90% of design capacity for seven (7) days.

During the RIPPT, demonstrate to the satisfaction of the Owner, that all equipment is coordinated and operating properly; that all controls, safety features, and alarms operate satisfactorily in coordination with the equipment installed; and that installed equipment complies in all respects mechanically and electrically with applicable Design Documents. Provide sufficient technical and/or supervisory personnel to be fully responsible for mechanical operation of the facilities.

The Owner's staff shall operate the Design-Build Improvements while water is being delivered to the distribution system. Upon completion of the test period, correct all items from the written list of operating problems, equipment malfunctions, or other deficiencies related to plant operations and retest the affected system. The retesting shall be performed for a time period sufficient to demonstrate the proper operation of the system. This time period will not exceed two-weeks.

7. Acceptance Testing (AT)

Acceptance Testing is to be performed immediately after successful completion of the Run-In Plant Performance Test (RIPPT). The Acceptance Testing Standards and Requirements are defined in Appendix 7.

4.4. TRAINING

A. DESCRIPTION

1. Design-Builder shall supervise and provide training on the operation and maintenance of the equipment and systems of the Project to Owner's staff such that staff is capable of operating the facilities safely and competently.
2. Training shall be provided for to up to 15 persons.

B. TRAINING LOCATION AND FACILITIES

Training shall be provided at the Owner's facilities located in Pacific Grove, California or on the Project Site. Owner shall provide access to Projectors, internet, and telephones at their facilities in Pacific Grove.

C. SUBMITTALS

1. The Design-Builder shall submit draft training plan by the 30% design submittal. The Design-Builder shall finalize the plan based on Owner review and comment and submit no later than 60% design submittal. Plan shall include training schedule.
2. Generic lesson plans shall be developed and submitted for Owner review.

D. SCOPE OF TRAINING

1. Training shall be provided on individual pieces of equipment, systems, and plant operation as a whole.
2. Training sessions shall be managed by Design-Builder and individual sessions shall be limited to 2 hours or less per class except as identified below.
3. Training shall utilize best practices for adult learning.
4. Training plan shall address both operation and maintenance.
5. Duration of training shall be commensurate with the complexity of the equipment or system.

E. QUALIFICATIONS OF INSTRUCTORS

1. Instructors shall be experienced and qualified to provide training.
2. Design-Builder shall submit qualifications of training providers to Owner for approval. Provide at least three (3) references for design-build instructor(s).
3. Design-Builder shall manage vendors to ensure that vendor instructors are qualified to instruct on proper operation and maintenance.

F. TRAINING MATERIALS

1. Design-Builder shall provide suitable instructional materials including books, pamphlets, and videos as part of the scope of training.
2. Training materials shall include the Basis of Design Report, the Project drawings and specifications, and vendor submittals.
3. Training materials shall include the Operation and Maintenance Manual and standard operating procedures.

G. TRAINING SCHEDULE

1. Training shall be provided during design, construction, commissioning, and post-commissioning. Training shall be scheduled such that all necessary training can be provided prior to the Acceptance Test. The time available for training during Commissioning is limited and compressing training during the Commissioning phase is not acceptable.
2. Owner's staff availability for training is limited and training must be coordinated with Owner. Owner's staff typically have 8 hours per week available for training.

3. Scheduling of training shall follow the mutually agreed Plan. Training shall be finalized at least 14 days prior to presentation.

H. DOCUMENTATION OF TRAINING

Design-Builder shall manage and document the training provided to Owner's staff. Class attendance shall be taken. Training received by each person shall be recorded. Monthly training reports shall be submitted to Owner on progress of training provided and planned training for the next three months.

I. DESIGN PROFESSIONAL ROLE IN TRAINING

1. The design professional shall provide training to Owner's staff during design to familiarize them with the Project and the processes.
2. The design professional shall oversee the training program and ensure that training materials accurately reflect the Project scope.

J. TRAINING BY VENDORS MANAGED BY DESIGN-BUILDER

1. Vendor training must address the following items at a minimum. It is recommended that model or demonstration equipment be made available to train staff. Design-Builder staff, familiar with the equipment at the Project are to co-present with the vendor trainer to identify site specific references such as instrumentation, alarms, and implications of equipment failure.
 1. Health and Safety Warnings
 2. Settings and Adjustments
 3. Start up steps and procedures
 4. Instrumentation and controls
 5. Normal operation procedures
 6. Local control
 7. Calibration
 8. Disassembly
 9. Reassembly
 10. Alignment
 11. Alarm settings
 12. Lubrication (materials, schedule, points)
 13. Preventive maintenance procedures
 14. Maintenance schedule

K. TRAINING BY VENDORS MANAGED BY DESIGN-BUILDER

The vendor training must address the following items at a minimum. It is recommended that model or demonstration equipment be made available to train staff. Design-Builder staff, familiar with the equipment at the Project are to co-present with the vendor trainer to identify site specific references such as instrumentation, alarms, and implications of equipment failure.

L. REVERSE OSMOSIS TRAINING

1. The Design-Builder shall supervise and manage training provided to Owner's staff on reverse osmosis process. Each training session shall be 6 to 8 hours in length. Class size shall be limited to 10 persons and two sessions per class are required.
2. The following classes shall be provided.
 - Introduction to Reverse Osmosis
 - Interpretation of water quality analyses
 - Seawater Reverse Osmosis Operation and Training

M. INSTRUMENTATION AND CONTROL SYSTEM TRAINING

1. The Design-Builder shall provide training on the operation of the instrumentation and control system. Operating training has the following goals
 - Use workstations, touch screens and keyboards
 - Retrieve and interpret all standard displays including graphics, overview displays, group displays, trends, point summaries, and alarm summaries,
 - Enter data manually
 - Change control parameters and setpoint values
 - Assume manual control of equipment and control it from the HMI
 - Print reports
 - Acknowledge alarms
 - Respond to hardware and software error
 - Historical data collection, retrieval, and archival
 - Capability and configurability of reports, alarm reporting, passwords, and system hardware configuration
 - Database backup and recovery

2. The Design-Builder shall provide maintenance training. This training equips Owner staff with the skills to diagnose, trouble shoot, and make repairs such as replacing fuses and circuit boards. As a minimum, maintenance training shall include
 - Power up and shutdown of all hardware devices
 - Perform schedule maintenance functions
 - Setup and use off line diagnostics to determine hardware failures
 - Use workstations, keypad, or keyboards to retrieve and interpret displays which provide online diagnostic information
 - Remove and replace all removable boards/modules
 - Maintenance training shall be at least 75% hands-on training.
3. Administrative training: provide training to personnel who need to make access changes to the Control System. This training includes:
 - Log on and log out to the HMI and OIT
 - Setting and clearing passwords
 - Configuring access levels for various parameters and set points

N. VIDEOGRAPHING OF TRAINING

1. Video recording of training sessions will be performed to the extent permitted. Video recording shall be organized and managed by Design-Builder.
2. Video recordings shall be transcribed to DVD for use by Owner.
3. Videographing shall be performed by someone with at least 5 years experience in making professional commercial/industrial video. Video shall include editing. Design-Builder shall provide suitable lighting and control of sound to provide a useful and well made training tool. Microphones shall be used as needed to provide audio input to videos.

O. TRAINING ON STANDARD OPERATING PROCEDURES

1. Design-Builder has responsibility to prepare standard operating procedures (SOP) used to start, stop, and operate various processes and the facility as a whole.
2. Design-Builder must provide training on SOPs.
3. SOPs shall be prepared ahead of providing training on SOPs.

4.5. DISINFECTION OF WATER MAINS

A. SUMMARY

Section Includes: Requirements for disinfection of water mains, including chemical feed lines.

B. REFERENCES

1. American National Institute:
 - ANSI/NSF Standard 60, Listing of Certified Drinking Water Treatment Chemicals – Health Effects.
2. American Water Works Association:
 - AWWA B300, Standard for Hypochlorites.
 - AWWA B301, Standard for Liquid Chlorine.
 - AWWA C600, Standard for Installation of Ductile Iron Water Mains and their Appurtenances.
 - AWWA C651, Standard for Disinfecting Water Mains.
 - AWWA Manual M12, Simplified Procedure for Water Examination.

C. SUBMITTALS

1. Bacteriological Test Results: See bacteriological tests below.
2. Wastewater Disposal Plan:
 - The Design-Builder shall develop a plan for safe disposal of chlorinated wastewater from disinfection/testing of pipelines, structures, etc. Submit the plan to the Engineer for review and to (Owner) or (State Department of Environmental Protection) for review and approval at least two weeks in advance of disinfection/testing activities. Do not perform disinfection/testing prior to receipt of approval from the (Owner) or (State Department of Environmental Protection).
 - The disposal plan shall include provisions for neutralizing chlorine and any other contaminants to levels acceptable to (Owner) or (State Department of Environmental Protection).
 - Specific methods and devices designed to prevent erosion and subsequent sedimentation at the point(s) of discharge shall also be included in the Design-Builder's plan.

D. QUALITY ASSURANCE

1. Bacteriological Tests:

- Required Number of Samples:
 - 1) Raw Water Main: One sample
 - 2) Filter Influent: One sample each filter
 - 3) Filter Effluent: One sample each filter
 - 4) Filter Washwater: One each line
 - 5) Plant Water Service: One sample
 - 6) Well: One sample
 - 7) Well Discharge: One sample
 - 8) Backwash Water: One sample
 - 9) Finish Water Main: One sample

E. DELIVERY, STORAGE, AND HANDLING

1. Transport, handle, and store specified disinfection products in manner recommended by respective manufacturers to prevent contamination and deterioration of products.
2. When handling disinfection products, due caution is advisable. Wear gloves, apron, goggles, and suitable vapor mask.

F. PROJECT CONDITIONS

1. Environmental Requirements:
 - Do not test or disinfect water mains if air temperature is expected to fall below 35 degrees F.
 - Keep pipe interior clean. Close open end of pipe with water tight plug when pipe laying is not in progress.
2. Operational Requirements:
 - Notify Owner a minimum of 24 hours in advance of any flushing operation.
 - Owner's representative must be present for operating valves required to fill mains. Valves may only be operated by Owner's personnel.
 - Flushing will be monitored by the Owner.

G. MATERIALS

1. Hypochlorites: AWWA Standard B300.
2. Liquid Chlorine: AWWA Standard B301.
3. Provide NSF Standard 60 certified products per Listing of Certified Drinking Water Treatment Chemicals – Health Effects.

H. WATER MAIN DISINFECTION

1. Disinfect water main installed under the Design-Build Agreement before placing in service.
2. Form of chlorine for disinfection: With Owner's approval, follow either of these two designated methods of procedure.
 - Liquid Chlorine: Apply chlorine gas-water mixture with solution feed chlorinating device in combination with booster pump for injecting chlorine gas-water mixture into main to be disinfected. Use only if Design-Builder can demonstrate to Owner that person supervising operation is thoroughly familiar and experienced in handling chlorine gas, suitable equipment is used, and proper safety equipment is available. Provide device with means to prevent backflow of water into chlorine cylinder. Design-Builder to comply with all local, State, and Federal regulatory requirements.
 - Calcium Hypochlorite Solution: Prepare chlorine-water solution of 1 percent available chlorine using granular calcium hypochlorite. Inject or pump solution into pipeline. Prepare chlorine-water solution of 1 percent available chlorine by mixing approximately 1 pound of calcium hypochlorite with 8 gallons of water.
3. Preparation
 - Preliminary Flushing: Prior to disinfection, thoroughly flush section of water main being disinfected with available water pressure and outlets.
 - Flush after pressure and leakage tests are complete.
4. Chlorination:
 - Chlorine Application: Apply hypochlorite solution to water main with gasoline or electrically-powered chemical feed pump. For smaller applications, prepare solution in a barrel and pump into main with hand pump, such as a hydraulic test pump. Apply at dosage rate resulting in chlorine concentration in water in pipe is a minimum of 25 mg/l free chlorine. Table below gives amount of calcium hypochlorite and quantity of 1 percent hypochlorite solution required to produce 25 mg/l chlorine concentrate in 100 feet of pipe:

CALCIUM HYPOCHLORITE AND CHLORINE SOLUTION REQUIRED TO PRODUCE 25 MG/L CONCENTRATION IN 100-FEET OF PIPE						
Pipe Size Inches	Contents in 100-ft.		Section Gals.	Quantity of Calcium Hypochlorite		1% Chlorine Solution Gallons
	Cu.Ft.	Lbs.		Ounces	Pounds	

CALCIUM HYPOCHLORITE AND CHLORINE SOLUTION REQUIRED TO PRODUCE 25 MG/L CONCENTRATION IN 100-FEET OF PIPE						
Pipe Size Inches	Contents in 100-ft.		Section Gals.	Quantity of Calcium Hypochlorite		1% Chlorine Solution Gallons
3	4.90	306	37	1/5	0.012	0.09
4	8.73	545	66	1/3	0.021	0.16
6	19.65	1,227	147	3/4	0.046	0.36
8	34.90	2,178	261	1-3/8	0.083	0.65
10	54.28	3,388	406	2-1/8	0.131	1.02
12	78.48	4,899	587	3-0	0.185	1.44
16	139.98	8,738	1,047	5-3/8	0.334	2.60
20	218.06	13,611	1,631	7-3/4	0.486	4.08
24	314.16	19,603	2,350	11-5/32	0.698	5.88
30	490.87	30,630	3,672	16-3/32	1.090	9.19
36	706.86	44,108	5,287	25-1/8	1.570	13.23
42	962.11	60,036	7,197	34-5/16	2.144	17.99
48	1,256.64	78,414	9,400	44-13/16	2.801	23.50
54	1,590.43	99,243	11,896	56-23/32	3.544	29.74
66	2,375.83	148,252	17,771	84-23/32	5.295	44.43

Feet of Pipe in Which 1 Ounce of Calcium Hypochlorite Will Produce 25 mg/l Available Chlorine														
3"	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"	42"	48"	54"	66"
576	324	144	79	51	36	20	13	9	6	4	3	2	1.8	1.2

- Point of Application:** Apply chlorinating agent at high end of pipeline section being chlorinated and through a corporation stop inserted in top of new pipe. If water for preparation of chlorine solution is supplied from tap on existing pipeline, provide a physical break between injector supply and injector or pump.

- Rate of Application: Pump chlorine solution slowly into new pipeline. Do not cease chlorine application until entire main is filled with chlorine solution. If required by Engineer, measure chlorine residual at several points along section of main being disinfected to ensure that proper dosage and distribution of chlorine solution is obtained.
- Prevention of Reverse Flow: Exercise great care in manipulating valves, so strong chlorine solution in line being treated will not flow back into adjoining water distribution system.
- Retention Period and Chlorine Concentration: Retain chlorinated water in main for at least 24 hours. Operate all valves and hydrants in section in order to disinfect appurtenances. At end of this 24 hour period, maintain 10 mg/l chlorine residual throughout length of main.
- Final Flushing: Following chlorination, thoroughly flush heavily chlorinated water from main at its extremities until replacement water throughout its length, is tested comparable to quality of water in existing distribution system.
- Flushing Water: Owner will provide water for flushing, however, do not operate valves on water distribution system without presence of duly qualified representative of Owner.

5. Bacteriological Tests:

- After final flushing and before each treated water main is placed in service, collect samples from end of line. Test samples for bacteriological quality in accordance with standard methods to show absence of coliform organisms. Take samples of water that has been standing in main for at least 16 hours after final flushing has been completed. All required tests will be made by Owner at no expense to the Design-Builder. The Design-Builder shall assist the Owner in collecting samples for Owner's tests.

6. Redisinfection:

- If initial disinfection fails to produce satisfactory bacteriological samples, reflush and resample main. If check samples show presence of coliform organisms, rechlorinate main as specified previously. Design-Builder shall reimburse the Owner for costs associated with retesting the lines.

7. Design-Builder shall be responsible for furnishing all water required for disinfection and flushing of waterlines and any additional disinfecting or flushing, required.

8. Include costs for disinfection of water main in the Fixed Design-Build Price. No separate payment will be made for disinfection.

I. WATER MAIN CONNECTION DISINFECTION

1. General: If not possible to disinfect piping, valves, and fittings installed at certain connections in manner specified in Article 3.01, Design-Builder will proceed as follows:

2. Installation of Connections: During installation, observe every precaution to prevent foreign material and trench water from entering piping connections, fittings, and valves.
3. Disinfection: Swab interior of piping connections, fittings, and valves with 5 percent hypochlorite solution. Obtain 5 percent hypochlorite solution by mixing approximately 3 pounds of granulated calcium hypochlorite with 5 gallons of water.
4. Flushing: After pipe, fittings, and valves have been swabbed, thoroughly flush with water in a manner to be addressed in the wastewater disposal plan. During installation, use extreme care to ensure foreign material is kept out of pipe.

4.6. DISINFECTION OF STRUCTURES AND EQUIPMENT

A. SUMMARY

Section Includes: Requirements for disinfection of plant structures and equipment.

B. REFERENCES

1. American National Standards Institute:
 - ANSI/NSF Standard 60, Listing of Certified Drinking Water Treatment Chemicals – Health Effects.
2. American Water Works Association:
 - AWWA B300, Standard for Hypochlorites.
 - AWWA B301, Standard for Liquid Chlorine.
 - AWWA C653, Disinfection of Water Treatment Plants.

C. SCHEDULE OF DISINFECTION

1. Coordination: Equipment is to be disinfected just prior to the Final Mechanical Performance Tests.
2. Items to be Disinfected:
 - Mixing and Vacuum Chambers
 - Clarifiers
 - Filters Influent Flume
 - Filters
 - Clearwells including ceiling

D. SUBMITTALS

1. Bacteriological Test Results: In accordance with Section 4.6(E).
2. Wastewater Disposal Plan:
 - The Design-Builder shall develop a plan for safe disposal of chlorinated wastewater from disinfection/testing of pipelines, structures, etc. Submit the plan to the Engineer for review and to (Owner) or (State Department of Environmental Protection) for review and approval at least two weeks in advance of disinfection/testing activities. Do not perform disinfection/testing prior to receipt of approval from (Owner) or (State Department of Environmental Protection).
 - The disposal plan shall include provisions for neutralizing chlorine and any other contaminants to levels acceptable to Owner.
 - Specific methods and devices designed to prevent erosion and subsequent sedimentation at the point(s) of discharge shall also be included in the Design-Builder's plan.

E. QUALITY ASSURANCE

1. Bacteriological Tests:
2. Number of Samples Required:
 - Mixing and Vacuum Chambers— one sample each unit
 - Clarifiers— one sample each
 - Filters Influent Flume - one sample
 - Filters -- one sample each
 - Clearwells including ceiling -- two samples each clearwell

F. PRODUCT DELIVERY, STORAGE AND HANDLING

1. Transport, handle and store disinfection products in a manner recommended by respective manufacturers to prevent contamination and deterioration of products.
2. When handling disinfection products, due caution is advisable. Wear gloves, apron, goggles, and suitable vapor mask.

G. MATERIALS

1. Hypochlorites: Standard AWWA B300.
2. Liquid Chlorine: Standard AWWA B301.

3. Provide NSF Standard 60 certified products per Listing of Certified Drinking Water Treatment Chemicals – Health Effects.

H. FLUSHING AND DISINFECTING WATER

1. Obtain flushing and disinfecting water for disinfection of structure at water treatment plant from Owner.
2. Incur all costs in utilizing and disposing of flushing and disinfecting water.
3. Owner will not charge for water used to initially flush and disinfect a structure. If any structure has to be reflushed and/or redisinfecting, cost of obtaining this additional water from Owner will be at Design-Builder's expense.
4. Include costs for disinfection of structures and equipment in unit or lump sum prices bid for work as no separate payment will be made for disinfection.
5. Bacteriological Tests: All required tests will be made by Owner at no expense to the Design-Builder. The Design-Builder shall assist the Owner in collecting samples for Owner's tests.

I. CLEANING AND PRELIMINARY FLUSHING

Clean items to be disinfected of dirt, debris, residual formed on sides of items, and any other foreign material. Thoroughly flush with water prior to disinfection.

J. CHLORINATION

1. General: After being thoroughly flushed, disinfect specified structure by chlorination.
2. Form of Chlorine: Apply chlorine in a chlorine gas-water mixture, calcium hypochlorite solution, or chlorine spray solution.
3. Methods of Application:
 - General: Submit methods of application to Engineer for approval.
 - Chlorine Gas-Water Mixture: Apply chlorine gas-water mixture by means of a solution feed chlorination device. Provide device with means to prevent backflow of water into chlorine cylinder.
 - Calcium Hypochlorite Solution: Inject or pump a solution consisting of 5 percent calcium hypochlorite powder and 95 percent water by weight into the lines.
 - Chlorine Spray Solution: Apply chlorine spray solution, having a concentration of at least 200 ppm. Apply uniformly to all interior surfaces, including equipment by fruit tree sprayers, fire hoses, or other approved equipment. After spraying, fill holding basin to a depth of 6 inches with water containing at least 50 ppm chlorine.

K. POINTS OF APPLICATION

If chlorine spray solution is not going to be used for basins, inject disinfecting solution into water as it enters each basin or inject into influent main.

L. RATE OF APPLICATION

Control water to be used in disinfection process to flow slowly into basins.

M. PREVENTION OF REVERSE FLOW

Exercise great care that strong chlorine solution in areas being treated will not flow back into water supply where water for disinfection is being obtained.

N. RETENTION PERIOD AND CHLORINE CONCENTRATION

Retain chlorinated water in above specified items at least twenty four (24) hours. After chlorine treated water has been retained for required time, the chlorine residual is to be at least 25.0 ppm. Should initial procedure fail to result in specified conditions, repeat chlorination procedure at no additional expense until results are obtained.

O. FINAL FLUSHING

Following chlorination, completely flush all treated water from above specified items until replacement water throughout each facility, upon test, is proven to have a combined chlorine residual of approximately 2.0 ppm.

P. CHLORINE CONCENTRATION AFTER DISINFECTION

After disinfection and during subsequent mechanical performance tests, maintain chlorine residual in all units of plant at a concentration satisfactory to Engineer. If chlorine residual drops to zero (0), Engineer has option to require redisinfection of any or all units of the Design-Build Improvements at no additional cost to Owner.

4.7. SUBMITTALS

A. PRELIMINARY PROGRESS SCHEDULE

The Design-Builder shall prepare and submit to the Owner for approval, a preliminary schedule. This submittal is to be made within ten (10) days from the Contract Date. The method of schedule preparation required is generally referred to as the critical path method (CPM).

This CPM schedule will be a computer-generated construction schedule, using Primavera Project Planner (P3), a Project management and control software developed by Primavera Systems, Inc., or the latest version of Microsoft Project.

In developing the Project schedule, the Design-Builder shall utilize the precedence diagramming method (PDM) option of P3 or Microsoft Project. The work day to calendar date correlation of the construction schedule shall be based on a 40-hour work week with adequate allowance for holidays, adverse weather and all other special requirements of the work.

The Design-Builder will be required to submit with the preliminary progress schedule, and all subsequent updates, a software generated back-up file. This back-up file must contain all descriptions, durations, logic, constraints, coding, cost information, and any other information required for computer analysis and generation of schedule and cost reports and plots. If resource loading is utilized, all resource loading, minimum and maximum limits, and any other information required for computer analysis must be provided.

The schedule shall include, as a minimum, the following separate activities:

1. Preliminary design, final design.
2. Physical construction (includes mobilization, demobilization, setup time, lags, etc.).
3. Issuance by Design-Builder of purchase orders for material and equipment and submittal of shop drawings and samples to the Owner.
4. Review by Engineer for each submittal of samples and shop drawings.
5. Fabrication time for materials and equipment.
6. Delivery of materials and equipment.
7. Installation of materials and equipment.
8. Testing, start-up and training for individual pieces of equipment or entire systems as appropriate.
9. Winter affected activities.
10. Outages or interruptions of Owner's facilities required to perform work.
11. Demolition or removal work under this Contract.

Activity durations shall represent the best estimate of elapsed time considering the scope of the Design-Build Work involved in the activity and the resources planned for accomplishing the activity expressed in working days.

Activity descriptions shall clearly define the scope of work associated with each activity. If activity descriptions contained in the schedule are not sufficient to describe the work, a supplemental narrative description is to be provided.

The construction work shall be detailed to an extent that progress can be readily monitored on a daily basis. In general, the construction work shall be detailed such that no construction activity shall have a duration greater than fifteen (15) work days.

Each activity shall be coded by the Design-Builder as necessary for proper and efficient utilization of the schedule. As a minimum, each activity shall be coded by:

1. Activity type (i.e., submittal, Engineer's review, delivery, construction, etc.).
2. Responsibility (i.e., Design-Builder, Engineer, subcontractor A, subcontractor B, Owner, etc.).

3. Area (i.e., Building A, Building B, sitework, etc.).
4. Task Order (i.e., Owner assigned number required for monthly invoicing requirements).

The above schedule development requirements are a minimum and the Design-Builder shall develop the schedule as necessary to properly control and manage the Project.

The preliminary progress schedule shall be submitted in a network analysis format and shall include, as a minimum, a graphic representation of all significant activities and events involved in the construction of the Project, and a written statement explanatory thereof for a complete understanding of the diagram. The Design-Builder may furnish a pure logic diagram with a detailed predecessor/successor analysis report.

The network graphic representation and statement must clearly depict and describe the sequence of activities planned by the Design-Builder, their interdependence and the times estimated to perform each activity. The network shall be submitted on sheets 24" x 36" or larger and may be divided into as many separate sheets as required.

