Project Responsibilities of Key Staff

Successful completion of any project requires technical competence and managerial skills in the assigned personnel, development of a thorough work plan, and understanding of the client's needs. The City of Sunnyvale requests a Consultant firm be responsible for preparing a complete pre-design study and basis of design report including construction cost estimates and schedules. The Consultant will also be responsible for providing complete project design and construction support services.

HDR Provides Team Member Expertise, Availability and Commitment to a Collaborative Approach

For the City of Sunnyvale WPCP's Sodium Hypochlorite Disinfection System conversion we have assembled a team of highly qualified and experienced professionals whose qualifications and responsibilities are tailored to the City of Sunnyvale's project objectives. Figure 4-1 below shows our proposed project team and illustrates our depth of resources and the reporting relationships of our team.

The HDR team has local, relevant experience that will allow us to successfully meet and exceed the City's goals and objectives and convert the existing wastewater disinfection system to the preferred sodium hypochlorite process. The following team members are responsible for executing key elements of the project.

- Joe Wojslaw, PE
- June Leng, Ph.D., PE
- Dave Reardon, PE
- John Koch, PE
- Craig Olson, PE
- Gary Fuller, PE

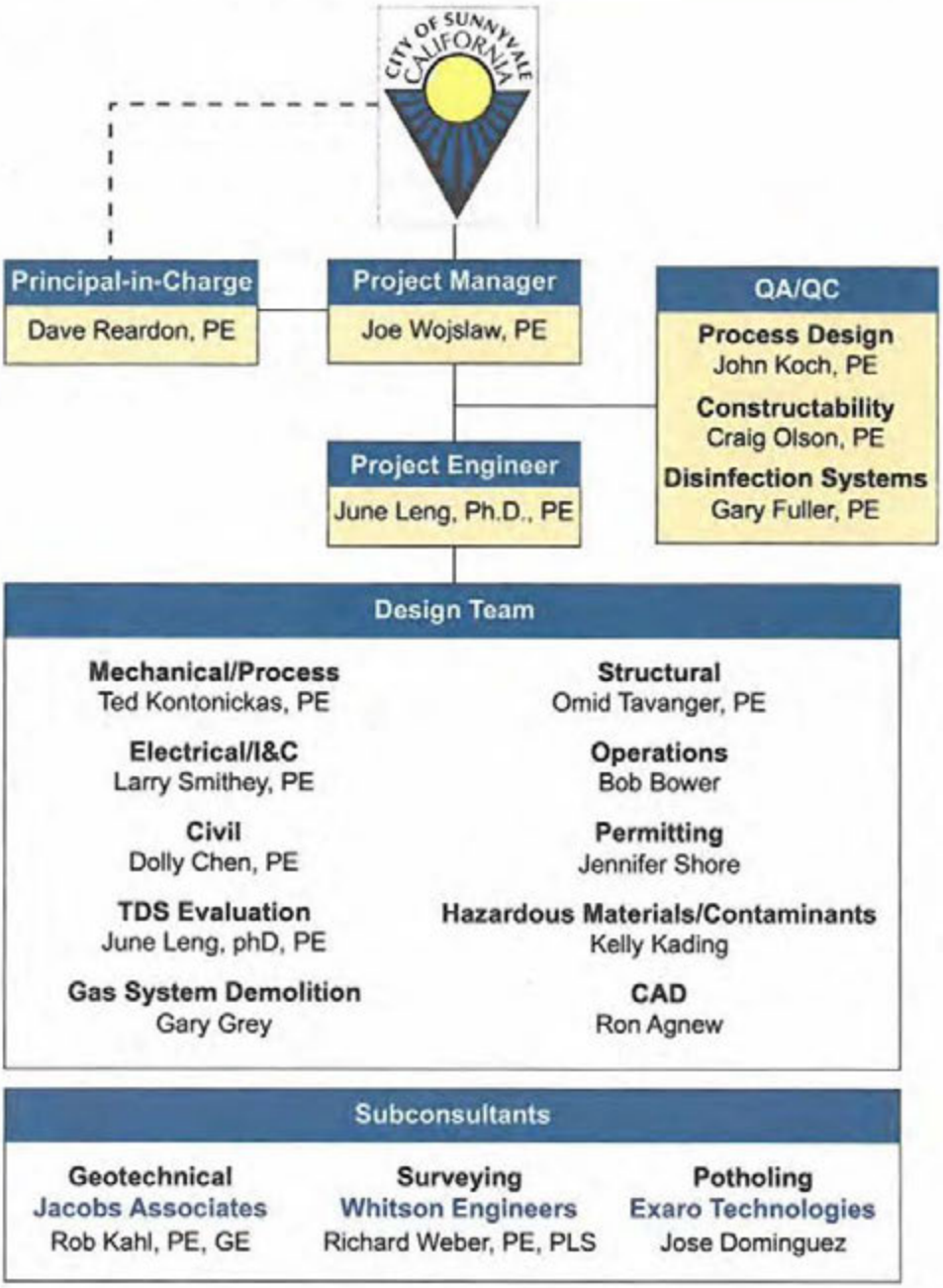


Figure 4-1 Project Team Organization Chart

Brief descriptions of their respective roles and functions on this project are listed below in Table 4-2. Our core team will be supported by specialty Subconsultants for geotechnical, surveying, and potholing and are presented in section 5.

Table 4-2: Key Team Members Program Roles and Functions

Team Member and Project Role	Project Responsibilities
Joe Wojslaw, PE Project Manager	▪ Providing overall project leadership and technical oversight ▪ Engaging project team experts as needed ▪ Working collaboratively with Sunnyvale WPCP staff to deliver a successful project ▪ Responsible for delivering a quality project, on time and within budget ▪ Working closely with project subconsultants ▪ Collaborating with other consultants involved on other City projects
June Leng, Ph.D., PE Project Engineer	▪ Responsible for overseeing the technical design team and coordinating closely with the project manager ▪ Primary lead on the TDS Evaluation effort ▪ Collaborating with other consultants involved on other City projects
Dave Reardon, PE Principal-in Charge	▪ Key point of contact for the City of Sunnyvale on all contractual issues ▪ Responsible for committing resources of the firm and ensuring follow through
John Koch, PE QA/QC Process Design	▪ Provide review of the conceptual and final process design of all project facilities ▪ Monitor design progress and deliverables to make sure that project quality meets the requirements of the City as described in the contract