Accompanying the network graphic representation of the construction schedule, the following computer generated schedule reports shall be submitted as part of the network analysis:

Detailed Activity Report - This report shall be sorted by activity number and shall include, as a minimum, the following information:

- a. activity number
- b. activity description
- c. estimated duration
- d. early start date (calendar dated)
- e. early finish date (calendar dated)
- f. latest allowable start date (calendar dated)
- g. latest allowable finish date (calendar dated)
- h. total float
- i. activity codes
- j. detailed predecessor(s) and successor(s)
- k. free float

Early Start Report - This report shall be sorted by activity type in an early start order.

Critical Path Report - This report shall be sorted by total float in an early start order.

Activity Cost Values - This report shall list the activity number, description and cost value assigned to it. Once approved, the Design-Builder will be provided work order numbers to be assigned to each activity for input into the schedule codes.

B. OPERATING AND MAINTENANCE INSTRUCTION MANUALS

1. The Design-Builder shall prepare complete written O&M Manuals covering each item of equipment finished or modified under this Design-Build Agreement. The Design-Builder shall submit in duplicate, at least eight (8) weeks prior to initial start-up, a draft form of the manual for review by the Engineer. After the manual has been approved, **four (4)** hard copies and one (1) electronic copy of the O&M Manuals shall be furnished to the Engineer. The final copies shall be received by the Engineer prior to start-up operations.
2. The O&M Manual shall include, but not be limited to, the following information: detailed description of the process and operating procedures as applicable; instruction for all components of the equipment whether manufactured by the supplier or not, including valves, controllers and other miscellaneous components; recommended lubrication and maintenance procedures and schedules including a detailed schedule of the manufacturer's preventative maintenance requirements; appropriate parts lists; exploded and/or sectional views; internal and external wiring and piping diagrams numbered to correspond to the installation; and all other pertinent information of value to obtain peak performance.
3. Equipment manufacturer's O&M Manuals which Design-Builder shall procure from the manufacturer shall include the following:
 1. Plant Specific Operating Instructions
 2. Maintenance and Lubrication Schedules and Lubricant Recommendations including recommended preventive maintenance schedules listed as daily, weekly, monthly, quarterly, semi annually and annually.
 3. Recommended Spare Parts List
 4. Plant Specific Troubleshooting guides with solutions recommended.
 5. Start-up Procedures
 6. Shut-down Procedure including extended shut-down recommendations.
 7. Emergency Operations
 8. Overhaul Procedures
 9. Selected drawings and exploded views.
 10. Internal wiring and piping diagrams.
 11. Complete catalog of parts used in final assembly of equipment.
 12. Service Centers List
 13. Manufacturer's name, contract number, model number and serial number of the equipment on the cover of each manufacturer's manual.
 14. Other pertinent information of value to obtain peak performance.

4. Equipment manufacturer's manuals shall be written for average journey men mechanics without prior knowledge of the specific equipment.
5. The O&M Manuals shall be assembled in **four (4)** sets and bound in 3 or 4 inch post type, first quality, hard cover, heavy duty three post binders and one (1) electronic copy of CD. One or more numbered volumes shall be provided as required. Each item of equipment shall be placed in a logical sequential order, as listed or ordered in the Design-Build Agreement and Appendices.
6. Provide a table of contents at the front of each volume showing the equipment items in the order in which they appear in the volume. Each equipment item shall include the functional name, applicable specification section(s) and the plant sheet listing, if any.
7. The preventive maintenance schedule shall be bound in the front of each section immediately following the index tab sheet. The schedule shall be identified with respect to the piece of equipment it is referring to.

Sheet size shall be 8½ x 11-inches.

Imprint on the front cover and spine of each binder the following:

Owner

Project Title

Operations and Maintenance Manual

Volume No. -----

8. Prior to release of final payments, revise and resubmit copies of the instructions to accord with any changes in procedures or equipment made during start-up or initial operation. Resubmittals are also required for changes made during the guarantee period.

4.8. TEMPORARY CONSTRUCTION FACILITIES

A. WATER SUPPLY & DISPOSAL

If reasonably available, water for the purpose of this Design-Build Agreement will be supplied to the Design-Builder by the Owner. The Design-Builder shall furnish and install all necessary meters, temporary piping and valves in connection with such water supply.

The Owner reserves the right to impose limitations upon the Design-Builder's use of water as the Owner, in its sole discretion, determines may be necessary to assure it of its continued ability to meet the demands of its customers and the volumes and pressures required for fire protection. Any water required by the Design-Builder in excess of the quantities the Owner provides to the Design-Builder must be furnished by the Design-Builder at his own cost.

Design-Builder will be responsible for disposal of all wastewater (including dechlorinating highly concentrated wastes that are the result of disinfection) from the sites.

B. TEMPORARY HEAT/AIR CONDITIONING

The Design-Builder shall provide approved type heating or air conditioning apparatus with the necessary power in order to protect the work. The stored materials and finished work shall be protected at all times from damage by the weather elements.

C. ELECTRICAL SUPPLY

The Design-Builder shall pay all fees, obtain necessary permits and have meter installed for power and light as may be required for the prosecution of his work. Owner shall pay for all fees and costs to have permanent power provided to the site. Design-Builder shall be responsible for all temporary electrical power (furnishing and installing) that is needed to perform construction, but not permanent power and not power for use for startup and testing.

D. TEMPORARY LIGHTING

The Design-Builder shall provide and maintain incandescent lighting for construction operations and lighting to exterior staging and storage areas after dark for security purposes as may be necessary.

E. BARRIERS

The Design-Builder shall provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing buildings. Provide protection for plant life designated to remain. Replace damaged plant life.

F. FENCING AND SECURITY

Design-Builder shall be responsible for protection of the Project Site, and all Design-Build Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

No claim shall be made against Owner by reason of any act of an employee or trespasser, and Design-Builder shall make good all damage to Owner's property resulting from Design-Builder's failure to provide security measures as specified.

Security measures shall be at least equal to those usually provided by Owner to protect Owner's existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, watchman services, and other measures as required to protect the Site.

All existing fences affected by the Design-Build Work shall be maintained by Design-Builder until completion of the Design-Build Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where

fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

On completion of the Design-Build Work across any tract of land, Design-Builder shall restore all fences to their original or to a better condition and to their original locations.

G. PARKING

Arrange for temporary gravel parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Designate two parking spaces each for the Owner, and Resident Project Representative.

H. PROGRESS CLEANING

Design-Builder shall keep the premises free at all times from accumulations of waste materials and rubbish. Design-Builder shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.

Construction materials, such as concrete forms and scaffolding, shall be neatly stacked when not in use. Design-Builder shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

Adequate cleanup will be a condition for recommendation of progress payment applications. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

Prior to Substantial Completion, Design-Builder shall clean the Site and make it ready for utilization by Owner. At completion of Construction, Design-Builder shall remove all tools, appliances, construction equipment, temporary construction and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Design-Build Agreement and Appendices.

I. SANITARY FACILITIES

The Design-Builder shall provide suitable temporary facilities and enclosures for the use of workmen and shall maintain same in a sanitary condition.

The Design-Builder is advised that the Owner is in the business of providing potable water and the Design-Builder's sanitary arrangements shall not endanger the Owner's facilities.

J. FIELD OFFICES

The Design-Builder shall provide, at a location designated or otherwise approved by the Owner, field offices for the Design-Builder and the Resident Project Representative (RPR). Unless otherwise approved, the Design-Builder's field office shall be large enough, and furnished, to conduct progress meetings. The Design-Builder's field office is to be an official place of business for the Design-Builder at which an authorized agent of the Design-Builder will be present while work is in progress. The record documents required to be maintained by the Design-Builder shall be kept at the Design-Builder's field office.

The Design-Builder shall provide a separate field office for the RPR and visiting Owner's personnel. The office shall be not less than 256 square feet (8' x 32') and be provided with an outside entrance door with a substantial lock; glazed windows suitable for light and ventilation; and adequate heating, air conditioning, and lighting facilities. Design-Builder shall pay all electricity and heating bills. At a minimum this shall include the following:

- (2) desks (built-in type, one at each end of trailer),
- (2) free standing desks(30"x60"), (2) office chairs & (4) padded folding chairs
- (3) 4-drawer file cabinets
- drawing table, drafting stool, plan rack and plan hangers
- (1) small (2'x4') and (1) large (4'x6') white boards, with markers and erasers
- wall shelves - minimum 16 lineal feet of 12" wide wood shelving
- (2) wastebaskets
- telephone service: 2 services, one for voice telephone, one for facsimile machine. Telephone with speakers attachment for conference calls, speed dial capabilities and answering machine (integral or separate). (NOTE: Design-Builder to arrange and pay for hook-up, Owner to pay subsequent monthly phone bills.)
- copying machine – desktop unit is acceptable, Design-Builder to service and maintain throughout the Project.
- High Speed internet connection: 1 service (DSL , cable, or equivalent), for internet connectivity and electronic communications to the RPR. Design-Builder to arrange and pay for hook-up and monthly charges.
- water, hot and cold at sink. Water service and drains to be frostproof.
- sanitary facilities: flush type water closet with accessories including a wall mirror, paper towel holder and paper holder. Facilities shall be connected to the local sanitary sewer system or a holding tank provided. Facilities shall be stocked and maintained by the Design-Builder.
- weekly janitorial service. Design-Builder shall employ a professional cleaning service.
- fire extinguisher, and first-aid kit
- electric water cooler with hot and cold water faucets and an accessory refrigerator
- digital video camera (from cash allowance)
- one (1) new Windows laptop computer, including docking station, with a Universal Serial Bus (USB) with Internet access and the following features (from cash allowance):

- CD ROM Drive
- DVD Drive
- Wi-Fi
- 24" monitor (minimum)
- Color ink jet printer/scanner/fax
- Licensed copies of:
 - Lotus Notes
 - Microsoft Office
 - Microsoft Project

The computer and digital video camera shall be maintained by the Design-Builder during the Design-Build Period and provided to the Owner at the completion of the Project.

The Design-Builder shall be responsible for cleaning and upkeep of the RPR's space or field office.

The field offices shall be maintained until final acceptance of the Project unless otherwise approved by the Owner.

A 24-inch by 35-inch plywood sign shall be erected on the outside wall of the field office in a location determined by the Owner. The sign shall be painted white with blue, 3-inch high lettering, neatly arranged as follows:

Field Offices
CALIFORNIA AMERICAN WATER COMPANY
AND
DESIGN-BUILDER

K. DUST CONTROL

1. Design-Builder shall take all necessary measure to control dust from his operations, and to prevent spillage of excavated materials on public roads.
2. Design-Builder shall remove all spillage of excavated materials, debris or dust from public roads by methods approved by the Owner.
3. Design-Builder shall sprinkle water at locations and in such quantities and at such frequencies as may be required by the Owner to control dust and prevent it from becoming a nuisance to the surrounding area.
4. Dust control and cleaning measures shall be provided at no additional cost to the Owner.

L. USE OF PROJECT SITE

Design-Builder shall construct and maintain suitable and safe crossings over trenches or provide detours as necessary to care for public and private traffic. Provide flagmen at junctions of public traffic and Design-Builder vehicles and equipment.

M. PROJECT SIGN

1. The Design-Builder shall erect a sign at the Project Site identifying the Project. The sign shall be erected prior to mobilization and shall be in accordance with the Design-Build Agreement and the Appendices and details included in this Section. The Project sign and sign panel shall be furnished, erected and maintained by the Design-Builder at the location designated by the Owner. Wording and colors shall be identified by the Owner.
2. The Project sign shall be fabricated, erected and maintained by the Design-Builder in accordance with the following specifications:
 - Sign Panel: The sign panel shall be constructed of $\frac{3}{4}$ inch minimum thickness marine plywood rebated into a 2 inch by 4 inch wood frame. All fasteners used in the construction of the sign shall be of a rustproof nature.
 - Painting: All supports, trim and back of the sign panel shall be painted with at least two (2) coats of the same paint used for the sign face. All paint used shall be exterior grade paint, suitable for use on wood signs.
 - Sign Supports: The supports for the Project sign shall be at least two 4 inch by 4 inch treated wood posts. The sign panel shall be securely fastened to the sign supports with at least six (6) $\frac{3}{8}$ " galvanized bolts, nuts and washers. The positioning and alignment of the sign shall be as determined by the Owner.

4.9. PRODUCTS

A. PROTECTION OF MATERIAL AND EQUIPMENT

All electrical and mechanical equipment shall be stored in a warm, dry shelter with proper ventilation. Under no circumstances shall motors, electrical control equipment or any other electrical or mechanical equipment be stored under polyethylene plastic covers or tarpaulins. When space is available inside existing structures, and the Owner approves, the Design-Builder will be allowed to store equipment inside them. Should such space not be available, the Design-Builder shall construct a shelter with a source of heat and proper ventilation as approved by the Owner for the storage of equipment.

The interior of all pipe and accessories shall be kept free from dirt and foreign matter at all times.

After valves and hydrants have been inspected, the Design-Builder shall properly store them prior to use. In order to prevent entry of foreign material that could cause damage to the seating surfaces, the valves and hydrants shall be stored in a fully closed position unless recommended otherwise by the manufacturer. Resilient seated valves shall be stored in accordance with the manufacturer's recommendations. This may include storage with protective covers for rubber seats and in marginally open condition. Valves and hydrants should be stored indoors.

If valves must be stored outdoors, the Design-Builder shall protect the operating mechanism, such as gears, motor, actuators and cylinders, from weather elements. Valve ports and flanges must be protected from the weather and foreign materials. If valves are subject to freezing

temperatures, all water must be removed from the valve interior and the valve closed tightly before storage, unless specifically recommended otherwise by the manufacturer. Valves shall be stored on pallets with the discs in a vertical position to prevent rainwater from accumulating on top of the disc, seeping into the valve body cavity and freezing and cracking the casting.

B. SERVICING EQUIPMENT

The Design-Builder shall check all equipment upon acceptance to determine if oil reservoirs are full and areas to be greased are properly packed with grease. The Design-Builder will provide the proper grease or oil for use in lubricating the required areas in the equipment. Any service to equipment while in storage, or installed pending acceptance, is the responsibility of the Design-Builder and shall be performed per manufacturer's requirements, industry standards or as stated specifically in the technical specifications.

C. GENERAL

Unless otherwise specifically provided for in the Design-Build Agreement and the Appendices, all equipment, materials and articles incorporated in the work shall be new, in current production and the best grade obtainable consistent with general construction usage.

D. COORDINATION OF DIMENSIONS

The Design-Builder shall verify and make necessary corrections to construction dimensions so that all specified and/or alternative equipment, can be installed and will function within the intent of the Design-Build Agreement and the Appendices.

E. SAFETY AND HEALTH REQUIREMENTS

All materials, equipment, fixtures and devices furnished shall comply with Applicable Law.

All equipment furnished and installed under this Contract shall be equipped with suitable and approved safety guards and devices required for the safety of the public and operating personnel. Such guards and safety devices shall be in accord with the latest requirements of safety codes approved by the American National Standards Institute as well as the safety requirements of Applicable Law. Where said safety codes of the ANSI are incompatible with Applicable Law, Applicable Law shall prevail.

F. INSTALLATION

Material and equipment shall be installed in accordance with the appropriate Sections of the Design-Build Agreement and the Appendices.

G. SERVICES OF MANUFACTURER'S REPRESENTATIVE

The Design-Builder shall arrange for a qualified service representative from each company, manufacturing or supplying certain equipment as required by the individual Specification Sections to perform the duties herein described.

After installation of the applicable equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:

- soundness (without cracked or otherwise damaged parts)
- completeness in all details, as specified
- correctness of setting, alignment, and relative arrangement of various parts
- adequacy and correctness of packing, sealing and lubricants

The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.

On completion of his Work, the manufacturer's or supplier's representative shall submit to the Owner a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that the equipment conforms to the requirements of the Design-Build Agreement and Appendices and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

After the Owner has reviewed the reports from the manufacturers' representatives, the Design-Builder shall make arrangements to have the manufacturers' representatives present when the mechanical performance tests are made.

4.10. PROJECT CLOSEOUT

A. CLOSEOUT PROCEDURES

Submit written certification that Design-Build Agreement and Appendices have been reviewed, Work has been inspected, and that Work is complete in accordance with Design-Build Agreement and Appendices and ready for Owner's inspection. Provide submittals to Owner that are required by governing or other authorities. Submit Application for final payment identifying total adjusted Contract sum, previous payments, and sum remaining due.

B. FINAL CLEANING

Execute final cleaning prior to final inspection. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean debris from roofs, gutters, downspouts, and drainage systems. Clean site; sweep paved areas, rake clean landscape surfaces. Remove waste and surplus materials, rubbish, and construction facilities from the site.

C. PROJECT RECORD DOCUMENTS

Maintain on site, one set of the following record documents; record actual revisions to the Design-Build:

- contract drawings
- specifications
- addenda
- change orders and other modifications to the Design-Build Agreement
- reviewed shop drawings, product data, and samples

Store record documents separate from documents used for construction. Record information concurrent with construction progress.

Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

- manufacturer's name and product model and number
- product substitutions or alternates utilized
- changes made by addenda and modifications

Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

- Measured depths of foundations in relation to finish floor datum.
- Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Design-Build Work.
- Field changes of dimension and detail.
- Details not on original drawings.

Submit the final Requisition to the Owner in accordance with Section 5.4 of the Design-Build Agreement.

Record Drawings shall be submitted as follows:

- 2 sets of electronic files in AutoCAD format on CD
- 2 sets of paper copies (24 x 36)
- 2 sets of paper copies (11 x 17)

D. SPARE PARTS AND MAINTENANCE MATERIALS

Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections. Design-Builder shall confirm with Owner during the design phase the requirements for spare parts.

Deliver to the Project Site and place in location as directed by Owner; obtain receipt prior to final payment.

Appendix 4 - Attachment 1

Safety Bulletin – October 2012

Pipe Cutting Requirements - Update

In June American Water issued interim requirements for the use of cut off saws. These interim requirements included prohibiting the use of diamond tipped blades in cut off saws. Since that time a work group was established to evaluate the use of pipe cutting tools and techniques.

This work group consisted of operations personnel and operational risk management staff. This workgroup represented a highly collaborative effort involving the review and research of pipe cutting tools. Additionally, several demonstrations of alternative pipe cutting tools were held.

As a result of their efforts, the work group established new pipe cutting requirements for American Water that were approved by state vice-presidents of operations. This effort was a collaborative process that evaluated safety, first and foremost, as well as operational considerations. Below is an update and summary of the new requirements designed to lower exposures to the potential hazards associated with the use of cut off saws.

- As communicated on June 1, 2012, the use of diamond tipped blades is prohibited in any cut-off saw application. Only abrasive blades will be used with cut-off saws.
- The use of cut-off and ring saws is banned in excavations and trenches. This is effective as soon as practical (upon attainment of approved, alternative cutting tools), and no later than January 1, 2013.
- The use of cut-off saws is only authorized for cutting pipe outside of a trench or excavation and must be limited to applications where alternative cutting methods are unsafe or not feasible or practical.
- Ring saws are allowed for cutting pipe outside an excavation only.
- To protect against kick back, cut off or ring saw blades cannot be re-introduced into a previous cut. For pipe cutting, the maximum pipe diameter that can be cut with a continuous or single pass cut will be dependent on work set up and blade size.
- Cut-off saws may be used for pavement cutting if equipped with approved abrasive blades and the saw is properly mounted in a cart approved by the manufacturer, and designed specifically for the saw model in use. If operational conditions are such that a cart cannot be used, the cart requirement is waived for that portion of the work only.

FOCUS ON SAFETY



AMERICAN WATER

- Alternative cutting tools approved for use in excavations and trenches include:
 - Chain saws specifically approved and equipped with appropriate cutting chain for the pipe material,
 - Diamond Wire Guillotine saws,
 - Manual, pneumatic, and hydraulic powered wheel and snap cutters
 - Reciprocating saws, and
 - Hand saws
- Appropriate Personal Protective Equipment (PPE), must be worn for protection from the hazards associated with the cutting tool and process. PPE includes, as a minimum with all pipe cutting tools: safety glasses or goggles, gloves, safety shoes, hardhat, and Class II or III reflective garment (when in the road right-of-way). Additional PPE including face shield and hearing protection is required when using reciprocating, cut off, chain, ring or guillotine saws.
- All pipe inside an excavation is required to be supported before making any cuts to prevent pinching of the cutting tool
- Employees using gas, hydraulic and/or pneumatic powered saws to cut pipe will receive training/re-training by December 31 of this year. Delivery of new saws may impact this schedule. Only trained employees will be authorized to use this equipment.
- A job safety analysis must be prepared and reviewed with employees as part of their training prior to using cut-off or ring saws for any approved purpose. Should specific hazards or safety concerns exist at the jobsite, these will also be reviewed and mitigated to the extent possible prior to commencement of work.
- In addition to the above requirements, all manufacturer requirements and safety warnings must be followed.
- American Water Procurement has obtained substantially discounted pricing from Stanley Tools (hydraulic powered chain saws), and ICS (hydraulic and gasoline powered chain saws). These chain saws must be purchased through Grainger to receive the American Water discount.
- A health and safety practice will be issued outlining these requirements and other applicable safety considerations.
- As we transition to these new requirements, the June 1, 2012 interim requirements remain in effect.

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APPLICATION TO CONTRACTORS AND SUBCONTRACTORS

Contractors and subcontractors performing work for American Water will conform to the following requirements. To the extent necessary, agreements and related statements of work will be amended to enforce the requirements.

- The use of cut-off and ring saws is prohibited in any trench or excavation.
- The use of diamond tipped blades is prohibited in any cut-off saw application. Only abrasive blades will be used with cut-off saws.
- The use of cut-off saws is only authorized for cutting pipe outside of a trench or excavation and should be limited to applications where alternative cutting methods are unsafe or not feasible or practical. All manufacturers' recommendations, warnings and safeguards must be followed.
- Ring saws are allowed for cutting pipe outside an excavation only on pipe diameters that allow for a single pass cut. All manufacturers' recommendations, warnings and safeguards must be followed.
- Cut-off and Ring saws may be used for pavement cutting if equipped with approved abrasive blades and the saw is properly mounted in a cart approved by the manufacturer and designed specifically for the saw model in use. If operational conditions are such that a cart cannot be used, the cart requirement is waived for that portion of the work only. All manufacturers' recommendations, warnings and safeguards must be followed.
- Contractors will be notified of these requirements by December 31, 2012 and expected to conform to these requirements no later than March 31, 2013.
- It remains the contractor/subcontractor's responsibility to train their respective employees on the proper use and application of all equipment, to follow manufacturer recommendations and to comply with all applicable Federal, State and local health and safety regulations.

In advance of your cooperation, thank you for ensuring we work safely and return home to our families each night without incident or injury.

Appendix 5

Design-Build Quality Management Plan and Quality Control Requirements

Appendix 5

Design-Build Quality Management Plan and Quality Control Requirements

5.1 PURPOSE

The purpose of this Appendix is to describe the minimum requirements for the Design-Build Quality Management Plan, including quality assurance (“QA”) and quality control (“QC”) procedures that shall be implemented during the Design-Build Period. Quality assurance and quality control (“QA/QC”) shall include inspection, sampling and testing, and other requirements.

5.2 OWNER’S QUALITY OBJECTIVES

The Design-Build Quality Management Plan, including QA/QC, shall be consistent with and support the following overall quality objectives established by the Owner:

- Ensure that the permitting, design, construction and testing of the Project are consistent with the Contract Standards.
- Provide for high-quality workmanship.
- Integrate and coordinate Governmental Approval specialists, environmental scientists, designers, Engineers, construction contractors, and operators into all review phases of the Design-Build Work.
- Develop and implement systems to ensure that problems are discovered early, resolved in a timely manner, and do not recur.
- Provide independent oversight equipped with adequate resources to ensure that quality is not compromised by production goals. During the permitting and design phase, independent oversight is defined as having QA/QC personnel separate from and independent of the design production team on whose work QA/QC functions are being performed. During the construction phase, the lead Engineering personnel involved in making design decisions shall remain involved (including receiving periodic updates on the progress of the construction and making site visits during key points in the construction related to their respective design expertise) to ensure quality assurance.
- Ensure implementation of the QA/QC functions by the use of specified procedures and audit functions.

5.3 DESIGN-BUILD QUALITY MANAGEMENT PLAN DEVELOPMENT AND IMPLEMENTATION

5.3.1 General Requirements

The development and implementation of the Design-Build Quality Management Plan shall be the responsibility of the Design-Builder. The Design-Build Quality Management Plan shall integrate the permitting, design, construction, commissioning and testing phases of the Project during the Design-Build Period and shall include detailed QA and QC programs as attachments. Other Design-Build Quality Management Plan requirements are defined in Section 5.4 of this

Appendix.

The Design-Build Quality Management Plan shall include:

- Provision of adequate resources dedicated exclusively to the plan's implementation. QA/QC staff must function independently of production staff and be empowered to enforce the plan's objectives, define quality expectations, independently verify quality, proactively identify any potential causes of unacceptable quality of work and provide safeguards to avoid any unacceptable quality of work, and if not fully successful, investigate any causes of unacceptable quality of work and implement immediate corrective action.
- Provision of adequate design Engineering personnel resources dedicated during the construction to provide full oversight of construction activities.
- A clear definition and understanding of roles and responsibilities and quality standards among all parties performing the Design-Build Work, including Subcontractors, to ensure that the expected quality standards are met.

The Design-Build Quality Management Plan components for permitting and design shall address procedures for such phases of the Design-Build Work in detail. The construction portion of the Design-Build Quality Management Plan shall include sufficient information to define roles and responsibilities for firms and key individuals, document submittal protocols, inspection procedures, and systems to ensure corrective action.

5.3.2 Owner's Review of Design-Build Quality Management Plan

Within 15 days following the Contract Date, the Design-Builder shall submit to the Owner for the Owner's review its Design-Build Quality Management Plan that describes how QA/QC will be provided and managed for all design and permitting activities. The Owner shall have 15 days to respond with questions and comments. A revised Design-Build Quality Management Plan, incorporating the Owner's comments and fully addressing any areas of non-compliance of the Design-Build Quality Management Plan with the requirements of this Appendix 5 and any other applicable Contract Standards, shall be submitted to the Owner within 15 days of receipt of the Owner's comments.

At least 60 days prior to the expected Construction Date, the Design-Builder shall submit, for the Owner's review, its Design-Build Quality Management Plan that describes how QA/QC will be provided and managed for all construction activities. The Owner shall have 30 days to respond with questions and comments. A revised Design-Build Quality Management Plan, incorporating the Owner comments and fully addressing any areas of non-compliance of the Design-Build Quality Management Plan with the requirements of this Appendix 5 and any other applicable Contract Standards, shall be submitted to the Owner prior to the Construction Date and shall be a precondition to the start of construction activities.

Revisions and updates to the Design-Builder's Design-Build Quality Management Plan may be proposed by the Design-Builder as the Design-Build Work progresses. Changes to the Design-Build Quality Management Plan that do not fully comply with the requirements of this Appendix 5 and any other applicable Contract Standards will require the approval of the Owner. Without exception, such proposed revisions or updates shall be provided to the Owner no later than 30

days prior to the start of the Design-Build Work to which the revision applies. The Owner will complete its review and respond within 30 days of receiving the proposed Design-Build Quality Management Plan change. These revisions and updates may occur in one or more iterations. The Design-Builder shall not initiate any of the Design-Build Work that is impacted by such a non-complying program change unless and until the Owner has reviewed and accepted the Design-Build Quality Management Plan change.

Changes to the Design-Build Quality Management Plan that fully comply with the requirements of this Appendix 5 and any other applicable Contract Standards will not require the approval of the Owner, but shall be provided to the Owner for review and comment. The Owner will complete its review and respond within 15 days of receiving the proposed Design-Build Quality Management Plan change that complies with this Appendix 5.

5.4 MINIMUM REQUIREMENTS FOR DESIGN-BUILD QUALITY MANAGEMENT PLAN

5.4.1 General Requirements

In addition to the requirements in subsection 5.3.1 of this Appendix, the Design-Build Quality Management Plan shall include, at a minimum, the following information for each phase of the Design-Build Work:

- The Design-Builder's overall quality approach, including its QA/QC philosophy, approach for each phase, and a discussion of methods that will be used to assure that contracting and subcontracting relationships will support the Design-Builder's and the Owner's quality objectives.
- Minimum staffing and resource commitments for QA/QC activities for each phase, including fully explained responsibilities and authorities.
- Organization charts for each phase showing the relationship and reporting plan for the QA/QC Manager, special inspectors, field Engineers, design Engineers, Subcontractors, the Owner, and others. This shall include descriptions of the relationships of QA/QC staff to the monitored organizations performing the Design-Build Work.
- Designation of the QA/QC Manager's authority on behalf of the Design-Builder to take actions to assure the Design-Build Work meets the Contract Standards and requirements of the Design-Build Quality Management Plan.
- Definition of design change process during construction describing the sequence of events to implement a design change and documentation of the design change, all consistent with the Owner's rights as described in Appendix 5 and Article III of the Design-Build Agreement.
- A description of the Design-Builder's procedures to proactively identify any potential causes of unacceptable quality of Design-Build Work and provide safeguards to avoid any unacceptable quality of Design-Build Work, and if not fully successful, investigate any causes of unacceptable quality of Design-Build Work and implement immediate corrective action.
- Procedures for ensuring environmental mitigation and monitoring requirements are

successfully implemented.

- Procedures for ensuring applicable Governmental Approval requirements are met.
- A description of the Design-Builder's process to identify, document, and reach concurrence on corrective action.
- Other QA/QC procedures and documentation requirements in detail.
- QA/QC documentation and report requirements in detail, including frequency of reporting.
- All other applicable requirements of the Design-Build Agreement.

5.4.2 Requirements for QA/QC Manager

For each phase of the Design-Build Work, the QA/QC Manager, who shall not be otherwise involved in the daily Design-Build Work, shall:

- Be responsible for developing and implementing the Design-Build Quality Management Plan.
- Be a registered professional Engineer in the State.
- Have served as the QA/QC Manager for at least one other Project of similar size and scope.
- Have a minimum of 10 years of experience in desalination facility design and commissioning activities.

5.4.3 Requirements for Governmental Approvals

The Design-Build Quality Management Plan shall, at a minimum, address the following:

- Roles and responsibilities for obtaining Government Approvals.
- Standards and methods to be used.
- Procedures for ensuring that requirements of Governmental Approvals are incorporated into Design Documents and for verifying compliance during construction.

5.4.4 Requirements for Design Phase

The Design-Build Quality Management Plan shall identify the roles, responsibilities, and procedures necessary to ensure that design quality is maintained during the development, review and approval processes. For each segment of the design work (including but not limited to civil, process, electrical, mechanical, HVAC, structural, geotechnical, etc.) identify the individual(s) serving as the Engineer-of-Record. The Design-Build Quality Management Plan shall include procedures for ensuring that all Contract Standards are incorporated into the Design-Build Work and for verifying compliance until Acceptance has been achieved. Controls shall be established to coordinate design development activities. Coordination shall include all internal and external parties involved in the design development and review process, including inter-discipline reviews, and the verification process used to ensure that changes are clearly and consistently

shown on all affected Design Documents. Methods shall be incorporated to ensure that all design issues and reviewer comments are identified and tracked, until they have been addressed and incorporated into the design.

Measures shall be taken to ensure that designs are not released to construction until authorized and approved by the Engineer-of-Record. Design Documents shall clearly show detailed quality requirements such as: construction tolerances, requirements from applicable codes, standards which are to be followed during construction, equipment model numbers, code material requirements, and any test reports or certifications required from the manufacturers.

5.4.5 Requirements for Construction Phase

The Design-Builder shall be responsible for controlling the quality of all Design-Build Work, including work of its Subcontractors and suppliers, and for ensuring that the required quality is achieved. The Design-Build Quality Management Plan shall describe the approach to on-site quality, off-site quality, the construction QA/QC organization, and the methods and procedures used to assure that quality is achieved during all stages of construction and testing. The Design-Build Quality Management Plan shall detail the QA/QC submittals for construction, ensure quality of all materials and equipment, and clearly define QA/QC activities, including responsible parties, roles, responsibility, and work products ensuring that the Design-Build Work is constructed as specified and required. These requirements shall be written with sufficient clarity to allow the Owner to verify that the Design-Build Quality Management Plan is being fully implemented, all work is inspected, and that all deficiencies are being identified and resolved.

The Design-Build Quality Management Plan shall describe the role of the Design-Builder's Engineer-of-Record and Subcontractors' registered Engineer(s), as applicable, during construction. There shall be full oversight of the construction under the direction of the Design-Builder or a Subcontractor responsible for the design of that portion of the Project. The firm responsible for each portion of the design shall be required to certify that the construction of the Project was consistent with the Contract Standards and with the Design Documents. A procedure for ensuring performance of this oversight, for documenting its performance, and for obtaining certifications by the firms responsible for the design shall be included.

The Design-Build Quality Management Plan shall include the details of the Design-Builder's Construction Quality Control Program ("CQCP"). Instructions for performing inspections must be clearly defined, including the work attributes to be inspected, the acceptance criteria, frequency of inspections, and the requirements for documenting the inspection results. The CQCP shall require inspection during construction by inspectors who are not responsible, in whole or in part, for the scheduling or construction of the Design-Build Work being inspected. Inspection records must be kept current, have sufficient detail to enable the Owner Engineer to identify inspections which have been performed, and the results of these inspections. Inspections must be made throughout the period of construction, including the initial construction, in-process inspections, final inspections, and testing during construction. The CQCP shall describe methods to be implemented to identify and track all unsatisfactory, deviating, and nonconforming work until the required repair, rework, or replacement is performed, and the work has been re-inspected and accepted. The CQCP shall detail the means and methods for identifying and correcting all construction deficiencies such that construction quality meets the

Contract Standards and the Design Documents. The Owner shall be informed of all unsatisfactory conditions that the Design-Builder will rectify and for any nonconforming conditions for which the Design-Builder intends to request the Owner's acceptance in accordance with the Design-Build Agreement.

The CQCP shall ensure the quality of all material and equipment. Procedures shall be used to verify that the procurement documents meet all Contract Standards and the Design Documents, and that quality has been controlled during the manufacture and testing of all equipment which is being fabricated especially for the Project. The CQCP shall require written documentation of inspection of all material and equipment to ensure that it meets all Contract Standards and the Design Documents. Documentation such as material test reports, certifications, and equipment tests results must be received by the Owner Engineer to demonstrate compliance with all Contract Standards and the Design Documents. The CQCP shall include monitoring procedures to ensure that material and equipment is being stored and maintained according to requirements of the designer and the manufacturer.

Procedures and controls shall be provided to ensure that inspections are being performed using the latest Design Documents and approved shop drawings. Procedures shall ensure that an adequate number of inspection personnel are available at all times, and that all inspectors are qualified, trained, and proficient in performing inspections for the Design-Build Work to which they are assigned.

The Design-Builder shall provide full-time construction management and full and comprehensive construction administration for the Design-Build Work. Construction inspectors, who shall be provided with the latest Design Documents released to construction, shall perform initial verification of procurement and construction activities, so that any conflicts will be identified at an early stage. The CQCP shall clearly identify the circumstances under which the Design-Builder's registered soils or geotechnical Engineer and the Engineer-of-Record will be involved in construction quality oversight.

The Design-Builder shall perform all testing and inspections as required by the Contract Standards, approved design documents, applicable codes, regulations, and standards (such as ACI and ASTM) which may be referenced in various sections of Appendix 2. Section 1.2(O) of the Design-Build Agreement shall govern any conflicts or inconsistency in the stringency of test requirements.

All construction testing shall be performed by individuals who are qualified and experienced in providing these testing services. Equipment used to perform tests shall be calibrated according to requirements in the testing procedure. The Design-Builder shall hire a certified independent testing laboratory to perform all laboratory testing. The laboratory selected shall be authorized to operate in the State, certified under the State's National Environmental Laboratory Accreditation Program, as applicable, and shall be subject to the approval of the Owner. Design-Builder requests for laboratory approval shall be made by the Design-Builder in a timely manner, in writing, to the Owner and Owner Engineer. The Owner shall have 15 days from receipt of such request to respond. Laboratory tests include the proposed concrete mix design, concrete aggregate tests, strength of concrete field test cylinders, gradation, and moisture density relationship of soils. The certified testing laboratory(s) must also perform on-site tests that the Design-Builder is not experienced, qualified, or certified to perform or that require independent testing under the Contract Standards. On-site tests include: concrete slump, concrete air

entrainment, concrete temperature, casting of concrete test cylinder specimens, in-place testing of concrete strength, compaction density testing of soils, coating thickness measurements, structural bolting torque, etc.

In addition to all of the above requirements, the CQCP and the Design-Builder's construction quality control activities shall comply with the requirements of Attachment 5A of this Appendix for construction of the Project.

Attachment 5A

Additional Construction Quality Control Requirements

PART 1 – GENERAL

1.1 SITE INVESTIGATION AND CONTROL

- A. The Design-Builder shall check and verify all dimensions and conditions in the field continuously during construction. The Design-Builder shall be solely responsible for any inaccuracies built into the Design-Build Work due to the Design-Builder's (including Subcontractor's) failure to comply with this requirement.
- B. The Design-Builder shall inspect related and appurtenant Design-Build Work and report in writing to the Owner any conditions which will prevent proper completion of the Design-Build Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Design-Builder at the Design-Builder's sole cost and expense.

1.2 INSPECTION OF DESIGN-BUILD WORK

- A. All Design-Build Work performed by the Design-Builder shall be inspected by the Design-Builder. All nonconforming Design-Build Work and any safety hazards in the work area shall be noted and promptly corrected. The Design-Builder is responsible for the Design-Build Work to be performed safely and in conformance with the Design-Build Agreement.
- B. The Owner, its employees, agents, representatives and contractors shall be permitted access to all parts of the Design-Build Work, including plants where materials or equipment are manufactured or fabricated.
- C. The presence of the Owner, its employees, agents, representatives and contractors shall not relieve the Design-Builder of the responsibility for the proper execution of the Design-Build Work in accordance with all requirements of the Design-Build Agreement. Compliance is the responsibility of the Design-Builder. No act or omission on the part of the Owner, its employees, agents, representative and contractors shall be construed as relieving the Design-Builder of this responsibility.
- D. All materials and articles furnished by the Design-Builder shall be subject to documented inspection, by qualified personnel, and no materials or articles shall be used in the Design-Build Work until they have been inspected and accepted by the QA/QC Manager or other designated representative. Any Design-Build Work covered in the absence of inspection shall be subject to uncovering as set forth in Section 3.14 of the Design-Build Agreement.

1.3 TIME OF INSPECTION AND TESTS

- A. Whenever the Design-Builder is ready to backfill, bury, cast in concrete or otherwise cover any Design-Build Work under the Design-Build Agreement, the Owner shall be notified before such covering and completion, and the Owner shall notify the Design-

Builder of a requested inspection of any such Design-Build Work as set forth in subsection 3.14(E) of the Design-Build Agreement. Failure of the Design-Builder to properly notify the Owner, as required by subsection 3.14(E) of the Design-Build Agreement, in advance of any such covering or completion shall be reasonable cause for the Owner to request the Design-Builder take apart or uncover for inspection or testing any previously covered or completed Design-Build Work in accordance with subsection 3.14(E) of the Design-Build Agreement. The costs of any uncovering, taking apart, remedial or corrective work required and all costs of such delays, including the impact on other portions of the Design-Build Work, shall be borne as set forth in subsection 3.14(E) of the Design-Build Agreement.

1.4 SAMPLING AND TESTING

- A. Except as otherwise required, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. The Owner reserves the right to use any generally accepted system of inspection that, in the opinion of the Owner, will ensure the Owner that the quality of the workmanship is in full accord with the Design-Build Agreement.
- B. The Owner reserves the right to make independent investigations and tests as specified in the following paragraph. The failure of any portion of the Design-Build Work to meet any of the Contract Standards shall be reasonable cause for the Owner to require the removal or correction and reconstruction of any such Design-Build Work.
- C. In addition to any other inspection or quality assurance provisions that may be specified, the Owner shall have the right to independently select, test, and analyze, additional test specimens of any or all of the materials to be used pursuant to subsection 3.14(B) of the Design-Build Agreement. Results of such tests and analyses shall be considered along with the tests or analyses made by the Design-Builder to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Design-Build Work, as a result of such independent testing or investigation by the Owner, fails to meet the requirements of the Design-Build Agreement, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Design-Build Work shall be borne by the Design-Builder in accordance with subsections 3.14(E) and 3.15(A) of the Design-Build Agreement.

1.5 RIGHT OF REJECTION

- A. The Owner shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Design-Build Agreement, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Design-Build Work at the Project Site. If the Owner, through an oversight or otherwise, has accepted materials or work which are defective or in any way contrary to the Design-Build Agreement, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected.
- B. The Design-Builder shall promptly remove or replace rejected articles or materials from

the Project Site after notification of rejection.

- C. All costs of removal and replacement of rejected articles or materials, as specified therein, shall be borne by the Design-Builder.
- D. The Design-Builder shall not be entitled to any adjustment to the Scheduled Acceptance Date due to the Owner's rejection of articles or materials that fail to meet the requirements of the Design-Build Agreement.

1.6 TESTING SERVICES

- 1. The Owner shall have the right to inspect work performed by the Owner-approved independent testing laboratory utilized by the Design-Builder, both at the Project Site and at the laboratory. This shall include inspection of the independent testing laboratory's internal quality assurance records (quality assurance manual, equipment calibrations, proficiency sample performance, etc.).
 - 2. The Design-Builder shall obtain the Owner's acceptance of the testing firm before having services performed, and pay all costs for these testing services
 - 3. Testing services provided by the Owner, if any, are for the sole benefit of the Owner; however, test results shall be available to the Design-Builder. Testing necessary to satisfy the Design-Builder's internal QA/QC procedures shall be the sole responsibility of the Design-Builder.
- B. Unless otherwise specified, the Design-Builder shall provide all testing services in connection with the following materials as required, for review by the Owner:
- 1. Concrete materials and mix designs.
 - 2. Masonry units, masonry grout, mortar materials, and design mixtures.
 - 3. Asphaltic concrete materials and design mixtures.
 - 4. Embankment, fill, and backfill materials.
 - 5. QC testing of all precast concrete.
 - 6. Holiday testing of pipeline coatings.
 - 7. Air testing of field-welded joints for steel pipe and fabricated specials.
 - 8. All other tests and Engineering data required for the Owner's review of materials and equipment proposed to be used in the Design-Build Work.
 - 9. Concrete strength tests.
 - 10. Test of masonry prisms.
 - 11. Field control test of masonry.
 - 12. Asphaltic concrete.
 - 13. Magnetic particle or dye penetrant testing of field welds for steel pipe and fabricated specials.
 - 14. Moisture-density and relative-density tests on embankment, fill, and backfill materials.

15. In-place field density test on embankments, fills, and backfill.
 16. Other materials and equipment as specified herein.
 17. Testing, including sampling, shall be performed by the Design-Builder or the testing firm's laboratory personnel, in the general manner and frequency required by the Contract Standards and the Design Documents.
 18. The testing firm's laboratory shall perform all laboratory tests within a reasonable time, consistent with the specified standards, and shall furnish a written report of each test.
 19. The Design-Builder shall furnish all sample materials and cooperate in the testing activities, including sampling, and shall interrupt the Design-Build Work when necessary to allow testing, including sampling, to be performed. The Design-Builder shall have no claim for an increase in contract price or contract times due to such interruption. When testing activities, including sampling, are performed in the field by the testing firm's laboratory personnel, the Design-Builder shall furnish personnel and facilities to assist in the activities.
- C. Written reports of tests and Engineering data regarding materials and equipment proposed to be used in the Design-Build Work shall be submitted by the Design-Builder for the Owner's review.
1. The testing firm retained by the Design-Builder for material testing shall furnish five copies of a written report for each test. Three copies of each test report shall be transmitted directly to the Owner in a sealed envelope, within three Working Days after each test is completed. Two copies of each test report shall be transmitted to the Design-Builder. The Design-Builder shall consecutively number each report for each type of test.
 2. The Owner shall furnish one copy of each field and laboratory QA/QC test conducted by the Owner to the Design-Builder.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Inspection: The Design-Builder shall inspect materials or equipment upon the arrival on the jobsite and immediately prior to installation and remove damaged and defective items from the jobsite. The Owner shall be provided the opportunity to observe any such Design-Builder inspections in accordance with Section 3.14 of the Design-Build Agreement.
- B. Measurements: The Design-Builder shall verify measurements and dimensions of the work as an integral step of starting each installation.
- C. Manufacturer's Instructions: Where installations include manufactured products, the Design-Builder shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Design-Build Agreement so as not to violate manufacturers' warranty conditions.

Appendix 6

Design-Build Work Review Procedures

APPENDIX 6

DESIGN-BUILD WORK REVIEW PROCEDURES

6.1 PURPOSE

The purpose of this Appendix is to set forth the procedures for the Owner's review of each aspect of the Design-Build Work to verify that the Project has been designed and constructed in accordance with the Design and Construction Requirements set forth in Appendix 2, the General Design-Build Work Requirements set forth in Appendix 4, and the terms and conditions of the Design-Build Agreement.

6.2 PARTNERING SESSION and INITIAL MEETING

Within thirty (30) days after the Contract Date, two consecutive one-day meetings will be held. The first day, a conference attended by Design-Builder, the Owner, and others shall be held with the assistance of a facilitator in order to establish a partnering relationship amongst the parties as to the Design-Build Work. At such conference, the parties shall develop common Project objectives in the form of a partnering charter and shall develop working arrangements for periodic meetings amongst the parties, including subsequent partnering meetings, and for the rapid resolution of issues that may develop. Owner and Design-Builder shall mutually agree on the selection of the Facilitator. The cost of the facilitator and the cost of the meeting facilities for all partnering sessions will be paid for by the Owner. Each party shall be responsible for the travel and living expenses of their employees and their subcontractors or consultants designated to attend the meeting.

On the second day, Design-Builder, the Owner and others shall attend another meeting to discuss the schedules, design issues, applications for payments and other submittals, maintaining required records and Project procedures and community relations.

6.3 DOCUMENT SUBMITTAL PROTOCOL

No later than 30 days following the Contract Date, the Design-Builder shall submit to the Owner a document submittal protocol ("Protocol"). The Protocol shall identify the key document submittal packages to be prepared by the Design-Builder and the expected submittal dates to the Owner. The Protocol shall also identify the frequency of the Design-Builder's design progress meetings during various phases of the design. The Protocol shall require the Design-Builder to submit a minimum of one original and four paper copies of each document submittal with two electronic copies of each submittal on CD disks, to the Owner, the Owner Engineer and the Contract Administrator. The Design-Builder may propose to create a Project web site, accessible to the Owner and its designees, for posting all submittals and other reference information. All major submittals shall be accompanied by a transmittal letter which states the: (i) date; (ii) "Monterey Peninsula Water Supply Project Desalination Infrastructure"; (iii) Design-Builder's name and address; (iv) identification number of each shop drawing, piece of data and sample submitted; and (v) notification of any deviations from the Design and Construction Requirements of Appendix 2.

At a minimum, the Protocol shall require the Design-Builder to include all submittals that are required to obtain the Governmental Approvals and the following Design-Build Work submittals and design package submittals:

A. Design-Build Work Submittals

- Communication Plan
- Vulnerability Assessment
- Manufacturer's warranties, certifications and other data
- Site-specific Health and Safety Plan
- Regulated Substances Management Program
- Emergency/Spill Response Plan
- Monthly Progress Schedule Updates
- Security Plan submittals

B. Design Package Submittals

Design package submittals will be defined in detail in the Protocol submittal. The submittals will be organized in a fashion to best meet the critical schedule requirements of design, permitting and construction activities. A general description of the organization of submittals follows:

- 1) Technical Submittal #1 (typical of a 15% overall design completion) including the following:
 - A. Draft Design Memorandum/Basis of Design Report;
 1. Following format provided in Appendix 2;
 2. Tabbed sections with concise text, tabular format, equipment schedules
 3. Identify equipment and equipment manufacturers
 - B. Topographic Survey of Site
 - C. Preliminary Site Plan showing structures and roadways
 - D. Preliminary Piping Plan
 - E. Preliminary Building Layouts showing equipment location
 - F. Preliminary P&IDs for Treatment and Pumping Systems
 - G. Hydraulic Profiles for treatment and waste processes
 - H. Electrical Single Line Diagram
 - I. Single Line Diagram for Medium Voltage Power Distribution
 - J. Preliminary Electrical Load Table
 - K. Preliminary Layout of Medium Voltage Switchgear and 480 Volt Switchboards
 - L. Preliminary Electrical Site Plan
 - M. SCADA Architecture Schematic
- 2) Technical Submittal No. 2 (typical of 30% Overall Design completion)
 - A. Updated versions of items in previous submittal
 - B. Landscaping Plan
 - C. Initial versions of Architectural Plans and Sections
 - D. Initial versions of Structural Plans and Sections
 - E. Preliminary Control Descriptions
 - F. First draft of Specifications for Division 11, 13, and 15

- 3) Technical Submittal No. 3 – Electrical Design Submittal (Typical of 30% Electrical Design Review)
 - A. One Line Power Distribution Riser Diagram
 1. Preliminary sizing based on initial loads
 2. Information dealing with obtaining electrical service
 - B. Electrical Site Plan
 - C. NEMA Designation Plans for Buildings
 - D. Power and Lighting Plans
 - E. Initial Electrical Specifications- Division 16
 - F. Initial Motor Control Center Elevations and Schedules
 - G. Standby Generator Sizing and Interconnection
 - H. Initial Power System Study/Analysis
- 4) Technical Submittal No. 4 (Typical of 60% Overall Design completion)
 - A. Updated versions of items in previous submittal
 - B. First draft of Specifications
 - C. Drawings, specifications, and reports to be submitted for permits
 - D. Initial HVAC and Plumbing Drawings
 - E. Initial Electrical – Lighting Plans
 - F. Operational Narrative
- 5) Technical Submittal No. 5 –Electrical Design Review (Typical of 60% Electrical Design Completion)
 - A. Updated versions of items submitted in previous Electrical Design submittal
 - B. Initial Short Circuit and Load Flow Calculations
 - C. Preliminary Protective Coordination
 1. Information outlining equipment and design approach
 - D. Updated Power System Study/Analysis
- 6) Technical Submittal No. 6 (Typical of 90% Design completion)
 - A. All drawings and specifications
 - B. Final Design Memorandum/Basis of Design Report
 - C. Drawings, specifications, and reports to be submitted for permits
 - D. Final Power System Study/Analysis including Arc Flash Hazard Analysis
- 7) Technical Submittal No. 7 - Drawings and specifications issued for construction

Electrical Design submittals shall be timely and in compliance with the Power System Study (Short Circuit, Protective Coordination, and Arc Flash Hazard Analysis/Evaluation) identified in Appendix 2.

All submittals shall be carefully reviewed by the Design-Builder prior to submission for review to the Owner, the Owner Engineer and the Contract Administrator. Each submittal shall be dated, signed and certified by the Design-Builder as being correct for the current stage of design completion. All submittals shall have a level of detail such that the Owner and its representatives can confirm compliance with the Design and Construction Requirements. The Owner may return any submittal that does not contain information sufficient for the Owner or its representatives to ascertain compliance with the Design and Construction Requirements. In the event the Owner returns a design submittal to the Design-Builder, the Owner shall notify the Design-Builder of any additional information that will be necessary for the Owner and its representatives to

ascertain conformance with the Design and Construction Requirements, and the Design-Builder shall be responsible for making all necessary corrections at its sole cost and expense. Design submittals re-submitted by the Design-Builder shall direct specific attention, in writing or on the resubmitted submittal, to revisions.

Construction activities shall not vary from the final Design Documents submitted to the Owner except where such variations are allowed, subject to the Owner's and applicable Governmental Body's review and approval, in accordance with this Appendix. Adherence to the final Design Documents will be one factor used by the Owner in its review and approval of the Design-Builder's applications for payment during construction.

The Design-Builder shall provide the following design information in the appropriate design package in accordance with the Protocol:

A. Specifications, Design Narratives, and Lists

- A. Project design criteria
- B. Basis of design report
- C. Specifications list
- D. Process systems piping line list
- E. Process system valve list
- F. Electrical loads list
- G. Major Equipment list (process, mechanical, electrical, instrumentation and control, support systems, other)
- H. Proprietary technology/equipment list
- I. Specifications for major equipment
- J. Narrative description of the following systems: controls, remote monitoring and operating capability, voice and data communications, and security.
- K. Specifications (general requirements, civil, structural, architectural, equipment, specialties, mechanical, and electrical and instrumentation and controls sections)

B. Drawings

- A. Cover sheet
- B. Drawing index
- C. Process flow diagram for all primary and secondary processes
- D. Layout of the Project Site
- E. Hydraulic profile
- F. Major outside piping layout
- G. Layout of operations building
- H. Project Site master planning layouts
- I. Landscape inventory plan
- J. Landscape and irrigation plans with landscape details/plant materials list
- K. Project Site grading and utility plans, with sections as needed for construction clarity or dimensioning
- L. Surface drainage system and features plans and details
- M. Erosion control system plans and details
- N. Stormwater Retention System plans and details

- O. Fire protection and security system plans
- P. Project Site sections and details
- Q. Process and support facilities general arrangement plans, with sections as needed for construction clarity or dimensioning
- R. Piping system plans, sections and details
- S. Corrosion control plans and details
- T. Major building structure foundation plans and sections
- U. Major building and structure floor plans
- V. Major building and structure exterior elevations and sections
- W. Typical sections through all major wall, roof and floor sections of major buildings and structures
- X. Architectural door, window, finish and hardware schedules and details
- Y. Architectural renderings
- Z. Non-process mechanical systems plans, details and schedules
- AA. Electrical site plan
- BB. Electrical one line drawing
- CC. Electrical point-to-point wiring diagrams
- DD. Process and instrumentation diagrams for all primary and secondary processes
- EE. SCADA system network drawings
- FF. Instrumentation and control system drawings, including loop drawings illustrating the functional elements in the path of the sensor to each control system input/output (ISA S5.4)

6.3.1 Electronic Drawing Submittal Format

All drawings submittals shall be in Portable Document Format (PDF), compliant with the Adobe PDF Specification Version 1.3, or the latest version. Such submittals shall be PDF formatted text and graphics or PDF searchable images. All drawings available in native format (i.e., AutoCAD) shall be provided as electronic files, in a native format supported by available viewers, in addition to in PDF format.

6.4 OWNER REVIEW OF DESIGN-BUILDER DESIGN

6.4.1 Integrated Design Review Procedures

In accordance with the terms and conditions of the Design-Build Agreement, the Owner will review the Design Documents for compliance and consistency with the Design and Construction Requirements, the Owner's shall have the ability to provide input on all issues including technical, as well as selection of finishes, architectural concept, landscaping, and environmental mitigation. the Owner's input to the design process shall be solicited by the Design-Builder on an integrated basis as the work is being performed. The Owner will make reasonable efforts to bring staff or representatives with review and decision-making authority to the work sessions as requested and scheduled by the Design-Builder. The Design-Builder shall provide the Owner with advance notice of the work sessions and agenda topics to facilitate the Owner's scheduling of the appropriate participants for the work sessions.

All design submittals shall comply with the following:

All design submittals shall comply with the Design and Construction Requirements. Any Design-Builder-requested change to the Design and Construction Requirements (regardless of prior discussion) must be clearly identified by the Design-Builder in its cover letter that transmits the request and must be fully documented with compelling justification of the Design-Builder's request for a change to the Design and Construction Requirements and the benefits to the Owner for consenting to such a change. No change to the Design and Construction Requirements shall be made except with the Owner's approval pursuant to Section 3.10 of the Design-Build Agreement. All proposed deviations from the Design and Construction Requirements shall be clearly identified. The Owner would expect such benefits may include a corresponding reduction in the Fixed Design-Build Price. The Design-Builder shall assume all risks associated with obtaining the Owner approval of any change to the Design and Construction Requirements.

The Owner shall be provided ten (10) Business Days to conduct a meaningful review of the Design Documents for compliance with the Design and Construction Requirements and to determine if any of the Design-Build Work is nonconforming.. The Design-Builder shall solicit the Owner's input to the design process during the design progress meetings and at key stages in the design preparation based on the Protocol. All design calculations shall be made available to the Owner upon request.

The Owner will provide its written comments in a tabular summation as to any concerns, problems, or non-compliance of such submittal. The tabular summation will be on a form created mutually by the Design-Builder and the Owner, with provisions on the form for the Design-Builder's responses. The Design-Builder will provide a written response to the Owner's comments within five Working Days of receipt of the Owner's comments, primarily through use of the tabular summary form, including documentation of responses and agreed upon action items. Design progress meetings will be scheduled as necessary to address review comments and facilitate timely completion of the submittal review. Any outstanding review comments not satisfactorily resolved will be transferred to an issues tracking form by the Design-Builder for subsequent follow-up. Governmental Approval application submittals will be reviewed in accordance with Section 3.11 of the Design-Build Agreement and this Appendix.

6.4.2 Design Progress Meetings and the Preconstruction Meeting

For the purpose of facilitating the design and design review process, the Design-Builder shall schedule design progress meetings with the Owner on a routine basis and at least monthly throughout the design development period in accordance with this Appendix 6. The parties shall schedule and participate in a preconstruction meeting that will be conducted no more than ten (10) days prior to the anticipated Construction Date. Representatives of Governmental Bodies having jurisdiction over the Project may attend such meetings. Design-Builder representatives with responsibility for design, permitting, and construction of the Project will participate in the meetings. the Owner will be appropriately represented by staff or representatives responsible for administering the Design-Build Agreement and monitoring the Design-Build Work in accordance with the Design-Build Agreement. Design progress meetings may coincide with construction progress meetings. The Design-Builder shall maintain an accurate updated submittal

log and shall bring this log to each scheduled design progress meeting. The submittal log shall include: (i) submittal description and assigned identification number; (ii) date of submission to the Owner, the Owner Engineer and Contract Administrator.

6.4.3 Design Submittals During Construction

It is anticipated that there could be some re-design or design clarifications needed during construction. This continuing design effort will be subject to the Owner's review for compliance and consistency with the Design and Construction Requirements in the same manner as set forth in subsection 6.3.1 of this Appendix.

Design changes to a particular Design Document performed following the issuance of the Design Document for construction shall be issued under a Design Change Notice ("DCN") process that accurately tracks and documents changes to the design. No later than 30 days prior to initiation of construction, the Design-Builder shall submit to the Owner additions to the document submittal Protocol to include the DCN process. The DCN process shall include provisions for the Owner to be provided with copies of all DCNs in a timely manner to allow review, comment, and, where appropriate, approval in the same manner as set forth in subsection 6.3.1 of this Appendix and in accordance with subsection 6.3.4 of this Appendix. Design clarifications shall be issued in a timely manner using a similar procedure. If a DCN requires a material change from what was reflected in the Governmental Approval applications, the DCN must be approved by the appropriate Governmental Body.

6.4.4 Design Change Authority

The Design-Builder shall be responsible for providing design changes to the Design Documents necessary to complete the Project for its intended purposes. All such changes shall be implemented in accordance with the DCN process described above and in compliance with the Owner's rights under Article III of the Design-Build Agreement. No DCN shall operate to change the Design and Construction Requirements. Any DCN which requests a change to the Design and Construction Requirements shall be subject to the Owner's rights under Sections 3.4, 3.9 and 3.10 of the Design-Build Agreement.

6.4.5 Design Changes Directed by Owner

The procedures to be followed for incorporating design changes directed by the Owner are specified in subsection 3.10(D) and 3.14 of the Design-Build Agreement.

6.5 OWNER REVIEW DURING GOVERNMENTAL APPROVAL PROCESS

The Design-Builder's responsibilities for obtaining and maintaining the Governmental Approvals required for construction of the Project are described in Article III of the Design-Build Agreement. The Owner shall have the right to review and comment on Design-Builder submittals as provided by the Design-Build Agreement and herein. To the extent that Governmental Approval applications include design specifications or drawings that the Owner has not previously reviewed, the Design-Builder shall submit draft copies of the Governmental Approval applications and supporting documents to the Owner in the same manner as described

in subsection 6.3.1 of this Appendix for design reviews. For all other Governmental Approval applications, the Design-Builder shall provide draft copies of the applications and supporting documents for Owner review in accordance with Section 3.6 of the Design-Build Agreement.

6.6 OWNER REVIEW DURING CONSTRUCTION

6.6.1 Construction Review Intent

In accordance with the terms and conditions of the Design-Build Agreement, the Owner and its designated representatives, including the Contract Administrator and the Owner Engineer, will have full access to the Project at all times and will periodically review construction activities and participate in construction progress meetings as needed to verify compliance with the Design-Build Agreement. In addition, the Owner will monitor the progress of construction to review and verify all applications for payment covering all construction work performed during the preceding calendar month in accordance with the procedures set forth in Appendix 13. the Owner's review of construction activities shall not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions and programs which are all the responsibility of the Design-Builder. It is anticipated that the Owner will have full-time representation at the Project Site throughout construction, start-up and Acceptance Testing.

The Owner's review and involvement in construction activities is intended for the informational purposes of the Owner and to monitor compliance with the Design-Build Agreement. Such activities shall not be viewed as part of the Design-Build Quality Management Plan and shall not limit or otherwise affect the Design-Builder's full responsibility for the performance of the Design-Build Work. The Design-Builder shall provide the Owner with copies of minutes and other documentation produced as a result of any construction progress meeting.

6.6.2 Equipment and Materials Submittals

The Design-Builder shall provide submittals for equipment and materials, shown on the Design Documents prepared by the Design-Builder, in accordance with all procedures and requirements specified in the Contract Standards. Submittals for Project equipment and materials shown or specified in Design Documents prepared by the Design-Builder shall be reviewed and approved by the Engineer-of-Record and shall be provided to the Owner. When making a submittal to the Owner, five copies of the submittal shall be provided. The Design-Builder shall create a secure Project website, accessible to the Owner, for posting all submittals and other reference information. The Owner may reduce the requirements for hard copies of submittals in consideration of access to information on the website. The Design-Builder shall have at least seven (7) working days to review approved submittals.

A list of shop drawings requiring the Owner's review and approval will be defined by the Owner during the preliminary design phase. Detailed procedures for numbering will be outlined at the pre-construction meeting.

Each submittal shall have an identifying title stamp as follows:

Design-Builder

Project Title _____
Specification Section _____
Shop Drawing No. _____ Rev. _____]

6.6.3 Materials and Equipment Samples

The Design-Builder shall furnish samples of materials and equipment inspected by the Design-Builder if requested by the Owner, the Owner Engineer or Contract Administrator. Such samples shall be delivered to the requesting party at the Project Site. The Design-Builder shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Design-Build Work until reviewed by the Owner. Samples provided pursuant to this subsection shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices and a full range of color, texture and pattern. Each sample shall clearly identify the material or equipment being represented, the place of origin, the name of the producer (if any) and the location in the Project where it will be used. The Design-Builder shall provide a minimum of two samples of each item for which samples are requested, unless otherwise directed by the Owner.

6.6.5 Construction Corrections and Owner Directed Changes

Section 3.15 of the Design-Build Agreement discusses the procedures to be followed for correction of non-conforming Design-Build Work and for instituting changes and additions to such work.

6.6.6 Construction Photographs and Audio-Video Records

The Design-Builder shall employ a professional photographer and videographer to record digital construction record photographs weekly and color digital audio/video pre- and post-construction records during the course of construction of the Project. Photographs and videography shall be taken in conformance with this subsection and shall be furnished to the Owner with each application for payment. The photographs and videography shall be a factual presentation of the condition and progress of the construction of the Project. Photographs and videography shall be taken at each of the major areas of construction of the Project and shall comply with the following requirements:

A. Views and Quantities

- A. Existing Project Site conditions before Design-Builder site work is started. The number of views shall be adequate to cover the Project Site.
- B. Five views of the overall Project, on a weekly basis, clearly showing the construction of the Project that is in progress.
- C. Each group of weekly photographs shall include at least two photographs taken showing the same overall view as was taken during the previous week's photographs.

- D. The Design-Builder shall consult with the Owner for instructions concerning the required views.
- E. The Design-Builder shall provide the Owner with two image CD disks (containing the photographs in JPEG or BMP format) with each application for payment.
- F. The Design-Builder shall provide bi-monthly color aerial photographs.

B. Videography Required

The Design-Builder shall prepare a color digital audio/video record of all the areas to be affected by construction prior to beginning any construction, and at Substantial Completion. The initial digital audio/video record shall be done one week prior to placement of materials or equipment on the Project Site. Prior to mobilization at the site, furnish to the Owner a CD or DVD recording of all planned construction areas, material storage areas, areas adjacent to these areas, including but not limited to, streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures and adjacent building structures. The purpose of the recording is to document existing conditions and to provide a fair measure of required restoration. Care should be taken to record all existing conditions which exhibit deterioration, imperfections, structural failures or situations that would be considered substandard.

The recording shall be performed by a professional firm specializing in audio-video work. The tapes shall be high quality, color and in a digital format. Temporary lighting shall be provided as necessary to properly tape areas where natural lighting is insufficient (indoors, shadows, etc.). The recording shall include an audio soundtrack to provide the following information:

- detailed description of location being viewed referenced to Design Documents (ie. station no., building designation, pipeline route etc.)
- direction (N, S, E, W, looking up, looking down, etc.) of camera view
- date, time, temperature, environmental conditions at time of taping.

Any areas not readily visible by the recording shall be described in detail. Unless otherwise approved by Owner, recording shall not be performed during inclement weather or when the ground is covered partially or totally with snow, ice, leaves, etc.

Prepare and provide as many CD/DVD as are necessary to satisfy the requirements of this section. The original recording shall be submitted to the Owner accompanied by a detailed log of the contents of each CD/DVD. The recording will be maintained by the Owner during construction and may be viewed at any time upon request. Upon final acceptance, the recording will become the permanent property of the Owner.

C. Digital Photographs and Audio/Video Records

- Digital images shall be color, high resolution and sharpness, maximum depth-of-field with minimum distortion. Cameras utilized for such images shall be professional digital models capable of High Definition recording.
- The audio/video recordings shall be in NTSC DVD +R format for easy viewing on standard DVD players.
- Each CD/DVD and image shall be identified on the CD/DVD, listing the following:
 1. Name of Project: “Monterey Peninsula Water Supply Project Desalination Infrastructure”
 2. Orientation of view
 3. Description of image
 4. Date image was taken
- To preclude the possibility of tampering or editing in any manner, all video recordings shall, by electronic means, generate and display continuously and simultaneously on the screen digital information to include the date and time of recording. The time information shall consist of hours, minutes and seconds, separated by colons (i.e., 10:35:18).
- The rate of speed in the general direction of travel of the conveyance used during digital videography shall be controlled to provide a usable image. Panning rates and zoom-in, zoom-out rates shall be controlled sufficiently such that playback will produce clarity of the object viewed.
- All digital audio/video records shall be done during times of good visibility. No digital audio/video records shall be done during periods of visible precipitation, unless otherwise authorized by the Owner.

6.6.7 Resident Project Representation

The duties, responsibilities and limitations of authority of the Resident Project Representative shall be as follows:

A. General

The Resident Project Representative (RPR) is Owner’s agent at the site, will act as directed by and under the supervision of Owner.

B. Duties and Responsibilities of RPR

1. Conference and Meetings: Attend meetings with Design-Builder, such as preconstruction conferences, progress meetings, job conferences and other Project-related meetings.
2. Liaison: Serve as Owner's liaison with Design-Builder working principally through Design-Builder's superintendent and assist in understanding the intent of the Design-Build Agreement; and assist the Owner in serving as liaison with Design-Builder when Design-Builder's operations affect Owner's on-site operations.
3. Shop Drawings and Samples: Advise Owner and Design-Builder of commencement of any Work requiring a Shop Drawing or sample if the submittal has not been approved by Design-Builder's design professional or Owner.
4. Review of Work, Rejection of Defective Work, Inspections and Tests:
 - a. Conduct on-site observations of the Design-Build Work in progress to assist Owner in determining if the Design-Build Work is in general proceeding in accordance with the Design-Build Agreement.
 - b. Report to Owner whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Design-Build Agreement, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made.
 - c. Verify that tests, equipment and systems startup and operating and maintenance training are conducted in the presence of appropriate personnel, and that Design-Builder maintains adequate records thereof.
5. Modifications: Consider and evaluate Design-Builder's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to Owner. Transmit to Design-Builder decisions as issued.
6. Payment Requests: Review applications for payment with Design-Builder for compliance with the established procedure for their submission and forward with recommendations to Owner, noting particularly the relationship of the payment requested to the schedule of values, Work completed and materials and delivered at the site but not incorporated in the Design-Build Work.
7. Completion:
 - a. Before Owner issues a certificate of Substantial Completion, submit to Design-Builder a list of observed items requiring completion or correction.

b. Conduct final inspection in the company of Owner and Design-Builder and prepare a final list of items to be completed or corrected.

c. Observe that all items on final list have been completed or corrected and make recommendations to Owner concerning acceptance.

C. Limitations of Authority

The Resident Project Representative:

1. Shall not authorize any deviation from the Design-Build Agreement or substitution of materials or equipment unless authorized by Owner.

2. Shall not exceed limitations of Owner's authority as set forth in the Agreement or the Design-Build Agreement.

3. Shall not undertake any of the responsibilities of Design-Builder, subcontractors or Design-Builder's superintendent.

4. Shall not issue directions relative to, or assume control over, any aspect of the means, methods or techniques of construction unless such directions or control are specifically required by the Design-Build Agreement.

Appendix 7

Acceptance Test Procedures and Requirements

Appendix 7

Acceptance Test Procedures and Requirements

SECTION 7.1. PURPOSE AND OBJECTIVES

The purpose of the Acceptance Test is to demonstrate that the Project complies with the performance and reliability requirements of the Design-Build Agreement, including the Design and Construction Requirements in Appendix 2 and all other applicable Contract Standards. The following steps are required for Acceptance:

- 1) Equipment and System Startup Testing and Commissioning, including the Initial Plant Performance tests (“IPPT”) (described in Appendix 4), which is prerequisite to the following two steps;
- 2) Run-In Plant Performance Tests (“RIPPT”), fourteen (14) day duration (described in Appendix 4), which is a prerequisite to Acceptance Testing;
- 3) Acceptance Testing, sixteen (16) day duration, described below in this Appendix.

Equipment and System Testing, which precedes RIPPT, is designed to test individual pieces of equipment and systems to be sure each component operates appropriately over the full range of operating conditions. The RIPPT is designed to demonstrate that all equipment, systems, and other elements of the Project function properly on a continuous basis as a complete unified facility prior to initiation of Acceptance Testing. Acceptance Testing is designed to demonstrate continuous stable operation of the Design-Build Improvements at both the rated capacity and the maximum capacity.

Throughout both the RIPPT and the Acceptance Testing, the Design-Builder shall be required to comply the applicable requirements of CDPH and other Governmental Bodies.

SECTION 7.2. ACCEPTANCE TESTING

Acceptance Testing shall be conducted over a sixteen (16) day continuous period. The objective of Acceptance Testing is to demonstrate continuous stable operation of the Design-Build Improvements. Testing shall demonstrate that the facility is able to produce Finished Water that is in compliance with all Applicable Law water quality standards as well as the Additional Finished Water Quality Standards and Requirements listed in this Appendix and Appendix 2. Acceptance Tests shall be conducted at the rated capacity for all but two days when testing shall be conducted at the maximum capacity.

The Acceptance Test data collection locations, frequency, accuracy, measurement conditions, detection levels, and format of presentation, reporting and recordkeeping shall be consistent with

meeting all requirements of all applicable Governmental Approvals, Applicable Law, and Subcontractor and equipment vendor warranties.

For the purpose of Acceptance Testing, the following definitions for Off-Specification Water and Unacceptable Water shall apply:

- **“Off-Specification Water”** means Finished Water that does not strictly conform to the Finished Water Quality Acceptance Standards and Requirements in every respect and to any extent whatsoever, particularly with regard to the Additional Finished Water Quality Acceptance Standards and Requirements, but is still considered potable under Applicable Law. Off-Specification Water does not include Unacceptable Water.
- **“Unacceptable Water”** means water produced by the Design-Build Improvements that do not comply with the Finished Water Acceptance Standards and Requirements (subsection 7.2(D) of this Appendix) to such an extent that it (1) is non-potable under Applicable Law; (2) presents a risk to public health or safety; or (3) has the potential to damage or destroy Owner property or private property or create a need to clean, repair, replace or restore any such property.

(A) Preconditions for Acceptance Testing

Acceptance Testing will begin following successful completion of the RIPPT. The Design-Builder shall certify that the following preconditions have been met prior to beginning Acceptance Testing of the Design-Build Improvements and all system:

- The Design-Builder shall have completed the requirements of Section 4.3 of the Design-Build Agreement.
- The Design-Builder shall have successfully completed both the Equipment and System Testing and the RIPPT described in Appendix 4.
- The Design-Builder shall have obtained the Owner’s approval of the Acceptance Test Plan, requirements of which are discussed below in subsection (B).
- The Design-Builder shall have trained the Owner’s staff to operate the Design-Build Improvements, as described in Appendix 4 (General Design Build Work Requirements) and Article 4 of the Design-Build Agreement.
- The Design-Builder shall have received written notice from the Owner that the MPWSP—slant wells and Raw Water pump station, all pipelines, and ancillary facilities—has been completed and is ready to provide Raw Water, receive Finished Water, and discharge brine and other waste streams.
- All Utilities specified or required under the Design-Build Agreement are connected and functioning properly.

- The Design-Builder shall have met with the Owner at least 60 days prior to the Scheduled Acceptance Test to provide a forecast of expected Finished Water production and delivery, and described the intended management of Finished Water and Off-Specification Finished Water.

(B) Acceptance Test Plan

The Design-Builder shall prepare an Acceptance Test Plan that outlines in detail the procedures and requirements for all Acceptance Testing, and provides the necessary checklist and forms for performing and tracking this work. The Acceptance Test Plan shall be submitted to the Owner for review and approval, at least 180 days before the planned commencement date for the Acceptance Test, in accordance with Article 4 of the Design-Build Agreement. The Acceptance Test Plan shall describe all operating procedures, clearly indicating that all equipment and systems shall be operated as intended within established operating boundaries as defined in Appendix 2. All Acceptance Tests shall be conducted at the facility's rated capacity, except for two days (48 hours) when testing shall be conducted at the facility's maximum capacity (as defined in Appendix 2).

The Acceptance Test Plan shall include the following information:

- Proposed Acceptance Test schedule.
- All Governmental Body monitoring requirements needed for obtaining a New Domestic Water Supply Permit.
- Procedures and operating conditions for Acceptance Testing of all facilities, equipment and systems.
- List of all parameters to be monitored and measurements to be made—including water quality, flow rates, and pressures—along with sampling/monitoring frequencies, in addition to the minimum water quality monitoring requirements set forth in Tables A7-1 through A7-6, presented in Attachment 1 to this Appendix.
- A proposed schedule for the number of pretreatment filters and membrane trains to operate at a time, as operations work toward continuous Raw Water flow necessary to produce the facility's rated capacity. Facility operation at flow rates less than the rated capacity shall not be included in the 16 days of Acceptance Testing.
- Identification of the State certified laboratory that will perform water quality analyses. The laboratory selected by the Design-Builder to analyze samples during Acceptance Testing shall be experienced in analyzing ocean water matrix samples. As discussed in Attachment 1 of this Appendix, the selected laboratory shall provide references and contact information for its experience analyzing ocean water matrix samples. The laboratory selected by the Design-Builder shall be subject to the approval of CDPH and the Owner.
- Standard methods proposed for all on-site chemical analyses and QA/QC plan for ensuring the accuracy of the measurements.
- SCADA system monitoring and control functions with a list of real-time data fields that shall be captured during Acceptance Testing.

- List of all necessary permanent and temporary monitoring and testing equipment needed to support the Acceptance Tests. The equipment shall be functioning and on-site at the start of Acceptance Testing.
- Instrument calibration procedures.
- Forms for tracking chemical consumption, power consumption, energy recovery.
- Forms for tracking individual unit process performance.
- Protocols for comparing collected data with Acceptance Standards and Requirements, defined in subsection (D) of this Section of this Appendix.
- Procedures for conducting tracer tests through the clearwell, in accordance with CDPH requirements, over the range of Owner anticipated flow rates to determine baffle factors and applicable T_{10} for calculating disinfection credit through the clearwell.
- Acceptance Test report outline.

(C) Performing Acceptance Test and Monitoring Requirements

The Design-Builder shall provide the Owner with at least 30 days prior written notice of the expected start of the Acceptance Test, in accordance with the requirements of Article 4 of the Design-Build Agreement. The Design-Builder shall be responsible for providing all personnel necessary to supervise the plant operation during Acceptance Testing and to document the testing results. The Owner will operate the Project during the Acceptance Testing. At all times during Acceptance Testing, the Finished Water shall be in compliance with all Applicable Law standards as well as the Additional Finished Water Quality Standards and Requirements listed in this Appendix and Appendix 2.

Acceptance Testing shall achieve successful operation and shall meet all Acceptance Standards and Requirements throughout the continuous 16 days, 24 hours per day, Acceptance Test period. If any equipment, subsystem or system malfunctions during the 16-day period, the item or equipment shall be repaired and the test resumed. Credit towards meeting the 16 day test will be given for the elapsed time before the malfunction, as long as the system operates without malfunction continuously for at least eight (8) days. The testing period shall be restarted at time zero, with no credit given for the elapsed time before the malfunction if either of the following occur: (1) less than eight (8) days has elapsed between the time of beginning the 16-day test period and the time of the malfunction, or (2) any subsystem or system malfunctions more than twice during the 16-day Acceptance Test period. The Finished Water produced during Acceptance Testing must be in compliance with Applicable Law water quality standards and with the Additional Finished Water Quality Standards and Requirements defined in this Appendix and Appendix 2, at all times. If the Finished Water is out of compliance with any of these water quality Acceptance Standards and Requirements, the testing period shall be restarted at time zero, with no credit given for the elapsed time of Acceptance Testing.

Acceptance Testing shall be conducted at the facility's rated capacity, except for two days (48 hours) of testing at the facility's maximum capacity. Facility operations at flows less than the rated capacity shall not be included in the 16 days of Acceptance Testing.

Acceptance Testing shall demonstrate that each facility system is able to comply with all performance Acceptance Standards and Requirements defined either in Section (D) of this Appendix or as established during design and equipment selection and described in the forms in Appendix 2 (Design and Construction Requirements) and this Appendix. Performance requirements shall include chemical consumption, electricity utilization, desalination system recovery and salt rejection over a range of temperatures, water production, waste stream flows, finished water stabilization, and final disinfection. The Design-Builder shall operate all Systems in a manner that does not require any extraordinary operational effort¹ or maintenance effort when operated at the ratings established by the equipment manufacturer or designer for the equipment throughout the entire duration of the Acceptance Test. For the RO system in particular, cartridge filter replacement or CIP operation shall not be performed during Acceptance Testing unless required for operational reasons in order to maintain conformance with manufacturer's recommendations for equipment operation.

Minimum monitoring requirements for Acceptance Testing are discussed for the following Project systems in Attachment 2 of this Appendix:

- a) Seawater Intake System
- b) Pretreatment Filtration System
- c) Reverse Osmosis / Energy Recovery / Brine Discharge System
- d) UV System
- e) Post-treatment Stabilization System
- f) Final Disinfection / Finished Water Pumping System
- g) Waste Backwash and Recycle System
- h) Chemical Storage and Delivery System

At a minimum, the monitoring plans for these systems shall include: chemical consumption, water quality throughout the Facility, all process and waste stream flows, and pressures at relevant locations throughout the treatment train. Minimum monitoring requirements are discussed in Attachment 2 of this Appendix. The Design-Builder shall be responsible for ensuring the monitoring plan and all associated tracking forms are complete for ensuring successful operation and performance of the Project throughout Acceptance Testing.

¹ Extraordinary operational effort shall be defined as: (1) operation of any equipment outside of the operating conditions envelope recommended by the equipment manufacturer, or (2) the need for any material temporary repairs or for material override of any equipment protective devices to keep equipment running during the Acceptance Test.

Minimum water quality monitoring requirements for each of the Project systems during Acceptance Testing is provided in Tables A7-1 through A7-6, in Attachment 1 to this Appendix. Allowances to be paid by the Owner for water quality analyses during Acceptance Testing is discussed in Appendix 2. The Analytical methods to be used during Acceptance Testing, for all water quality monitoring, are also defined in each of the minimum water quality monitoring requirement tables—Tables A7-1 to A7-6. Analytical methods are stipulated to ensure the Design-Builder uses methods with sufficiently low method detection limit (MDL) to ensure successful performance during Acceptance Testing. All analytical methods used during Acceptance Testing shall be CDPH approved methods. If a particular parameter does not have a method approved by CDPH, methods currently approved by the EPA or contained in the most recent edition of the *Standards Methods Online - Standard Methods for the Examination of Water and Wastewater* shall be used by the Design-Builder subject to approval by CDPH and by the Owner.

(D) Minimum Performance Standards and Requirements for Achieving Acceptance

The Design-Builder shall be responsible for completion of Acceptance Testing in accordance with the Acceptance Test Plan that was prepared by the Design-Builder and approved by the Owner. The purpose of the Acceptance Test is to demonstrate the ability of the Project to satisfy the applicable Acceptance Standards and Requirements for the entire 16-day Acceptance Test period.

This Section of Appendix 7 describes the minimum Acceptance Standards and Requirements that must be met for each Project system and the Finished Water production and Finished Water quality that must be met in order for the Design-Builder to have effectively demonstrated acceptable plant performance. The Acceptance Standards and Requirements consider the following:

General Acceptance Standards and Requirements for Achieving Acceptance:

- Water Production
- Finished Water Quality
- Electricity Utilization
- Brine Stream and Other Waste Stream Flow
- Microbial Removal/Inactivation
- Chemical Consumption
- Permit Compliance

Acceptance Standards and Requirements for Achieving Acceptance:

- Pretreatment Filtration System

- Reverse Osmosis / Energy Recovery / Brine Discharge System
- UV System
- Post-treatment Stabilization System
- Final Disinfection / Finished Water Pumping System
- Waste Backwash and Recycle System

The following are the minimum Acceptance Standards and Requirements that must be met in order for the Design-Builder to achieve Acceptance (the “Acceptance Standards and Requirements”). Failure to comply with any of the Acceptance Standards and Requirements shall result in the Design-Builder failing the Acceptance Test. The Design-Builder shall refer to Article 4 of the Agreement for failure to achieve acceptance. If Acceptance Testing is restarted because of failure to meet the Acceptance Standards and Requirements, the 16-day testing period shall be restarted at time zero, unless otherwise noted in the following subsections discussing Acceptance Standards and Requirements. The Finished Water produced during Acceptance Testing must be in compliance with all Applicable Law water quality standards and with the Additional Finished Water Quality Standards and Requirements defined in this Appendix and Appendix 2, at all times. If the Finished Water is out of compliance with any of these water quality Acceptance Standards and Requirements, the testing period shall be restarted at time zero, with no credit given for the elapsed time of Acceptance Testing.

If the duration of Acceptance Testing is extended to accommodate the Design-Builder’s failure to meet the Acceptance Standards and Requirements, the Design-Builder shall pay liquidated damages in accordance with Article 4 of the Design-Build Agreement.

(a) General Performance Standards and Requirements for Achieving Acceptance

(i) Water Production

During the Acceptance Test, the Design-Build Improvements shall operate for a period of 16 consecutive days (such period, as may be adjusted pursuant to compliance with the minimum Acceptance Standards and Requirements defined herein this subsection (D)), and produce 9.6 MGD of Finished Water when operated at the design rated capacity, and 12.8 MGD of Finished Water when operated at the design maximum capacity. Facility operation at flow rates less than the rated capacity shall subtracted from the required 16 days of Acceptance Testing. Off-Specification Water shall not be counted as acceptable Finished Water produced by the Design-Build Improvements for purposes of this subsection.

(ii) Finished water quality

All Finished Water produced by the Design-Build Improvements shall be in compliance with

Applicable Law including all enforceable primary and secondary drinking water standards established by CDPH as specified in Title 22 of the California Code of Regulations, all enforceable federal drinking water regulations (e.g., primary maximum contaminant levels (MCLs), pathogen removal and inactivation regulations, disinfection byproduct control regulations) promulgated by the EPA, and all contaminants with a drinking water notification level (NL) established by CDPH which require notification of exceedances as stipulated by State law (Health & Safety Code §116455). In addition, all Finished Water shall be in compliance with the Additional Finished Water Quality Standards and Requirements listed in Table A7-7 of this Appendix. Table A7-8 lists the raw water conditions for specified Raw Water quality parameters under which the Design-Builder shall be entitled to relief during Startup and Acceptance Testing. Maximum Raw Water quality conditions, which shall serve as the basis of design for the desalination facility, are summarized in Attachment 2 of Appendix 2.

Table A7-7. Additional Finished Water Quality Acceptance Standards and Requirements^{1, 2}

Parameter	Analytical Method	Sampling Frequency	Maximum Average Concentration ^{3, 4}	Allowed Variance from Maximum Average Concentration	Not to Exceed Concentration ⁵
General and Inorganic					
Total Dissolved Solids (mg/L)	SM 2540C	one grab per day			300
Turbidity (NTU)	EPA 180.1	Continuous	0.5 ⁶	NA	1.0
Boron (mg/L)	EPA 200.7	one grab per day	0.5	NA	0.7
Chloride (mg/L)	EPA 300.0	one grab per day	60	NA	100
Bromide (mg/L)	EPA 300.0	one grab per day	0.3	NA	0.5
Sodium (mg/L)	EPA 200.7	one grab per day	35	NA	60
Product Water Stabilization⁷					
Hardness, total ⁸ (mg/L as CaCO ₃)	SM 2340B	one grab per day	40 to 100	± 5	—
pH ⁸	EPA 150.1	Continuous	7.7 to 8.7	± 0.1	—
Alkalinity, total ⁸ (mg/L as CaCO ₃)	SM 2320B	one grab per day	40 to 100	± 5	—
Langelier Saturation Index (LSI) ⁸	SM 2330	Calculated daily	0 to 0.2	± 0.1	—

Parameter	Analytical Method	Sampling Frequency	Maximum Average Concentration ^{3,4}	Allowed Variance from Maximum Average Concentration	Not to Exceed Concentration ⁵
Calcium Carbonate Precipitation Potential (CCPP) (mg/L) ⁸	SM 2330	Calculated daily	0 to 5	± 0.5	–
Orthophosphate ⁸ (mg/L as PO ₄)	SM 4500P-E	Calculated daily	Set by Owner within the range of 1.0 to 3.5 mg/L	± 0.3	3.5
Disinfection and Disinfection Byproducts					
Total Chlorine Residual (mg/L) ⁸	Amperometric Titration (SM 4500-Cl D or SM 4500-Cl E, as appropriate)	Continuous	Set by Owner for a target of 2 mg/L, within the range of 1.5 to 2.5 mg/L	± 10%	3.5
Trihalomethanes, total (µg/L) ⁹	SM 551.1	one grab per week	40	NA	64
Haloacetic Acids, total of 5 (µg/L) ⁹	SM 6251B	one grab per week	30	NA	48
Total Nitrosamines ^{9,10} (µg/L)	SM 6450	one grab per week	5	NA	8
Bromate (µg/L)	EPA 317	one grab per week	5	NA	8

¹ The Point of Performance Measurement for all these Finished Water quality parameters is the Finished Water leaving the clearwell that is (a) in compliance with Applicable Law; (b) sufficiently downstream from the last point of chemical addition that affects the parameters being monitored so that the chemical added is uniformly mixed in the Finished Water, and (c) before the first customer as defined by Applicable Law.

² At all times during Acceptance Testing, the Finished Water shall be in compliance with all applicable laws and additional finished water quality acceptance standards and requirements. If not the water shall not be pumped into the distribution system.

³ The **average** of the measured concentrations shall be below the Maximum Average Concentration at all times. This footnote does not apply to (a) turbidity or (b) finished water total hardness, pH, alkalinity, LSI or CCPP; separate footnotes apply to these parameters.

- ⁴ Maximum Average Concentration cannot be exceeded during the applicable period, which shall be (i) daily for continuous samples and samples collected every 15 minutes; and (ii) for the duration of the Acceptance Test, for samples collected daily or weekly.
- ⁵ No measurement shall exceed this value, at any time.
- ⁶ Measured values must be less than the “maximum average” concentration 95% of the time.
- ⁷ Then Owner will set the conditions for product water stabilization to minimize corrosion in the existing distribution system.
- ⁸ Finished Water shall be within the “target range” at all times, where the target range is the target concentration set by the Owner, plus or minus the allowed variance.
- ⁹ TTHM, HAA5, and total nitrosamine concentrations shall be determined using the Simulated Distribution (SDS) test method in Standard Methods (Method 5710C). Samples of the finished water where it enters the distribution system shall be collected, with no adjustment of chlorine residual or pH, and held at the temperature of the finished water at the time of collection ($\pm 2^{\circ}\text{C}$) for a 48-hour holding time.
- ¹⁰ Total Nitrosamines includes the 6 nitrosamine compounds on the EPA’s UCMR2-List 2; NDEA, NDMA, NDBA, NDPA, NMEA and NPYR.
-

Performance relief shall be offered for Uncontrollable Circumstances, but applies only during Project Startup and Acceptance Testing. No relief shall be provided for Uncontrollable Circumstances, unless the specified Raw Water conditions persist and cause the Design-Builder a delay in meeting the Scheduled Acceptance Date. If the Design-Builder can demonstrate to the satisfaction of Owner that the duration of Uncontrollable Circumstances has caused the delay in meeting the Scheduled Acceptance Date, the Owner shall provide the Design-Builder cost relief in accordance with Article 9 of the Design-Build Agreement.

The Finished Water shall be in compliance with all Applicable Law Water Quality Standards and with all Additional Finished Water Quality Standards and Requirements stipulated in Table A7-7 at all times during Acceptance Testing, unless the Raw Water quality is out of the range of “typical” anticipated water quality for the specified parameters in Table A7-8 below.

Table A7-8. Specified Raw Water Quality Parameters

Parameter	Raw Water Condition of Relief ^{1, 5}	Definition of Relief ^{2, 3}
Boron (mg/L)	> 5.4	Performance Relief on Boron
Bromide (mg/L)	> 110	Performance Relief on Bromide
Chloride (mg/L) ⁴	> 21,000	Performance Relief on Chloride

Parameter	Raw Water Condition of Relief ^{1,5}	Definition of Relief ^{2,3}
Sodium (mg/L)	> 11,700	Performance Relief on Sodium
Iron, total (mg/L)	> 2	Production Volume Relief
Manganese, total (mg/L)	> 0.2	Production Volume Relief
Salinity (PSS) ⁵	> 37	Performance Relief
Temperature (°C)	< 8°C or > 20°C	Production Volume Relief when < 8°C Performance Relief when > 20°C
TOC (mg/L)	> 4	Production Volume Relief
Turbidity (NTU)	> 10 NTU	Production Volume Relief

¹ Condition of Relief shall be based on daily average concentrations using the analytical methods specified in Table A7-1 (Minimum Raw Water Quality Monitoring during Acceptance Testing). To claim relief, the daily average shall be based on all measurements taken during that 24-hour period, which shall be a minimum of three measurements, from samples collected a minimum of four (4) hours apart. For parameters measured on a continuous basis, the daily average shall be calculated from measurements taken at intervals of 15 minutes or less.

² Performance or production volume relief only shall be provided unless the Uncontrollable Circumstance Raw Water condition persists and causes a delay in meeting the Scheduled Acceptance Date.

³ Relief is offered from the Additional Finished Water Quality Acceptance Standards and Requirements (Table A7-7) but not from Applicable Law drinking water standards.

⁴ Based on the measurement of chlorinity using the analytical method provided in *Methods of Seawater Analysis* (Grasshoff, 1999).

⁵ The analysis of salinity and the other constituents in this table shall be performed by a State Certified Laboratory that specializes in seawater analyses, mutually agreed upon by both the Design-Builder and the Owner.

(iii) Electricity Utilization

The Electricity Utilization (EU) is the measured amount of electricity in kilowatt-hours (kW-hr) that will be used by the Project per thousand gallons (kgal) of Finished Water produced during the Acceptance Test. The EU shall be measured and calculated using the revenue grade electrical consumption meters required for the facility, or the electrical utility's billing meters, and the

volume of finished water treated and delivered to the distribution system over the 16- day period of Acceptance testing.

The measured EU during the Acceptance Test shall not exceed the Maximum Electricity Utilization (MEU) defined in Attachment 3 and Table A7-9 of this Appendix. The MEU shall be adjusted for the weighted average temperature and salinity values for the duration of the Acceptance Test, as determined in Attachment 3 of this Appendix.

The MEU in Attachment 3 of this Appendix include all the power used to operate the Project including all facilities and ancillary facilities, from downstream of the slant well pump station through the finished water pump station.

Should the measured EU exceed the MEU during the Acceptance Test, the Design-Builder shall prepare a report identifying alternatives to achieve the MEU, and shall make the necessary modifications to the facility at the Design-Builders cost to achieve the MEU. The Acceptance Test shall be terminated until the problem is rectified and the Acceptance Test restarted at time zero.

(iv) Brine Stream and Other Waste Stream Flow

As required by CDPH, spent filter backwash water decant that is recycled to the head of the plant, prior to any chemical addition, shall not exceed 10% of the Raw Water influent plant flow nor have a turbidity greater than 2.0 NTU. Including a 20% factor of safety, the recycled spent backwash water shall not exceed 8% of the Raw Water influent plant flow, on a daily basis, and the turbidity of this return water shall be less than 1.6 NTU at all times. The brine discharge flow and water quality shall comply with all permit requirements including NPDES requirements and requirements from the Owner's agreement with the Monterey Regional Pollution Control Agency. In addition, the brine discharge dissolved oxygen shall be within ten percent of the ambient ocean seawater at the ocean outfall discharge location.

(v) Microbial Removal/ Inactivation

As discussed in Appendix 2 (Design and Construction Requirements), two disinfection cases are considered for the Project design because the slant wells are not in place for source water microbial monitoring. The first case assumes the source water is placed in Bin 2 of the long-term 2 enhanced surface water treatment rule (LT2ESWTR) and the highest level of *Giardia* and virus reduction is required. This first case requires UV disinfection facilities. The second case assumes the source water is classified as being in Bin 1 of the LT2ESWTR, and *Giardia* and virus reduction is the same as required by the surface water treatment rule (SWTR). The second case will not require UV disinfection facilities.

The Design-Builder shall design and construct the Project Facility to meet the Acceptance

Standards and Requirement for microbial removal and inactivation as defined in Table A7-10a or Table A7-10b below, to ensure compliance with CDPH and Federal regulations pathogen removal and inactivation (i.e., SWTR, IESWTR, LT2ESWTR). Sampling and monitoring requirements included in the Acceptance Monitoring Plan shall have been designed to demonstrate compliance with the microbial reduction requirements shown in Table A7-10.

Table A7-10a. Treatment Guarantee of Minimum Log Reduction for *Cryptosporidium*, *Giardia*, and viruses (Case 1, LT2ESWTR Bin 2)

Treatment System	Log Reduction Requirement		
	<i>Cryptosporidium</i>	<i>Giardia</i>	Viruses
RO Membranes ¹	2	2	2
UV Disinfection	2	2	
Chlorine Final Disinfection		1	4
TOTAL	4	5	6

¹ Determined by achieving 2-log reduction of TDS, as measured by specific conductance, through the RO Membrane System and as determined by CDPH.

Table A7-10b. Treatment Guarantee of Minimum Log Reduction for *Cryptosporidium*, *Giardia*, and viruses (Case 2, LT2ESWTR Bin 1)

Treatment System	Log Reduction Requirement		
	<i>Cryptosporidium</i>	<i>Giardia</i>	Viruses
RO Membranes ¹	2	2	2
Chlorine Final Disinfection		1	4
TOTAL	2	3	6

¹ Determined by achieving 2-log reduction of TDS, as measured by specific conductance, through the RO Membrane System and as determined by CDPH.

(vi) Permit Compliance

The Plant shall comply with all Project Permit requirements and all other Applicable Law during Acceptance Testing.

(b) Acceptance Standards and Requirements for Achieving Acceptance of Project systems

(i) Pretreatment Filtration System

The Acceptance Standards and Requirements for the Pretreatment Filtration System are provided in Table A7-11, below. Failure to meet these pretreatment Acceptance Standards and Requirements at any time shall constitute an Acceptance Test failure and the Acceptance Test will be stopped until the condition is remedied. Once the condition is rectified, the Acceptance Test shall be restarted at time zero.

Table A7-11. Acceptance Standards and Requirements for the Pretreatment Filtration System

Parameter	Performance Standards and Requirements
Media Pressure Filter	
Backwash cycle	≤ 2 backwashes per day per filter
Total backwash volume	≤ 200 gpm/ft ² /wash
Filtered water turbidity (NTU)	≤ 0.15 NTU for 95% of the time; Not to exceed 1.0 NTU at any time.
Filter effluent Iron, total (mg/L)	≤ 0.02 mg/L average; Not to exceed 0.04 mg/L at any time
Filter effluent Manganese, total (mg/L)	≤ 0.01 mg/L average; Not to exceed 0.02 mg/L at any time
Cartridge Filter	
Filter effluent SDI (15)	≤ 2 for 95 % of the time and < 4 at all times (unless more stringent requirements apply based on SWRO membrane supplier warranty)
Differential pressure across cartridge filters (other than cartridge filters having a mechanical defect) during the Acceptance Test above and beyond the initial pressure drop across any of the cartridge filter vessels used at the end of the Acceptance Test	Demonstrate that: (i) the Plant has operated without replacement of any cartridge filters (other than cartridge filters having a workmanship or materials defect), and (ii) without exceeding a 15 psi differential pressure increase over the initial startup (“clean”) differential pressure across any of the cartridge filter vessels used at the end of the Acceptance Test.
Number of cartridges replaced per vessel	None

Parameter	Performance Standards and Requirements
(for each vessel in operation at any time, other than cartridge filters having a mechanical defect)	

(ii) Reverse Osmosis / Energy Recovery / Brine Discharge System

The Design-Builder shall demonstrate compliance with the Performance Acceptance Standards and Requirements for the Reverse Osmosis System by performing all monitoring required by the Acceptance Test Plan and meeting the performance Acceptance Standards and Requirements provided in Table A7-12, A7-13, and A7-14 at all times during Acceptance Testing. Failure to meet these performance Acceptance Standards and Requirements at any time shall constitute an Acceptance Test failure and the Acceptance Test will be stopped until the condition is remedied. Once the condition is rectified, the Acceptance Test shall be restarted at time zero.

Table A7-12. Minimum Performance Acceptance Standards and Requirements for the RO Membrane System

Parameter	Performance Standard and Requirement
Reverse osmosis membrane replacement	None (other than membranes having a workmanship or materials defect).
Reverse osmosis membrane end cap, connector, seal, spacer or blank replacement	None (other than those having a workmanship or materials defect).
Differential pressure across the RO membrane elements	Demonstrate that the membrane trains do not exceed a five percent increase over the software design differential pressure across any of the RO system trains.
Normalized permeate flow	Demonstrate that the membrane trains do not lose more than five percent of the software design normalized permeate flow.
Normalized salt passage	Demonstrate that the membrane trains do not gain more than five percent of the software design normalized salt passage
RO membrane cleaning	None

The concentrations of boron, chloride, bromide and sodium will be sampled from the combined permeate during the Acceptance Test to determine if the Project is in compliance with the Project's RO System Performance Acceptance Standards and Requirements.

The Design-Builder shall first demonstrate that the proposed overall system is operating under conditions that meet all the requirements of the Design-Build Agreement and produces a combined RO permeate that is in compliance with the Project's treated water performance Acceptance Standards and Requirements. Said compliance shall be demonstrated using the membrane manufacturer's publically available model.

As described below, the Design-Builder shall then use the same model to describe the expected performance of new membranes during Acceptance Testing. Performance during the Acceptance Test shall be based on achieving average performance equal to or better than model predictions.

Step One: Use Membrane Manufacturer's Model to Demonstrate Performance of the Overall System Design.

The Design-Builder shall use the membrane manufacturer's publically available membrane computer model to assess future salt rejection in the Design-Builder's overall system design, that is, to demonstrate the system's ability to meet the water quality Acceptance Standards and Requirements for the RO system. The Raw Water conditions to be used as the basis for design are provided in Appendix 2, Attachment 2. The design proposed by the Design-Builder shall meet the performance Acceptance Standards and Requirements shown in Table A7-13, Appendix 7 and Appendix 2.

Table A7-13. Combined RO Permeate Water Quality Performance Standards and Requirements

Parameter	Combined RO Permeate Concentrations, mg/L	
	Maximum Average ¹	Not-to-Exceed ²
Boron (mg/L)	0.5	0.7
Chloride (mg/L)	60	100
Bromide (mg/L)	0.3	0.5
Sodium (mg/L)	35	60

¹ The **average** of the measured concentrations shall be below the Maximum Average Concentration at all times.

² No measurement shall exceed this value, at any time.

The model, which shall be made available for the Owner to use during proposal evaluation and Acceptance Testing, shall demonstrate compliance under both of the following conditions:

For Compliance with the RO Combined Permeate Maximum Average Concentrations:

- 1- Average water quality conditions shown in Appendix 2, Attachment 2
- 2- Average age of SWRO membranes in the model at 5 years
- 3- Average age of BWRO membranes in the model at 5 years
- 4- Average temperature in Appendix 2, Attachment 2

For Compliance with the RO Combined Permeate Not-to-Exceed Concentrations:

- 1- Maximum water quality conditions shown in Appendix 2
- 2- Average age of SWRO membranes in the model at 5 years
- 3- Average age of BWRO membranes in the model at 5 years
- 4- Design maximum temperature shown in Appendix 2

All modeling shall assume an annual salt passage increase of 7% and an annual fouling factor of 5%.

On Proposal Form 18 of the RFP, the Design-Builder provided copies of separate runs of the same model demonstrating Compliance with both the Maximum Average Concentrations and the Not-to –Exceed Concentrations in Table A7-13.

Step Two: Generation of Table to be Used During Acceptance Test

During the Acceptance Test, when combined RO permeate samples shall be taken, all RO trains must each produce their design permeate flowrate, at their design recovery (as defined in Appendix 2). This statement applies to each train of the first pass and each train of the second pass.

During the Acceptance Test, the RO system performance shall be evaluated with respect to compliance with the standards for salt rejection as a function of temperature, set forth in Table A7-14. The Design-Builder shall include data necessary to substantiate such performance, including but not limited to, results from the manufacturer’s model for the overall system design at years zero (0) and five (5) years as well as existing plant performance data demonstrating that similar concentrations or rejections have been achieved

The Design-Builder shall fill in Table A7-14 below (using Proposal Form 19) assuming the RO System is treating the average Raw Water quality specified in Appendix 2, Attachment 2. The model shall be run at the design parameters (e.g., flowrates, flux, recovery, etc.) specified by the Design-Builder in Appendix 2. The model shall assume a yearly salt passage increase of 7% per year and a fouling factor of 10% per year. The purpose of Table A7-14 is to provide information on how the system will operate across the entire temperature range with (a) new membranes (comparable to Acceptance Test conditions) and with (b) older membranes (comparable to Design conditions).

Table A7-14 Maximum of Average Combined Permeate Concentrations⁽¹⁾

Membrane Age	Year 0 (Maximum Average Concentration for Acceptance Test)		Year 5 (Maximum Average Concentration for Compliance with Table A7-13)	
Temperature (°C)	Boron (mg/L)	Chloride (mg/L)	Boron (mg/L)	Chloride (mg/L)
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				

⁽¹⁾ RO Model shall assume the average Raw Water quality condition for all parameters other than temperature, as shown in Appendix 2, Attachment 2.

During the Acceptance Test, the boron and chloride concentrations in the combined permeate shall not exceed the concentrations set forth in Table A7-14 for the actual average temperature of Acceptance Test conditions for year 0. The Design-Builder shall confirm that the estimated future (for year 5) concentrations for boron and chloride will meet the combined permeate

performance Acceptance Standards and Requirements stipulated in Table A7-13 as well as the RO system performance warranty provided.

In the event that the average boron and chloride concentrations in the feedwater during the Acceptance Test is not within 5% of the average Raw Water boron and chloride concentrations used in the preparation Table A7-14, the RO system model will be rerun for year zero (0) using the actual average boron and chloride concentrations in the feedwater during the Acceptance Test and the revised model output concentrations will be used as maximum average boron and chloride concentrations, which may not be exceeded during the Acceptance Test.

(iii) UV System

Monitoring of the UV disinfection system during Acceptance Testing shall confirm that the UV system is capable of continuously delivering, without interruption, a UV dose sufficient to meet CDPH requirements for 4-log inactivation of *Cryptosporidium*, shown in Table A7-10a. Monitoring during Acceptance Testing shall also confirm that the UV lamps continuously achieve > 95% UV transmittance. Failure to meet these performance Acceptance Standards and Requirements at any time shall constitute an Acceptance Test failure and the Acceptance Test will be stopped until the condition is remedied. Once the condition is rectified, the Acceptance Test shall be restarted at time zero.

(iv) Post-Treatment Stabilization System

During Acceptance Testing of the RO product water post-treatment stabilization system, effective operation under the following three conditions must be demonstrated:

Condition 1: Calcium carbonate saturation with low hardness and alkalinity

Condition 2: Calcium carbonate saturation with moderate hardness and alkalinity

Condition 3: Orthophosphate treatment with low hardness and alkalinity

The specific sampling requirements and Acceptance Standards and Requirements for each of the three operating conditions listed above are shown in Table A7-15. Each of the three operating conditions must be continuously held within the requirements of Table A7-15 for a period of 72 hours during the Acceptance Test. If these requirements are not continuously met for a particular operating condition during the 72-hour test, the entire test for that operating condition must be repeated, with no Acceptance Test credit given for the 72-hour test conditions producing Off-Specification Water. If Unacceptable Water is produced at any time during Acceptance Testing of the Post-Treatment Stabilization System, the entire 16-day Acceptance Test shall be restarted at time zero.

After demonstrating effective performance of each of the three post-treatment stabilization conditions, the Owner shall set the post-treatment stabilization conditions for the remainder of the Acceptance Test.

Table A7-15. Sampling and Performance Acceptance Standards and Requirements for the RO Product Water Post-Treatment Stabilization System

Parameter ¹	Units	Condition 1	Condition 2	Condition 3	Sampling Frequency ²	Allowable Error ³
Calcium Hardness	mg/L as CaCO ₃	40	100	40	(4)	±5
Alkalinity	mg/L as CaCO ₃	40	100	40	(4)	±5
pH	pH units	8.7	7.9	8.0	(5)	±0.1
LSI	pH units	0.1	0.1	-	(6)	±0.1
Turbidity	NTU	≤ 0.5 95% of time ≤ 1.0 100% of time			(5)	-
Orthophosphate	mg/L as PO ₄	-	-	1 to 3.5	(4)	±0.3

1-All parameters to be measured at a point after all chemicals have been added and thoroughly blended and a stable pH has been reached

2-Sampling frequency during post treatment Acceptance testing

3-Allowable error in the average of measurements at the end of each day

4-Every 3 hours

5-Continuously monitored; values at 15-min intervals used for calculation of daily average

6-Daily calculation using average values

(v) Final Disinfection / Finished Water Pumping System

The Design-Builder shall demonstrate compliance with the Acceptance Standards and Requirements for the final disinfection and Finished Water pumping system by performing all monitoring required by the Acceptance Test Plan and meeting the Acceptance Standards and Requirements provided in Table A7-16 at all times during Acceptance Testing. Failure to meet these Acceptance Standards and Requirements at any time shall constitute an Acceptance Test failure and the Acceptance Test will be stopped until the condition is remedied. Once the condition is rectified, the Acceptance Test shall be restarted at time zero.

At all times during Acceptance Testing, the Finished Water shall be in compliance with all Applicable Law and Additional Finished Water Quality Acceptance Standards and Requirements. As discussed in Subsection (D)(a)(ii) of this Section, production of Unacceptable Water or Off-Specification Water shall constitute failure of the Acceptance Test. Neither Unacceptable Water nor Off-Specification Water shall be pumped into the distribution system, but shall be disposed of in accordance with the Acceptance Test Plan and Applicable Law.

Table A7-16. Performance Acceptance Standards and Requirements for the Final Disinfection / Finished Water Pumping System

Parameter	Performance Standard and Requirement
Finished Water residual chlorine concentration.	Maintain the Finished Water chlorine residual specified by the Owner \pm 10%.
Finished Water pH	Maintain the Finished Water pH specified by the Owner \pm 0.1 pH units.
Log inactivation of Giardia and viruses	CT inactivation credit to continuously provide > 1-log Giardia inactivation and > 3-log virus inactivation. Compliance shall be based on the daily minimum CT achieved (calculated in 15 minute intervals).
Water delivery to the Finished Water storage tank or distribution system tie-in.	Finished Water pumps shall provide a minimum capacity of 9.6 MGD to the Distribution System tie-in or storage tank, with one pump out of service.

(vi) Waste Backwash and Recycle System

The Design-Builder shall demonstrate compliance with the following performance Acceptance Standards and Requirements for the waste backwash and recycle system at all times during Acceptance Testing:

- Recycled spent backwash water shall not exceed 8% of the Raw Water influent plant flow.
- Turbidity of recycled spent backwash water shall be less than 1.6 NTU at all times.

Failure to meet these performance Acceptance Standards and Requirements at any time shall constitute an Acceptance Test failure and the Acceptance Test will be stopped until the condition is remedied. Once the condition is rectified, the Acceptance Test shall be restarted at time zero.

(vii) Chemical Storage and Delivery System

The Design-Builder shall confirm that all chemical feed systems are able to feed the required chemical dose continuously, consistently and at all applicable locations, for the entire duration of Acceptance Testing. All chemical feed systems shall be operated within the equipment manufacturer's recommended operating envelope. The metered chemical dose shall always be within 2% of the desired dose.

Failure to meet these performance Acceptance Standards and Requirements at any time shall constitute an Acceptance Test failure and the Acceptance Test will be stopped until the condition is remedied. Once the condition is rectified, the Acceptance Test shall be restarted at time zero.

(E) Surge Protection System

In order to assess performance and acceptability of the Surge Protection System, the Design-Builder shall (1) propose a plan to test the Surge Protection System, (2) prepare a hydraulic transient analysis by modeling the Surge Protection System, and (3) test the System to evaluate surge protection performance and compare actual performance with the computer-modeled performance. The Surge Protection System shall be tested on the last day of the Acceptance Test. The Surge Protection System Test Plan and hydraulic transient analysis shall be submitted to the Owner for review and acceptance at least forty-five (45) days prior to the proposed test date. Prior to testing, the Design-Builder shall have obtained the Owner's approval of the Surge Protection System Test Plan.

(a) Surge Protection System Test

On the last day of the Acceptance Test, the Design-Builder shall perform a full flow power failure test of the surge protection system. The surge protection system test shall demonstrate whether the surge protection system is able to limit the resulting transient pressures in a manner consistent with the design conditions that will be established in the final hydraulic transient analysis prepared by the Design-Builder.

(b) Surge Protection System Test Report

Following testing, the Design-Builder shall prepare a surge protection system test report that (i) compares the actual values of the pressure recorded during the surge protection system test to the values established in the hydraulic transient analysis prepared by the Design-Builder; (ii) discusses whether each piece of equipment functioned in a manner that is consistent with the final hydraulic transient analysis; and (iii) if the facility failed to meet the requirements of the surge protection system test, the repairs and modifications that need to be made. The surge

protection system test report shall be signed and sealed by an Engineer licensed in California, and certified as true, complete and correct by an officer of the Design-Builder.

(c) Retesting the Surge Protection System

Within five Business Days of receiving the surge protection system test report, the Owner will deliver to the Design-Builder written notice setting forth the repairs and modifications that: (i) because of their material effect on the safe operation of the Project and associated pipelines, need to be completed prior to Acceptance (such repairs and modifications include, but are not limited to, any damage that presents a safety concern; visible damage to concrete structures, pipe anchors, pipe supports; pipeline and pipeline appurtenance leaks; any damage to surge suppression system components; damage to valves, valve actuators, and meters required to control or measure Finished Water deliveries or isolate the Finished Water pipeline; and damage to any field instruments that allow local automated control of the pump station, flow meter, and surge suppression system); and (ii) may be completed after Acceptance but prior to Final Completion. If the Owner's notice sets forth repairs or modifications which need to be made before Acceptance, the Design-Builder shall repeat the surge protection system test and comply with the requirements of the surge protection system test plan. The Design-Builder shall have no obligation to repeat the surge protection system test for modifications or repairs that the Owner's notice states may be completed after Acceptance but prior to Final Completion.

(d) Failure to Meet Surge Protection System Test

If any Project equipment, systems, pipelines, and/or ancillary facilities are damaged as a result of a failure by the Design-Build Improvements to meet the transient pressure requirements of the surge protection system test, the Design-Builder shall be responsible for paying for and making any necessary repairs to the Design-Build Improvements that were damaged as a result of the failure of the Design-Build Improvements to meet the transient pressure requirements of the surge protection system test.

(F) Acceptance Test Report

Upon completion of Acceptance Testing, the Design-Builder shall prepare the Acceptance Test Report, in accordance with the Acceptance Test Plan. The Acceptance Test Report shall include, but not be limited to, the following minimum requirements:

- All data obtained during the Acceptance Test.
- A chart comparing the actual values to the minimum performance Acceptance Standards and Requirements, and explanations for any failure to achieve such minimum Acceptance Standards and Requirements. The level of detail of such information shall be sufficient so that all performance metrics cited in the Acceptance Test Report can be independently calculated and verified.

- All data deemed to be outliers along with an explanation of why such data were judged to be outliers.
- All water quality laboratory reports prepared by or for the Design-Builder.
- An organized comparison of all SCADA data, laboratory analytical data, and Project local instrumentation readings and field measurements that is sufficiently detailed to show how the data were verified for accuracy and precision.
- Signed operator's daily logs.
- Normalized plots showing RO system performance for permeability, salt passage, differential pressure, permeate backpressure.
- Electronic form (MS Excel) of operating data for slant well pump station, pretreatment system, RO systems (including all associated pumps and ERDs), post-treatment stabilization system, solids handling, and Finished Water pumping system.
- All instrumentation and control settings (including PID loop control parameters) and any measurements, checks and settings that may be required by operating and maintenance personnel.
- Report of all spare parts used.
- Report of all equipment malfunctions and repairs.
- All calculations used or prepared by the Design-Builder shall be sufficiently documented so that they can be independently verified.
- The total Facility power consumption used to operate the Project including all facilities and ancillary facilities from the downstream of the slant well pump station through the Finished Water pump station.
- Applicable data, as agreed upon in the Acceptance Test Plan, in tabular form for the following systems:
 - (i) Seawater Intake System
 - (ii) Pretreatment System
 - (iii) Reverse Osmosis / Energy Recovery / Brine Discharge System
 - (iv) Post-Treatment Stabilization System
 - (v) Final Disinfection and Finished Water Pumping System
 - (vi) Waste Backwash and Recycle System.
- Whether or not and how often the Acceptance Test was aborted. If it was aborted, what were the causes and resolutions.
- Whether or not any portion of the Design-Build Improvements was shutdown during Acceptance Testing. If there were shutdowns, what were the causes and resolutions.

The Acceptance Test Report shall be signed and sealed by an Engineer licensed in California and certified as true, complete and correct by an officer of the Design-Builder.

APPENDIX 7 – ATTACHMENT 1

MINIMUM WATER QUALITY MONITORING REQUIREMENTS DURING ACCEPTANCE TESTING

Minimum water quality monitoring requirements for Acceptance Testing, for each of the Project systems, is indicated in Tables A7-1 through A7-6 of this Attachment to Appendix 7 (Acceptance Test Procedures and Standards). During Acceptance Testing, the Design-Builder, at its own discretion, may sample at more locations or more frequently than set forth in these tables. The analytical results of all valid samples obtained by or on behalf of the Owner during the Acceptance Test shall be reported in the Acceptance Test Report.

The saline water matrices associated with ocean water desalination introduce challenges with respect to method detection limits and reporting limits. Analytical methods used during Acceptance Testing must provide detection limits and reporting limits that will provide meaningful results for assessing reverse osmosis system performance and compliance with all Acceptance Standards and Requirements discussed in this Appendix.

The laboratory selected by the Design-Builder to analyze samples during Acceptance Testing shall be experienced in analyzing ocean water matrix samples. The laboratory shall provide the Design-Builder and the Owner with references and contact information for a minimum of two clients for whom the Laboratory has analyzed ocean water matrix samples. The laboratory selected by the Design-Builder shall be subject to approval of CDPH and the Owner.

Analytical methods that shall be used during Acceptance Testing are provided in each of the minimum monitoring requirement tables included in this Attachment. The methods appropriate for the analysis of saline water, including raw water, RO feed water, and brine stream, are contained in the text entitled *Methods of Seawater Analysis* (Grasshoff, et al., 1999). For the analysis of low saline water, including first pass SWRO permeate, second pass BWRO permeate, combined RO permeate, and Finished Water, the methods shall be either EPA Methods for drinking water or methods contained in the most recent edition of *Standard Methods Online - Standard Methods for the Examination of Water and Wastewater*. The methods are defined in the minimum monitoring requirement tables below to ensure sufficiently low method detection limits (MDLs) for demonstrating successful treatment performance during Acceptance Testing. The Design-Builder may propose alternate analytical methods if deemed necessary, but shall be subject to CDPH and Owner approval. Nonetheless, all analytical methods used during acceptance testing shall be CDPH approved methods; appropriate for use on either saline water

or non-saline water matrix where appropriate; and, where possible, shall have MDLs below CDPH's detection limits for the purpose of reporting (DLRs).

During the Acceptance Test, the Design-Builder shall allow Owner representatives to witness sampling activities and provide split samples to the Owner, if requested. The Owner shall: (1) make such representatives available in a manner that accommodates the Design-Builder's schedule for its sampling activities; (2) not unduly delay the Design-Builder's sampling activities; and (3) make prior arrangements and coordinate such sampling activities with the Design-Builder to assure the requested split samples can be reasonably obtained without an appreciable increase in effort or cost.

Table A7-1. Minimum Raw Water Quality Monitoring during Acceptance Testing ¹

Parameter	Analytical Method	Minimum Collection Frequency ³	Units
Total Dissolved Solids (TDS)	SM 2540C	one grab per day	mg/L
Specific Conductance	SM 2510B	Continuous ^{4,5}	μS/cm
Alkalinity, total	Grasshoff, 1999 – Chapter 8	one grab per day	mg/L as CaCO ₃
Ammonia	Grasshoff, 1999 – Chapter 10 (10.2.10)	three grabs per week	mg/L as N
Barium	EPA 200.8	three grabs per week	mg/L
Boron	Grasshoff, 1999 – Chapter 11 (11.2.7)	one grab per day	mg/L
Bromide	Grasshoff, 1999 – Chapter 11 (11.2.6)	three grabs per week	mg/L
Calcium	Grasshoff, 1999 – Chapter 11 (11.2.1)	one grab per day	mg/L
Chloride	EPA 300.0	one grab per day	mg/L
Chlorinity	Grasshoff, 1999 – Chapter 11	three grabs per week	g/kg and mg/L (based on

	(11.2.4)		seawater density)
Color	SM2120B	three grabs per week	color units
Dissolved Organic Carbon (DOC) ³	TBD	three grabs per week	mg/L
Dissolved Oxygen (DO)	SM 4500-O G	three grabs per week	mg/L
<i>E. coli</i>	SM 9221 F	three grabs per week	MPN/100 mL
Hardness, total	SM 2340B	one grab per day	mg/L as CaCO ₃
Iron, dissolved	Grasshoff, 1999 – Chapter 12 (12.2.1)	three grabs per week	mg/L
Iron, total	Grasshoff, 1999 – Chapter 12 (12.2.1)	three grabs per week	mg/L
Magnesium	Grasshoff, 1999 – Chapter 11 (11.2.2)	one grab per day	mg/L
Manganese, dissolved	Grasshoff, 1999 – Chapter 12 (12.2.2)	three grabs per week	mg/L
Manganese, total	Grasshoff, 1999 – Chapter 12 (12.2.2)	three grabs per week	mg/L
Nitrate	Grasshoff, 1999 – Chapter 10 (10.2.9)	three grabs per week	mg/L as N
pH	Grasshoff, 1999 – Chapter 7	Continuous ^{4,5}	pH units
Potassium	Grasshoff, 1999 – Chapter 11 (11.2.3)	three grabs per week	mg/L
Salinity	SM 2520	three grabs per week	PSS

Silica	EPA 200.8	three grabs per week	mg/L
Sodium	EPA 200.7	one grab per day	mg/L
Strontium	EPA 200.8	three grabs per week	mg/L
Sulfate	Grasshoff, 1999 – Chapter 11 (11.2.5)	three grabs per week	mg/L
Temperature	SM 2550	Continuous ^{4,5}	°C
Total Coliform	SM 9221B	three grabs per week	MPN/100 mL
Total Organic Carbon (TOC) ⁶	TBD	three grabs per week	mg/L
Total Suspended Solids (TSS)	SM 2540D	three grabs per week	mg/L
Turbidity	EPA 180.1	Continuous ^{4,5}	NTU
UV-254, filtered	SM 5910	one grab per day	cm ⁻¹
Other Constituents Pursuant to Facility NPDES Permit ⁷	As needed to comply with all Applicable Law and Governmental Approvals	As needed to comply with all Applicable Law and Governmental Approvals	
California Title 22 or other CDPH Raw Water monitoring requirements pursuant to Facility Drinking Water Permit ⁷	As needed to comply with all Applicable Law and Governmental Approvals	As needed to comply with all Applicable Law and Governmental Approvals	

¹ All Raw Water samples shall be collected at the facility influent, after the feedwater equalization tanks but prior to any chemical addition and prior to the pretreatment filtration system, unless indicated otherwise in this Table, by footnote.

³ Sample collection frequency shall be evenly spaced, as reasonable. Constituents sampled daily should have samples collected close to the same time each day. Constituents sampled multiple times during the week, but not daily, should have samples collected at approximate even intervals throughout the week.

⁴ For continuous monitoring, data storage and trending values shall be taken at intervals of 15 minutes or less.

⁵ Automatic analyzers for pH, turbidity and ORP, total chlorine residual shall have grab samples analyzed three times per day (evenly spaced through the day) for instrument confirmation.

⁶ Samples should be collected daily during algal bloom conditions.

⁷ Raw Water samples shall be collected at the facility influent unless an alternate or additional location(s) is required by Governmental Bodies.

Table A7-2. Minimum Water Quality Monitoring for the Pretreatment Filtration System during Acceptance Testing

Parameter	Analytical Method	Sampling Location	Minimum Collection Frequency ¹	Units
Pressure Filters				
Turbidity	SM 2130B or EPA 180.1	Individual Filter Effluent (IFE) and Combined Filter Effluent (CFE)	Continuous ²	NTU
Total Coliform	SM 9221B	CFE	three grabs per week	MPN/100 mL
<i>E. coli</i>	SM 9221 F	CFE	three grabs per week	MPN/100 mL
Color	SM2120B	CFE	three grabs per week	Color units
SDI	TBD	CFE ⁴	one grab per day	min ⁻¹
pH	Grasshoff, 1999 – Chapter 7	CFE, upstream of sulfuric acid feed	Continuous ^{2,3}	pH units
Iron, total	Grasshoff, 1999 – Chapter 12 (12.2.1)	CFE	three grabs per week	mg/L
Manganese, total	Grasshoff, 1999 – Chapter 12 (12.2.2)	CFE	three grabs per week	mg/L
Total Chlorine Residual	Amperometric Titration (SM 4500-Cl D or SM 4500-Cl E, as appropriate)	CFE, upstream of bisulfite feed	Continuous ^{2,3}	mg/L as Cl ₂
Total Organic Carbon (TOC)	TBD	CFE, upstream of bisulfite and sulfuric acid feed	three grabs per week	mg/L

Parameter	Analytical Method	Sampling Location	Minimum Collection Frequency ¹	Units
Dissolved Organic Carbon (DOC)	TBD	CFE, upstream of bisulfite and sulfuric acid feed	three grabs per week	mg/L
Oxidation-Reduction Potential (ORP)	SM 2580	CFE, downstream of bisulfite feed and complete mixing	Continuous ^{2,3}	millivolts
Cartridge Filters				
Turbidity	SM 2130B or EPA 180.1	Cartridge filter effluent, upstream of high pressure RO pumps and ERD	Continuous	NTU
Total Chlorine Residual	Amperometric Titration (SM 4500-Cl D or SM 4500-Cl E, as appropriate)	Cartridge filter effluent, upstream of high pressure RO pumps and ERD	Continuous ^{2,3}	mg/L as Cl ₂
SDI	TBD	Cartridge filter effluent ⁴	Every four hours	min ⁻¹
Total Coliform	SM 9221B	Cartridge filter effluent, upstream of high pressure RO pumps and ERD	three grabs per week	MPN/100 mL
<i>E. coli</i>	SM 9221 F	Cartridge filter effluent, upstream of high pressure RO pumps and ERD	three grabs per week	MPN/100 mL

¹ Sample collection frequency shall be evenly spaced, as reasonable. Constituents sampled daily should have samples collected close to the same time each day. Constituents sampled multiple times during the week, but not daily, should have samples collected at approximate even intervals throughout the week.

- ² For continuous monitoring, data storage and trending values shall be taken at intervals of 15 minutes or less.
- ³ Automatic analyzers for pH, Turbidity and ORP, total chlorine residual shall have grab samples analyzed three times per day (evenly spaced through the day) for instrument confirmation.
- ⁴ Downstream of each cartridge filter bank, feeding either the high pressure RO pumps or and ERD.
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Table A7-3. Minimum Water Quality Monitoring for the Reverse Osmosis System during Acceptance Testing

Parameter	Analytical Method	Minimum Collection Frequency	Units
Sampling Location = First Pass RO Feedwater			
Alkalinity, total	Grasshoff, 1999 – Chapter 8	one grab per day	mg/L as CaCO ₃
Boron	Grasshoff, 1999 – Chapter 11 (11.2.7)	one grab per day	mg/L
Bromide	Grasshoff, 1999 – Chapter 11 (11.2.6)	one grab per day	mg/L
Chloride	EPA 300.0	one grab per day	mg/L
Chlorinity	Grasshoff, 1999 – Chapter 11 (11.2.4)	three grabs per week	g/kg and mg/L (based on seawater density)
pH	Grasshoff, 1999 – Chapter 7	Continuous	pH units
Sodium	EPA 200.7	one grab per day	mg/L
Specific Conductance	SM 2510B	Continuous	μS/cm
Temperature	SM 2550	Continuous	°C
Total Dissolved Solids (TDS)	SM 2540C	one grab per day	mg/L
Turbidity	EPA 180.1	Continuous	NTU
Other Constituents ^x	TBD	TBD	
Sampling Location = First Pass RO Permeate (prior to second pass chemical addition)			
Alkalinity, total	SM 2320B	one grab per day	mg/L as CaCO ₃
Boron	EPA 200.7	one grab per day	mg/L
Bromide	EPA 300.0	one grab per day	mg/L
Calcium	EPA 200.7	one grab per day	mg/L
Chloride	EPA 300.0	one grab per day	mg/L
Magnesium	EPA 200.7	one grab per day	mg/L
pH	EPA 150.1	Continuous	pH units

Parameter	Analytical Method	Minimum Collection Frequency	Units
Sodium	EPA 200.7	one grab per day	mg/L
Specific Conductance	SM 2510B	Continuous	μS/cm
Temperature	SM 2550	Continuous	°C
Turbidity	EPA 180.1	Continuous	NTU
Other Constituents ^x	TBD	TBD	
Sampling Location = Second Pass RO Feedwater (after second pass chemical addition)			
pH	EPA 150.1	Continuous	pH units
Specific Conductance	SM 2510B	Continuous	μS/cm
Temperature	SM 2550	Continuous	°C
Other Constituents ¹	TBD	TBD	
Sampling Location = Second Pass RO Permeate			
Alkalinity, Total	SM 2320B	one grab per day	mg/L as CaCO ₃
Boron	EPA 200.7	one grab per day	mg/L
Bromide	EPA 300.0	one grab per day	mg/L
Calcium	EPA 200.7	one grab per day	mg/L
Chloride	EPA 300.0	one grab per day	mg/L
Magnesium	EPA 200.7	one grab per day	mg/L
pH	EPA 150.1	Continuous	pH units
Sodium	EPA 200.7	one grab per day	mg/L
Specific Conductance	SM 2510B	Continuous	μS/cm
Temperature	SM 2550	Continuous	°C
Turbidity	EPA 180.1	Continuous	NTU
Other Constituents ¹	TBD	TBD	
Sampling Location - Combined RO Permeate			
Alkalinity, total	SM 2320B	one grab per day	mg/L as CaCO ₃
Boron	EPA 200.7	one grab per day	mg/L
Bromide	EPA 300.0	one grab per day	mg/L
Calcium	EPA 200.7	one grab per day	mg/L
Chloride	EPA 300.0	one grab per day	mg/L

Parameter	Analytical Method	Minimum Collection Frequency	Units
Magnesium	EPA 200.7	one grab per day	mg/L
pH	EPA 150.1	Continuous	pH units
Sodium	EPA 200.7	one grab per day	mg/L
Specific Conductance	SM 2510B	Continuous	μS/cm
Temperature	SM 2550	Continuous	°C
Total Dissolved Solids (TDS)	SM 2540C	one grab per day	mg/L
Total Hardness	SM 2340B	one grab per day	mg/L as CaCO ₃
Total Organic Carbon (TOC)	SM 5310C	one grab per day	mg/L
Sampling Location - Combined RO Concentrate			
Total Dissolved Solids	SM 2540C	one grab per day	mg/L
Chloride	EPA 300.0	one grab per day	mg/L
Chlorinity	Grasshoff, 1999 – Chapter 11 (11.2.4)	three grabs per week	g/kg
Bromide	Grasshoff, 1999 – Chapter 11 (11.2.6)	three grabs per week	mg/L
Boron	Grasshoff, 1999 – Chapter 11 (11.2.7)	three grabs per week	mg/L
Dissolved Oxygen	SM 4500-O G	one grab per day	mg/L
Salinity	SM 2520	one grab per day	PSS
Specific Conductance	SM 2510B	Continuous	μS/cm
Turbidity	EPA 180.1	Continuous	NTU
Other Constituents Pursuant to Facility NPDES Permit and the Brine Discharge permit	TBD	As needed to comply with all Applicable Law and Governmental Approvals	

¹ Per requirements of Membrane Manufacturer's Warranty Conditions.

Table A7-4. Minimum Water Quality Monitoring for the Post-Treatment Stabilization System during Acceptance Testing

Parameter	Analytical Method	Sampling Location ¹	Minimum Collection Frequency	Units
pH	EPA 150.1	post-stabilization effluent	Continuous	pH units
pH	EPA 150.1	post-stabilization effluent (after phosphate or chlorine addition)	Continuous	pH units
Alkalinity, total	SM2320B	post-stabilization effluent	every 4 hours	mg/L as CaCO ₃
Total Hardness	SM2340B	post-stabilization effluent	every 4 hours	mg/L as CaCO ₃
Orthophosphate	SM4500 P-E	post-stabilization effluent (after phosphate) ²	one grab per day	mg/L as PO ₄
Calcium	EPA 200.7	post-stabilization effluent	twice per day	mg/L
LSI	SM2330	post-stabilization effluent	every 4 hours	–
Magnesium	EPA 200.7	post-stabilization effluent	every 4 hours	mg/L
CCPP	SM2330	post-stabilization effluent	every 4 hours	mg/L
Temperature	SM2550	post-stabilization effluent	Continuous	°C
TDS	SM2540C	post-stabilization effluent	one grab per day	mg/L
Specific Conductance	SM 2510B	post-stabilization effluent	Continuous	µS/cm
Turbidity	EPA 180.1	post-stabilization effluent	Continuous	NTU

¹ Measured before phosphate or chlorine addition, unless indicated otherwise by a separate footnote.

² Sampling required only if phosphate is added for corrosion control.

Table A7-5. Minimum Water Quality Monitoring for the Final Disinfection System and Finished Water during Acceptance Testing ¹

Parameter	Analytical Method	Minimum Collection Frequency	Units	Additional Finished Water Quality Standard ²
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Parameter	Analytical Method	Minimum Collection Frequency	Units	Additional Finished Water Quality Standard ²
General and Inorganic				
Aluminum, total ³	EPA 200.8	weekly grab	mg/L	
Ammonia	EPA 350.1	weekly grab	mg/L as N	
Boron (mg/L)	EPA 200.7	one grab per day	mg/L	See Table A7-7
Bromide (mg/L)	EPA 300.0	one grab per day	mg/L	See Table A7-7
Chloride (mg/L)	EPA 300.0	one grab per day	mg/L	See Table A7-7
Copper, total	EPA 200.8	weekly grab	µg/L	
Dissolved Oxygen	SM 4500-O G	weekly grab	mg/L	
Fluoride	EPA 300.0	weekly grab	mg/L	
Iron, total (mg/L)	EPA 200.7	one grab per day	mg/L	See Table A7-7
Lead, total	EPA 200.8	weekly grab	µg/L	
Manganese, total (mg/L)	EPA 200.8	one grab per day	mg/L	See Table A7-7
Nitrate	EPA 300.0	weekly grab	mg/L as N	
Sodium (mg/L)	EPA 200.7	one grab per day	mg/L	See Table A7-7
Specific Conductance	SM 2510B	Continuous	µS/cm	
Temperature	SM 2550	Continuous	°C	
Total Dissolved Solids (mg/L)	SM 2540C	one grab per day	mg/L	See Table A7-7
Total Organic Carbon (TOC)	SM 5310C	one grab per day	mg/L	
Turbidity (NTU)	EPA 180.1	Continuous	NTU	See Table A7-7
Product Water Stabilization				
Hardness, total	SM 2340B	one grab per day	mg/L as CaCO ₃	See Table A7-7
pH	EPA 150.1	Continuous	pH units	See Table A7-7
Alkalinity, total	SM 2320B	one grab per day	mg/L as CaCO ₃	See Table A7-7
Langelier Saturation Index (LSI)	SM 2330	Calculated daily	–	See Table A7-7

Parameter	Analytical Method	Minimum Collection Frequency	Units	Additional Finished Water Quality Standard ²
Calcium Carbonate Precipitation Potential (CCPP)	SM 2330	Calculated daily	mg/L	See Table A7-7
Orthophosphate	SM 4500P-E	Calculated daily	mg/L as PO ₄	See Table A7-7
Disinfection and Disinfection Byproducts				
Total Chlorine Residual	SM 4500-Cl G	Continuous	mg/L as Cl ₂	See Table A7-7
Trihalomethanes, total	EPA 551.1	one grab per week	µg/L	See Table A7-7
Haloacetic Acids, total of 5	SM 6251B	one grab per week	µg/L	See Table A7-7
Total Nitrosamines	SM 6450	one grab per week	µg/L	See Table A7-7
Bromate	EPA 317	one grab per week	µg/L	See Table A7-7
Total Coliform	SM 9221B	weekly grab	MPN/100 mL	
<i>E. coli</i>	SM 9221 F	weekly grab	MPN/100 mL	
California Title 22 or other CDPH Finished Water monitoring requirements pursuant to Facility Drinking Water Permit	As needed to comply with all Applicable Law and Governmental Approvals	As needed to comply with all Applicable Law and Governmental Approvals		

¹ All Finished Water samples shall be collected at the Clearwell effluent, after the last point of chemical addition and complete mixing, unless indicated otherwise in this Table by footnote.

² Additional Finished Water Quality Acceptance Standards and Requirements are provided in Table A7-7 for the indicated constituents. The Design-BUILDER shall demonstrate compliance with all Applicable Law regulatory standards as well as the Additional Finished Water Quality Acceptance Standards and Requirements throughout Acceptance Testing. In most cases, the Additional Finished Water Quality Acceptance Standards and Requirements are more stringent than Applicable Law.

³ Analyze only if aluminum salts are added during pretreatment.

Table A7-6. Minimum Water Quality Monitoring for the Filter Backwash System and Recycle Streams during Acceptance Testing

Parameter	Analytical Method	Sampling Location	Minimum Collection Frequency	Units
Turbidity	SM 2130B or EPA 180.1	Spent backwash decant stream	Continuous during recycle	NTU
Total Suspended Solids (TSS)	SM 2540D	Spent backwash decant stream	one grab per day during recycle	mg/L
Total Suspended Solids (TSS)	SM 2540D	Settled solids stream	one grab per blowdown	mg/L
Percent Solids	TBD	Settled solids stream	one grab per blowdown	%

APPENDIX 7 – ATTACHMENT 2
MINIMUM SYSTEM MONITORING REQUIREMENTS DURING ACCEPTANCE
TESTING

Minimum system monitoring requirements for Acceptance Testing, for each of the Project systems, is indicated in this Attachment. During Acceptance Testing, the Design-Builder, at its own discretion, may monitor more locations and parameters or more frequently than set forth in this attachment. The monitoring results of parameters by or on behalf of the Owner during the Acceptance Test shall be reported in the Acceptance Test Report.

During the Acceptance Test, the Design-Builder shall allow Owner representatives to witness monitoring activities and provide additional measurements to the Owner, if requested. The Owner shall: (1) make such representatives available in a manner that accommodates the Design-Builder's schedule; and (2) not unduly delay the Design-Builder's monitoring activities.

Minimum monitoring requirements are discussed for the following Project systems in this Attachment:

- a) Seawater Intake System
- b) Pretreatment Filtration System
- c) Reverse Osmosis / Energy Recovery / Brine Discharge System
- d) UV System
- e) Post-treatment Stabilization System
- f) Final Disinfection / Finished Water Pumping System
- g) Waste Backwash and Recycle System
- h) Chemical Storage and Delivery System

At a minimum, the monitoring plans for these Systems shall include: chemical consumption, water quality throughout the Design-Build Improvements, all process and waste stream flows, and pressures at relevant locations throughout the treatment train. Minimum monitoring requirements are discussed in the subsections below. The Design-Builder shall be responsible for ensuring the monitoring plan and all associated tracking forms are complete for ensuring successful operation and performance of the Project throughout Acceptance Testing.

Minimum water quality monitoring requirements for each of the Project systems is provided in Tables A7-1 through A7-6, found in Attachment 1 to this Appendix.

(a) Seawater Intake System

The slant wells and Raw Water pumps shall have been operated a minimum of 4 weeks, prior to the RIPPT and Acceptance Testing to ensure the pipeline is effectively free of silt and sand.

Monitoring of the seawater intake system during Acceptance Testing shall include, but not be limited to, the following:

- Raw Water quality characteristics including the minimum sampling requirements indicated in Table A7-1 (found in Attachment 1).
- Flow, continuously monitored.
- If applicable and relevant, chlorine addition frequency, dosage (mg/L), and daily use (lbs/day).

The minimum Raw Water quality monitoring requirements for Acceptance Testing are set forth in Table A7-1, found in Attachment 1. The Design-Builder, at its discretion, may sample the Raw Water at more locations or more frequently than described in Table A7-1. The analytical results of all valid samples obtained by or on behalf of the Owner during the Acceptance Test shall be reported in the Acceptance Test Report.

(b) Pretreatment Filtration System

Monitoring of the pretreatment filtration system—both the media pressure filters and the cartridge filters—during Acceptance Testing shall include but not be limited to the following:

- Water quality characteristics including the minimum requirements indicated in Table A7-2 (see Attachment 1).
- Average filter surface loading rate (gpm/sf) for the pressure filter, reported daily and for the entire Acceptance Test, calculated and tabulated by filter.
- Operational criteria for deciding backwash frequency.
- Filter backwash volume, per backwash and per day (MGD), reported daily and for the entire Acceptance Test.
- Filter backwash frequency (on a number of backwashes per day basis) daily and for the entire Acceptance Test, tabulated by filter.
- Continuous differential pressure increase (feet), for each filter, between startup and backwash.
- Run times between backwashes for the media filters, daily and average for the entire Acceptance Test, tabulated by filter.
- Antiscalant, sulfuric acid, and sodium bisulfite dosage (mg/L), daily usage (lbs/day) and average for the entire Acceptance Test.
- Chlorine residual concentration at the pressure filter effluent and cartridge filter effluent measured continuously but tabulated as daily averages.
- Frequency and duration of any and all detectable chlorine residual concentration measurements (above the detection limit), at the cartridge filter effluent, tabulated over the entire Acceptance Test.
- Number of cartridge filter vessels on-line and off-line each day, and average over the entire Acceptance Test.
- Hydraulic loading rate for each cartridge filter vessel, daily and average over the entire Acceptance Test.
- Differential pressure across each cartridge filter vessel (psig), measured continuously.
- Cartridge filter replacement frequency, per filter, over the entire Acceptance Test.

(c) Reverse Osmosis / Energy Recovery / Brine Discharge System

Monitoring of the RO, Energy Recovery, and concentrate discharge systems during Acceptance Testing shall include but not be limited to the following:

- SWRO and BWRO feedwater, permeate and concentrate water quality characteristics including the minimum monitoring requirements indicated in Table A7-3, found in Attachment 1.
- RO feedwater, permeate, and concentrate flow (MGD)—per train, total per pass and total per stage—monitored continuously, averaged daily, and averaged over the duration of the Acceptance Test.
- Concentrate discharge total and average flow (MGD), and flow duration, to brine storage pond and/or brine discharge pipeline.
- SWRO and BWRO feedwater pressure for each RO train (psig), monitored continuously and averaged daily, for the duration of the Acceptance Test
- SWRO feed water temperature (°C), monitored continuously plus daily minimum, maximum and average, and average for the duration of the Acceptance Test.
- SWRO and BWRO concentrate pressure (psig) for each RO train, monitored continuously and averaged daily, for the duration of the Acceptance Test.
- Combined concentrate pressure (psig), monitored continuously, averaged daily, and averaged over the duration of the Acceptance Test.
- Pressure of concentrate exiting the energy recovery system (psig) monitored continuously, averaged daily, and averaged over the duration of the Acceptance Test.
- SWRO and BWRO permeate pressure for each RO train (psig), monitored continuously, averaged daily, and averaged over the duration of the Acceptance Test.
- Combined permeate pressure (psig), monitored continuously, averaged daily, and averaged over the duration of the Acceptance Test.
- Recovery each day (%), calculated per train, per pass/stage, for the total RO system, and the total facility— averaged daily, and averaged over the duration of the Acceptance Test, and trended over the entire Acceptance Test.
- Actual and normalized differential pressure (pressure drop) across each RO train (psig), calculated at 4-hour intervals and averaged over the duration of the Acceptance Test. All such normalized data shall be trended.
- Normalized membrane permeability (gfd/psig), calculated at 4-hour intervals and averaged over the duration of the Acceptance Test. All such normalized data shall be trended.
- Correlation between TDS and conductivity, for both the plant influent and combined RO permeate, over the entire Acceptance Test.
- Correlation between chloride concentration (measured by EPA method) and chlorinity (measured by Grasshoff method) and between Salinity and TDS, for the plant influent and combined RO concentrate, over the entire Acceptance Test.
- Actual and normalized salt passage (%), calculated at 4-hour intervals and averaged over the duration of the Acceptance Test. All such normalized data shall be trended.
- SWRO and BWRO feed pump power consumption (kWh/kgal Product Water).
- ERD bank individual and total system recovered power (kWh/kgal Product Water).

- Average daily power consumption of each pumping component of the RO system (excluding the Finished Water pump station) (kWh/kgal of Product Water).
- Number of pumps in operation and operational hours of each pump, calculated at 4-hour intervals and average for the duration of the Acceptance Test.
- Other membrane data and normalized trends pursuant to applicable membrane manufacturer's warranty conditions and other guidelines. All such normalized data shall be trended over the entire Acceptance Test period.

(d) UV System

Monitoring of the UV disinfection system during Acceptance Testing shall include but not be limited to the following:

- Electricity Utilization for each UV reactor (kWh/kgal).
- Flow through each UV reactor, monitored continuously and averaged daily over the duration of the Acceptance Test.
- UV transmittance for each UV reactor, monitored continuously and averaged daily over the duration of the Acceptance Test.

(e) Post-Treatment Stabilization System

Monitoring of the post-treatment stabilization system during Acceptance Testing shall include but not be limited to the following:

- Water quality characteristics including the minimum sampling requirements indicated in Table A7-4 (found in Attachment 1) and Table A7-15 (found in Section (D)(b)(iv) of this Appendix).
- Where applicable and relevant, chemical feed concentration, chemical dosage (mg/L), and daily usage (lbs/day) for orthophosphate, carbon dioxide, hydrated lime, and/or sodium hydroxide
- Flow rate through each train or contactor, measured continuously and averaged daily over the duration of Acceptance Testing.
- If a calcite or limestone contactor is used, the calculated Empty Bed Contact Time (EBCT), calculated hourly and averaged daily over the duration of Acceptance Testing.
- Calcium dissolution rate verified by analysis and material balance, if a calcite or limestone contactor is used.

(f) Final Disinfection / Finished Water Pumping System

The Acceptance Test shall demonstrate that the Product Water storage and pumping system is capable of delivering, from the Finished Water pump station to the distribution system tie-in location, an average daily flow of 9.6 MGD, with one pump in standby, at the TDH utilized in the final design for the period of time required by the Acceptance Test Plan.

Monitoring of the final disinfection and finished water pumping system during Acceptance Testing shall include but not be limited to the following:

- Water quality characteristics including the minimum sampling requirements indicated in Table A7-5 (provided in Attachment 1).
- Daily average, maximum and minimum chlorine dosage (mg/L), daily usage (lbs/day) and average usage for the entire Acceptance Test.
- Influent temperature (°C), measured continuously and averaged daily over the entire Acceptance Test period.
- Minimum, maximum and average flow rate through the clearwell.
- Minimum, maximum and average disinfection credit through the clearwell, calculated daily and over the entire Acceptance Test period.

(g) Waste Backwash and Recycle System

All waste streams, including but not limited to spent filter backwash solids and lime sludge, must be managed on-site as there is no means of direct discharge or disposal, as described in Appendix 2. Acceptance Testing of the waste backwash and recycle system shall demonstrate effective operation of all recycle pumps, waste settling and storage basins, and associated monitoring equipment and controls.

Monitoring of the filter backwash system and other recycle streams during Acceptance Testing shall include but not be limited to the following:

- Water quality characteristics including the minimum requirements indicated in Table A7-6 (provided in Attachment 1).
- Recycle rate (gpm), recycle frequency, recycle duration, and percent recovery for the spent backwash water.
- Lime sludge production (lbs/day) and waste stream flow.
- If applicable and relevant, chlorine and/or polymer dosage (mg/L) and usage rate (lbs/day), calculated daily and average over the entire Acceptance Test.

(h) Chemical Storage and Delivery System

For each chemical used and stored on-site, the following minimum information regarding chemical consumption shall be recorded by the Design-Builder throughout the Acceptance Test:

- Chemical name, concentration and grade (as delivered).
- Daily minimum, maximum and average dosing rate, mg/L.
- Chemical consumption (lbs/day), recorded daily and averaged over the duration of the Acceptance Test.
- All changes in dosing rate.
- Solution concentration (as dosed).
- Day tank and bulk storage tank levels, deliveries, and changes in inventory amounts;
- Chemical dosing information shall be computed as a daily average dose based on actual consumption and compared with dosing set points in the Acceptance Test Report to confirm the proper functionality of the chemical addition systems. Separate chemical consumption values shall be reported for each chemical used for pretreatment, RO

treatment, post-treatment stabilization, and final disinfection.

- SCADA records demonstrating the SCADA interface operates correctly to control all chemical feed systems, and to monitor and record chemical consumption.

APPENDIX 7 – ATTACHMENT 3

MAXIMUM ELECTRICITY UTILIZATION

The Maximum Electricity Utilization (MEU) represents the maximum amount of electricity in kilowatt-hours (kW-hr) that shall not be exceeded by the Project (including the UV disinfection system) per thousand gallons (kgal) of Finished Water produced during the Acceptance Test.

MEU shall include all the power used to operate the Project including all facilities and ancillary facilities, from downstream of the slant well pump station through the Finished Water pump station.

MEU shall equal the kWh/kgal Plant amount of power consumption, adjusted for the weighted average temperature and salinity values for the duration of the Acceptance Test, as determined pursuant to Table A7-9 herein.

For the purposes of this Acceptance Test, the MEU shall be selected from Table A7-9 based on a temperature and salinity, which shall have been adjusted for the conditions of the Acceptance Test. The adjusted temperature (T_{avg}) and the adjusted salinity (C_{avg}) shall be determined as described below:

STEP 1: The adjusted temperature shall be the weighted average influent water temperature (T_{avg}) for the Acceptance Test and shall be determined as follows:

$$T_{avg} = \frac{1}{V_T} \sum_{i=1}^N (T_i V_i) \quad (1)$$

Where

N = the number of 24 hour periods in the Acceptance Test.

T_i = the RO feedwater water temperature measured at the discharge of the High Pressure RO pumps at the end of each 24 hour period in the Acceptance Test, expressed in degrees Celsius.

V_i = the volume of Finished Water produced during each 24 hour period during the Acceptance Test, expressed in kgal.

V_T = the total volume of Finished Water produced during the Acceptance Test, expressed in kgal.

To find the row for selecting the MEU for the Acceptance Test in Table A7-9 of this Attachment, the adjusted temperature (T_{avg}) determined in equation (1) shall be rounded down to the closest temperature value listed in Table A7-9 of this Attachment, which is below T_{avg} .

STEP 2: The adjusted salinity shall be the weighted average influent salinity (C_{avg}) for

the Acceptance Test and shall be determined as follows:

$$C_{avg} = \frac{1}{V_T} \sum_{i=1}^N (C_i V_i) \quad (2)$$

Where

N = the number of 24 hour periods in the Acceptance Test.

C_i = the plant feedwater water salinity measured at the end of each 24 hour period in the Acceptance Test pursuant to Table A7-9, expressed in ppt.

V_i = the volume of Finished Water produced during each 24 hour period during the Acceptance Test, expressed in kgal.

V_T = the total volume of Finished Water produced during the Acceptance Test, expressed in kgal.

The adjusted MEU for the Acceptance Test shall be determined by linearly interpolation, based on the adjusted salinity (C_{avg}), between the two MEU values in the row selected in STEP 1, which most closely correspond to the adjusted salinity (C_{avg}).

Table A7-9. Maximum Electricity Utilization for All Acceptance Test Finished Water Output Levels (Values to be Provided in Design-Build Agreement – Appendix 2 and RFP Form 17)⁽¹⁾

C _{avg} (Salinity in ppt)	24 ppt	28 ppt	32.2 ppt	33.6 ppt	34.6 ppt	38ppt
T _{avg} Feedwater Temperature (in °C)	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal
8						
9						
10						
11						
12				EMEUE		
13						
14						
15						
16						

C _{avg} (Salinity in ppt)	24 ppt	28 ppt	32.2 ppt	33.6 ppt	34.6 ppt	38ppt
T _{avg} Feedwater Temperature (in °C)	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal	Plant kWh/kgal
17						
18						

⁽¹⁾ These MEUs include all the power used to operate the Project including all facilities, including ancillary facilities, from downstream of the slant well pump station through the finished water pump station.

Appendix 8

[Reserved]

Appendix 8

[Reserved]

Appendix 9

Operation and Maintenance-Related Deliverables

Appendix 9

Operation and Maintenance-Related Deliverables

The following table lists the Operation and Maintenance-Related Deliverables that the Design-Builder is required to provide to the Owner.

<u>O&M RELATED DELIVERABLE</u>	<u>REFERENCE LOCATION</u>
1. Electronic Record Drawings	Appendix 4, item 8 (pg 4-4)
2. O&M Manual (hard copy)	Appendix 4, Section 4.7.B (pg 4-32)
3. Electronic Project Files CD	Appendix 4, item 10 (pg 4-4)
4. Equipment Maintenance Data Sheets	Appendix 4, item 13 (pg 4-5)
5. Warranties & Service Contracts	
a. General Information	DB Agreement, Section 3.18
b. RO Equipment	Appendix 2, item 9 (pg 16)
c. UV Equipment	Appendix 2, item 13 (pg 35)
d. On-Site Hypo Equipment	Appendix 2, item 21.b (pg 45)

Appendix 10

Key Personnel and Approved Subcontractors

Appendix 10

Key Personnel and Approved Subcontractors

[Note: to be provided by Proposer.]

Appendix 11

Insurance Requirements

Appendix 11

Insurance Requirements

I. DESIGN-BUILDER INSURANCE REQUIREMENTS.

A. Insurance Limits and Coverage. At no expense to the Owner, the Design-Builder shall obtain and keep in force during the term of this Design-Build Agreement the following minimum insurance limits and coverage (or greater where required by Applicable Law). The insurance coverage limits stated below are minimum coverage requirements, not limitations of liability, and shall not be construed in any way as the Owner's acceptance of the responsibility of the Design-Builder.

1. Commercial General liability:

\$1,000,000 per occurrence Combined Single Limits

\$1,000,000 General Aggregate

\$1,000,000 Products and Completed Operations Aggregate

CGL ISO 1996 or later Occurrence form including Premises and Operations Coverage, Products and Completed Operations, Coverage for Independent Contractors, Personal Injury Coverage and Blanket Contractual Liability, and Contractors Protective Liability if the Design/Builder subcontracts to another all or any portion of the Design-Build Work. Completed operations shall be maintained for a period of five (5) years following Final Completion for any construction, renovation, repair and or maintenance service.

2. Workers' Compensation

Applicable Federal or State Requirements: Statutory Minimum

Employer's Liability:

Each Accident	\$1,000,000
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Each Employee – Disease	\$1,000,000
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Policy Limit – Disease	\$1,000,000
------------------------	-------------

Other States insurance.

The Workers' Compensation policy shall also include U.S. Longshoreman and Harbors Workers' Compensation Act Coverage, if any Work shall be done over or within 100 feet of any body of water, or otherwise at the sole discretion of Water Company. It shall provide maritime (Jones Act) coverage if a boat or vessel of any type is used.

Automobile Liability - (including owned, hired, borrowed and non-ownership liability)

Bodily Injury and Property Damage \$1,000,000 each accident Combined Single Limits

3. Umbrella Liability

\$50,000,000 each occurrence and annual aggregate in excess of Employer's Liability, General Liability and Automotive Liability (no more restrictive than underlying insurance)

4. Professional Liability

Professional Liability or Errors and Omissions insurance acceptable to the Owner covering the Design-Builder's liabilities for loss due to error, omission, negligence, mistakes, or failure to take appropriate action in the performance of business or professional duties of their employees in the amount of at least \$10,000,000 per claim and in the aggregate shall be procured prior to the commencement of the design work during the procurement phase to be maintained and retroactive to this date during the Design-Build Agreement term and for a period of at least five (5) years after completion of the Design-Build Agreement evidenced either by annual renewal of the policy for five (5) years or by endorsement or addition of an Extended Reporting (or Discovery) Period for at least five (5) years following the policy expiration date. Policy shall be endorsed to provide contingent bodily injury and property damage liability coverage.

5. Environmental Impairment Liability (EIL) or Pollution Liability insurance

Covering losses caused by pollution conditions that arise from the operations of Design-Builder described in this Design-Build Agreement. This insurance shall apply to bodily injury; property damage, including loss of use of damaged property or of property that has not been physically injured; cleanup costs; and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims. The policy of insurance affording these required coverages shall be written in an amount of at least \$5,000,000 per claim with an annual aggregate of at least \$5,000,000.

6. Builders Risk Insurance

The Design-Builder shall bear all risks of all loss or damage to the Design-Build Work until Final Completion, except that the Design-Builder may claim reimbursement under the Owner's builder's risk insurance policy as herein provided and limited. The Owner will carry "All Risk" Builders Risk Insurance subject to deductibles, terms and conditions as stated in the policy and below with Design-Builder as an additional insured. It is the obligation and responsibility of the Design-Builder to make appropriate claim to the insurance company for all losses claimed under the policy. Should any loss not be covered under this policy, in whole in or parts, the Design-Builder shall bear the loss. Any questions regarding coverages, limitation, exclusion, etc. contained in the policy shall be addressed by proposers prior to submittal of proposals, to *Director, Risk Management, American Water, Email: jimli@amwater.com.*

Such insurance shall cover the full value of the cost of replacement to the Owner, less applicable deductibles, of all completed portions of the Design-Build Work to be performed throughout the

entire time of construction. The deductibles on each separate and unrelated loss are: (1) At least 5% of the total insurable value at each location involved in a wind, earthquake, and flood loss, subject to a minimum of \$1,000,000, whichever is greater; and (2) \$100,000 on all other losses. Owner will furnish to the Design-Builder evidence of the insurance coverage provided.

Such insurance shall not cover: (1) damage to or loss of material or equipment furnished by either party which are damaged or lost due to carelessness or negligence on the part of the Design-Builder; or (2) damage to or loss of machinery, tools, equipment, or other property furnished by the Design-Builder whether or not used by the Design-Builder in carrying out the terms of the Design-Build Agreement unless such machinery, tools, equipment or other property are specifically intended for permanent incorporation into the Design-Build Work and are included in an approved application for payment.

B. Satisfaction of Limits. The minimum liability limits required by this Appendix 11 may be satisfied through the combination of the primary General Liability, Employers' Liability, and Automotive Liability limits with an Umbrella Liability policy (with coverage no more restrictive than the underlying insurance) providing excess limits at least equal to or greater than the combined primary limits.

C. Additional Insureds. All Commercial General Liability including completed operations-products liability coverage, Automobile liability and Pollution Liability insurance shall designate the Owner, its parent and affiliates, their respective directors, officers, employees and agents, Owner's Representative, and [INSERT ANY ADDITIONAL] as Additional Insureds.

D. Other Requirements. All insurance required by this Appendix 11 shall be primary and non-contributory, and is required to respond and pay prior to any other insurance or self-insurance available to the Owner. In addition to the liability limits available, such insurance will pay on behalf of or will indemnify the Owner for defense costs. Any other coverage available to the Owner applies on a contingent and excess basis. All such insurance shall include appropriate clauses pursuant to which the insurance companies shall waive their rights of subrogation against the Owner.

E. Certificates of Insurance. Design-Builder and its Subcontractors shall furnish, prior to the start of work, certificates or adequate proof of the foregoing insurance including, if specifically requested by the Owner, copies of the insurance policies and endorsements naming the Owner and other required Additional Insureds. Current certificates of insurance shall be provided prior to the commencement of the Design-Build Work and shall be maintained until completion of the Design-Build Agreement. Such certificates shall evidence that the Owner is included as Additional Insured, except for workers compensation and professional liability. The Design-Builder shall notify the Owner in writing, at least thirty (30) days prior to cancellation of or a material change in a policy. Such cancellation or material alteration shall not relieve the Design-Builder of its continuing obligation to maintain insurance coverage in accordance with this Design-Build Agreement.

F. Carrier Rating. Carriers providing coverage will be rated by A.M. Best with at least an A-rating and a financial size category of at least Class VII. Carriers shall be licensed in state(s) where work shall be performed.

G. Failure to Procure. If the Design-Builder shall fail to procure and maintain said insurance, the Owner, upon written notice, may, but shall not be required to, procure and maintain same, but at the expense of the Design-Builder. In the alternative, the Owner may declare a default hereunder and, unless such default is timely cured, terminate the Design-Build Agreement. Unless and until the default is cured, neither the Design-Builder nor its servants, employees or agents will be allowed to enter upon the Owner's premises.

II. SUBCONTRACTOR INSURANCE REQUIREMENTS.

The Design-Builder shall require each Subcontractor to obtain and keep in force the coverages required of Design-Builder. Design-Builder may, however, in its discretion, allow a Subcontractor to secure lower insurance limits than the limits required of Design-Builder. Design-Builder may also request in writing that the Owner approve the waiver of certain coverages for a specific Subcontractor, which approval will not be unreasonably withheld by the Owner. Any such approval by the Owner must be in writing.

Appendix 12

Allowances

Appendix 12

Schedule of Cash Allowances

A. Earthwork – Testing Asphalt Concrete Paving - Testing Cast-in-Place Concrete –Testing

The Fixed Design-Build Price includes an Allowance of **\$100,000** for providing the services of an independent testing laboratory to perform testing for concrete, soils, asphalt, structural steel bolting and welding, and steel tank painting inspection as specified in the Design-Build Agreement. Approval by the Owner of the independent testing laboratory is required before commencement of work at the Project Site.

During the course of the work, the independent testing laboratory shall perform for the Design-Builder and Owner such tests as are required to verify conformance to the requirements of the specifications. Such tests are not intended to provide the Design-Builder with information required by it for proper execution of the Design-Build Work, and their performance shall not relieve the Design-Builder of the necessity to perform tests for that purpose.

B. RPR Special Equipment and Supplies

In addition to the RPR field trailer, equipment and supplies included as temporary facilities pursuant to the Design and Construction Requirements of Appendix 2, the Fixed Design-Build Price includes an Allowance of **\$50,000** for special equipment and supplies. These equipment and supplies may include, but are not limited to: computer, printer, fax, scanner, telephone, digital camera and office supplies. The Allowance shall also be used to pay on a monthly basis the telephone usage bills for telephone lines designated for RPR use. The costs reimbursed shall be for the actual cost incurred and shall not include any Design-Builder markups. All purchases for RPR equipment and supplies shall be approved by the Owner. If the actual cost of the equipment, supplies and telephone bills are greater than or less than allowance amount, a Change Order will be processed to account for the difference.

C. Security

The Fixed Design-Build Price includes an Allowance of **\$10,000** for providing background checks for the Design-Builder's key employees including Subcontractors.

The Owner will require that key employees of the Design-Builder working on the Project site to have a background checks completed. The Design-Builder shall conduct a background check on each of its key employees prior to the employee performing any function or activity under the Design-Build Agreement involving any Design-Build Work at the Project Site. The background check conducted by the Design-Builder shall consist of a check of at least the following: previous employers and dates of employment; education; driving record; criminal history (State

and federal); references and credit history. Prior to commencing work, Design-Builder shall provide proof to the Owner that the requirements of this paragraph have been met. Design-Builder shall make available to the Owner, upon request, the documentation and results of the background check with respect to any employee of Design-Builder performing any function under the Design-Build Agreement involving any Design-Build Work at the Project Site.

D. Miscellaneous

- a. Elective Landscaping Features- \$75,000**
- b. Elective Exterior Architecture Features: \$75,000**
- c. Elective Interior Architecture Features: \$50,000**
- d. Computer/Telephones, etc - \$50,000**

Appendix 13

Payment Procedures and Drawdown Schedule

Appendix 13

PAYMENT PROCEDURES AND DRAWDOWN SCHEDULE

13.1 PURPOSE

This Appendix sets forth the requirements for the development of a detailed Progress Payment Schedule for the Design-Build Period and sets forth the drawdown schedule that establishes the estimated monthly payments during the Design-Build Period.

13.2 PAYMENT PROCEDURES

The Design-Builder shall be entitled to submit Requisitions and receive from Owner the payments that will be set forth in the Progress Payment Schedule developed in accordance with this Appendix 13 subject to the conditions to payment set forth in the Design-Build Agreement. The estimated drawdown schedule set forth in this Appendix and the Progress Payment Schedule developed by the Design-Builder and approved by Owner shall serve as the basis for progress payments and will be incorporated into a detailed Progress Payment Schedule acceptable to Owner in accordance with this Appendix.

On or about the date established in the Design-Build Agreement for submission of each application for progress payment (but not more often than once a month), Design-Builder shall submit to Owner for review an application for payment ("Application for Payment") filled out and signed by Design-Builder covering the Design-Build Work completed as of the date indicated on the Application and accompanied by supporting documentation as required by the Design-Build Agreement. If payment is requested on the basis of materials and equipment not incorporated in the Design-Build Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect Owner's interest therein, all of which will be satisfactory to Owner.

Beginning with the second Application for Payment, each Application shall include an affidavit of Design-Builder stating that all previous progress payments received on account of the Design-Build Work have been applied on account to discharge Design-Builder's legitimate obligations associated with prior Applications for Payment.

The amount of retainage with respect to progress payments will be as stipulated in the Design-Build Agreement.

A. Procedure. Progress payments shall be made by the Owner to the Design-Builder according to the following procedure:

1. Owner will, within twenty days of receipt of each Application for Payment, either indicate in writing its acceptance of the Application and state that the Application is being

processed for payment, or return the Application to Design-Builder indicating in writing its reasons for refusing to accept the Application. Not more than ten days after accepting such Application the amount will become due and when due will be paid by Owner to Design-Builder.

2. If Owner should fail to pay Design-Builder at the time the payment of any amount becomes due, then Design-Builder may, at any time thereafter, upon serving written notice that he will stop the Design-Build Work within seven days after receipt of the notice by Owner, and after such seven day period, stop the Design-Build Work until payment of the amount owing has been received. Written notice shall be deemed to have been duly served if sent by certified mail to the last known business address of Owner.

3. Payments due but unpaid shall bear interest at the rate specified in the Agreement.

4. No Progress Payment nor any partial or entire use or occupancy of the Project by Owner shall constitute an acceptance of any Work not in accordance with the Design-Build Agreement.

13.3 PROGRESS PAYMENT SCHEDULE AND PROGRESS PAYMENTS

Within 30 days following the Contract Date, the Design-Builder shall prepare and submit for approval by Owner an interim Progress Payment Schedule to assist Owner, Owner Engineer and the Contract Administrator in evaluating Design-Builder Requisitions for progress payments to be paid on a percent complete basis during the first 180 days of the Design-Build Period in accordance with the Design-Build Agreement. The interim Progress Payment Schedule shall be based upon the interim schedule prepared by the Design-Builder pursuant to Appendix [4]. The Design-Builder shall not receive payments for any Design-Build Work completed during the first 180 days of the Design-Build Period unless Owner has approved the interim Progress Payment Schedule and the Requisition for such work contains a copy of the final interim schedule that has been established and updated in accordance with Appendix 4 and shows the progress made by the Design-Builder for the period covered by such Requisition.

Within 30 days following acceptance of the Design-Builder's master schedule by Owner in accordance with Appendix 4, the Design-Builder shall prepare and submit for approval by Owner a final Progress Payment Schedule to assist Owner, Owner Engineer and the Contract Administrator in evaluating Design-Builder Requisitions for progress payments to be paid on a percent complete basis in accordance with the Design-Build Agreement. The final Progress Payment Schedule shall be based upon the master schedule prepared by the Design-Builder pursuant to Appendix 4 and shall become the basis for Owner's consideration of partial payments to be made to the Design-Builder following the first 180 days of the Design-Build Period. The Design-Builder shall not receive payments for any invoices for any Design-Build Work completed following the first 180 days of the Design-Build Period unless Owner has approved the final Progress Payment Schedule and the Requisition for such work contains a copy of the final master schedule that has been established and updated in accordance with Appendix 4 and shows the progress made by the Design-Builder for the period covered by the Requisition. The Progress Payment Schedules prepared by the Design-Builder shall be consistent with the requirements set forth in Attachment 13A to this Appendix. The detailed Progress Payment Schedule prepared by the Design-Builder shall also be consistent with Table 13-1 in all respects

and in no event shall there be any change to the percentages set forth in Table 13-1. Upon the request of Owner, City Engineer or Contract Administrator, the Design-Builder shall support all values with data that substantiates the correctness of any information contained in the Progress Payment Schedule submitted by the Design-Builder. After review and comment by Owner, Owner Engineer and the Contract Administrator, the Design-Builder shall revise and resubmit the Progress Payment Schedules as necessary until a detailed Progress Payment Schedule is approved by Owner. The Design-Builder shall resubmit subsequent revised Progress Payment Schedules in the same manner, upon request by Owner for necessary changes.

Each Requisition for payment shall be signed and certified by the Design-Build Manager and the Engineer-of-Record, and the Design-Builder shall provide all supporting information in accordance with Section 5.2(B) of the Design-Build Agreement. The Design-Builder shall not submit any Requisition for payments on a percent complete basis prior to approval by Owner of the interim or final Progress Payment Schedule, as applicable.]

13.3.2 *Partial Utilization*

Prior to Substantial Completion of all the Design-Build Work, Owner may use or occupy any substantially completed part of the Construction which (i) has specifically been identified in the Design-Build Agreement, or (ii) Owner and Design-Builder agree constitute a separately functioning and usable part of the Construction that can be used by Owner for its intended purpose without significant interference with Design/ Builder's performance of the remainder of the Design-Build Improvements, subject to the following:

1. Owner at any time may request Design-Builder in writing to permit Owner to use or occupy any such part of the Construction which Owner believes to be ready for its intended use and substantially complete. If Design-Builder agrees that such part of the Design-Build Work is substantially complete, Design-Builder will certify to Owner that such part of the Design-Build Improvements is substantially complete and request Owner to issue a certificate of Substantial Completion for that part of the Construction. Design-Builder at any time may notify Owner in writing that Design-Builder considers any such part of the Design-Build Work ready for its intended use and substantially complete and request Owner to issue a certificate of Substantial Completion for that part of the Design-Build Work. Within a reasonable time after either such request, Owner and Design-Builder shall make an inspection of that part of the Design-Build Work to determine its status of completion. If Owner does not consider that part of the Design-Build Work to be substantially complete, Owner will notify Design-Builder in writing giving the reasons therefore. If Owner considers that part of the Design-Build Work to be substantially complete, the provisions of paragraph 13.5 will apply with respect to certification of Substantial Completion of that part of the Design-Build Work and the division of responsibility in respect thereof and access thereto.

2. No use or occupancy of part of the Design-Build Improvements will be accomplished prior to compliance with the requirements of paragraph 13.10 regarding property insurance.

3. Owner may at any time submit a written request to Design-Builder to permit Owner to take over operation of any such part of the Construction although it is not substantially

complete. Owner and Design-Builder shall make an inspection of that part of the Construction to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If Design-Builder does not object in writing to Owner that such part of the Construction is not ready for separate operation by Owner, Owner will finalize the list of items to be completed or corrected and will deliver such list to Design-Builder together with a written division of responsibilities pending final payment between Owner and Design-Builder with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Construction which will become binding upon Owner and Design-Builder at the time when Owner takes over such operation. During such operation and prior to substantial completion of such part of the Construction, Owner shall allow Design-Builder reasonable access to complete or correct items on said list and to complete other related Construction.

13.3.3 *Final Inspection*

A. Upon written notice from Design-Builder that the entire Design-Build Work or an agreed portion thereof is complete, Owner will make a final inspection with Design-Builder and will notify Design-Builder in writing of all particulars in which this inspection reveals that the Design-Build Work is incomplete or defective. Design-Builder shall immediately take such measures as are necessary to complete such Design-Build Work or remedy such deficiencies.

13.4 CERTAIN LIMITATIONS ASSOCIATED WITH PROGRESS PAYMENTS

The Design-Builder's detailed Progress Payment Schedule shall be in sufficient detail to indicate further breakdown of items on the schedule into equipment, systems, subsystems, building structures and other discrete elements.

The Design-Builder shall submit a schedule of values representing a detailed subdivision of the lump sum Contract amount. This subdivision, when approved by the Engineer, will become the basis for computing the Design-Builder's monthly progress payments. If practical, the schedule of values shall be developed by assigning a cost value to the appropriate activities contained in the preliminary progress schedule. If activities, or other line items, in the schedule of values contain costs associated with material, labor or subcontracts these costs are to be identified separately by listing the activity multiple times and identifying material, labor and subcontract with a suffix M, L and S respectively. Cost values for activities representing materials/equipment only shall be assigned to the activity representing delivery of such material/equipment to the Project Site.

In addition to the cost of material, labor and subcontracts, the following costs are to be identified separately in the schedule of values accompanied by such supporting documentation as required by the Owner to substantiate the amounts listed.

1. Mobilization - To include actual cost to setup temporary facilities at the Project Site.
2. Bonds, Insurance - To reflect premiums paid, or to be paid, for Bonds and insurance required to be provided per the Design-Build Agreement. Additional insurance coverage or

bonds purchased optionally shall be considered general overhead and apportioned to construction activity costs.

3. Job Site Overhead - To reflect the cost of maintaining the temporary facilities at the Project Site including the cost of direct field supervision. This value, when approved, will be paid in equal monthly increments based on the number of months between mobilization and final completion.

4. Demobilization - To reflect the cost of removing the temporary facilities and final site cleanup.

5. Permits - To include fees required to obtain any permits including inspection fees associated with such permits. The Design-Builder's detailed Progress Payment Schedule shall also include a breakdown of all design and permitting submittals and for obtaining significant Governmental Approvals. Governmental Approval applications shall be complete, as determined by the applicable Governmental Body, in order for the Design-Builder to receive payment for the corresponding progress payment associated with the submittal of the Governmental Approval application.

The cost of home office overhead, profit, financing, contingencies, etc. are to be apportioned to the construction activities in the schedule of values based on the percentage that each construction activity cost represents when compared to the subtotal of all construction activity costs. This subtotal is excluding mobilization, demobilization, Project Site overhead, permits, home office overhead, profit, financing, contingencies, etc. The total of all items in the schedule of values shall equal the Contract Price.

Payments shall be made on account of equipment or unit of materials delivered and suitably stored at the Project Site for subsequent incorporation into the Design-Build Work. If approved in advance by Owner, Requisitions may also be submitted for materials and equipment suitably stored off the Project Site at a location acceptable to Owner, subject to any requirements imposed by the Insurance Requirements. The Design-Builder shall not be entitled to payment for materials and equipment that are not stored properly, either at the Project Site or off the Project Site, in accordance with the Contract Standards so as to protect such materials and equipment from damaging environmental elements (e.g., dust intrusion into rotating equipment). All material and equipment storage locations, either at the Project Site or off the Project Site, shall be subject to inspection by Owner and its representatives during normal business hours.

In no event shall the cumulative Design-Build Price payments in any month exceed the cumulative Value of Work completed by the end of that month.,

13.5 QUARTERLY PROGRESS PAYMENT ESTIMATES

The Design-Builder shall provide Owner with a good faith calendar quarterly estimate of payments of the Design-Build Price throughout the Design-Build Period. The first such estimate shall be submitted to Owner with the initial submittal of the detailed Progress Payment Schedule required pursuant to Section 13.3 of this Appendix.

13.6 DRAWDOWN SCHEDULE

The Design-Builder shall also submit to the Owner, for approval, a Cash Flow Schedule. The Cash Flow Schedule shall show the amounts of money by months which will be required to reimburse the Design-Builder for Work performed during each month of the Contract Times. The sum of all the monthly cash requirements shall equal the Contract Price. The monthly cash requirements shall be proportioned based on the CPM Schedule. The initial cash flow schedule shall depict monthly cash requirements based on the early start dates of the CPM Schedule as well as the monthly cash requirements based on late start dates of the CPM Schedule. The approved cash flow schedule will be developed by the Owner and will reflect the Design-Builder's schedule performance as of the date of approval. This process of approving cash flow schedules will occur with each required schedule update.

The approved Cash Flow Schedule will be used by the Owner to program funds for progress payments to the Design-Builder. Monthly payments will be made to the Design-Builder in accordance with the Design-Build Agreement.

Table 13-1 sets forth the estimated monthly payment that the Design-Builder is subject to in its submittal of Requisitions as set forth in Section 6.2 of the Design-Build Agreement. The percentages set forth in Table 13-1 are percentages of the total Fixed Design-Build Price, as set forth in subsection 5.1(B) of the Design-Build Agreement.

Table 13-1
FIXED DESIGN-BUILD PRICE
DRAWDOWN SCHEDULE

[To Be Developed Based on Proposal Form 16]

Attachment 13A
Progress Payment Schedule Requirements

1.01 FORM AND CONTENT OF PROGRESS PAYMENT SCHEDULE

A. The Design-Builder's standard forms and computer printout will be considered for approval by Owner upon the Design-Builder's request. The Progress Payment Schedule shall identify:

1. Project name and location.
2. Name and address of Design-Builder.
3. Owner name.
4. Date of submission.

B. The Schedule of Values will serve as the basis for progress payments. Design-Builder's Schedule of Values, as described in Section 13.4 of this Appendix will be acceptable to Owner as to form and substance if it provides a reasonable allocation of the Fixed Design-Build Price to component parts of the work.

C. Each line item shall be identified with the number and title of the respective major section of the Technical Specifications. Line items or indicated groups of line items shall match the construction activities' breakdown in the Design-Builder's interim schedule or master schedule, as applicable. The cash loaded schedules shall be used as the basis of the Progress Payment Schedule and therefore the basis of payment.

D. For each major line item, the Progress Payment Schedule shall list sub-values of major products or operations under the item.

E. Each item shall include a directly proportional amount of the Design-Builder's overhead and profit.

F. For items on which partial payments will be requested for properly stored materials, the value shall be broken down into:

1. The cost of the materials and equipment to be incorporated into the Design- Build Work, delivered and unloaded, with taxes paid. Invoices shall be required for materials and equipment to be incorporated into the Design-Build Work, upon request by Owner, Owner's Representative or the Contract Administrator.

2. The total installed value.

G. The specific requirements and procedures for submitting progress payments to Owner will be discussed at the initial conference.

1.02 SCHEDULE OF PROPERTY UNIT VALUES

A. In addition to the Schedule of Values, Design-Builder shall provide a breakdown of the construction cost by Property Units in accordance with the list of Property Units identified in the Attachment to this specification section. The detailed arrangement for submittal of the construction cost by Property Units shall be discussed at the initial conference.

Appendix 14

MINIMUM FINANCIAL CRITERIA

Appendix 14

MINIMUM FINANCIAL CRITERIA

[To be provided from Proposal Form 7]

Appendix 15

RESTRICTED PERSONS

Appendix 15

RESTRICTED PERSONS

The following firms are Restricted Persons as defined in the Design-Build Agreement:

- RBF Consulting
- Trussell Technologies
- URS Corporation
- Kris Helms Consulting
- Separation Processes, Inc.

Appendix 16

WMDVBE Utilization Plan

Appendix 16

WMDVBE Utilization Plan

[Note: to be provided by Proposer.]

Appendix 17

Local Resources Utilization Plan