Craig Olson, PE QA/QC Constructability	▪ Provide review, input and oversight to the design team on all issues related to constructability of facilities
Gary Fuller, PE QA/QC Disinfection Systems	▪ Provide review and oversight of the technical and non-technical issues associated with disinfection systems to help guide the design team

Overview

The City of Sunnyvale now collects, treats, and discharges an average of 14 million gallons of wastewater per day (MGD) at its water pollution control plant (WPCP) located at 1444 Borregas Avenue. This treatment plant was built in the 1950's and has undergone significant upgrades and improvements over the years. The existing process train includes aerated grit removal and primary sedimentation for primary treatment; 440 acres of oxidation ponds for secondary treatment; and fixed growth reactors, air flotation tanks (AFTs), dual-media filtration, and chlorine disinfection for tertiary treatment. The City is currently beginning the implementations process of long range improvements to the WPCP as part of its Strategic Infrastructure Plan (SIP). Upgrading the disinfection facilities is one component of that plan.

Sunnyvale WPCP's Site Plan

Project Understanding

For decades, the Sunnyvale WPCP has used gaseous chlorine as a final treatment of secondary effluent before neutralizing with bi-sulfate prior to Bay discharge. The recycled water production process also uses gaseous chlorine for disinfection and residual chlorine. Due to safety and useful life concerns, the City would like to replace these facilities with a sodium hypochlorite system. This would reduce risks associated with gaseous chlorine containers as well as improve safety at the plant.

Through the RFP, review of available reports previously prepared for the upgrades and expansion of the Sunnyvale WPCF, and communication and meetings with the City engineering staff, HDR has developed the following detailed understanding of the facilities and your expectations in four (4) tasks.

Task 1 - Implementing a conversion from gas disinfection and dechlorination to liquid chemical disinfection and dechlorination

The existing WPCF disinfection system uses gaseous chlorine for disinfection of entire plant effluent. Gaseous chlorine is delivered to the plant in 1-ton containers and stored in the Chlorine Building adjacent to the primary clarifiers. Chlorine is fed from the containers through evaporators to ensure it is in a complete gas phase prior to metering it with plant No.3 water to send as a solution to the chlorine contact basins. Gaseous sulfur dioxide is used for dechlorination in a similar way. Gaseous sulfur dioxide is injected to the plant effluent as it leaves the chlorine contact basin for Bay discharge. A liquid sodium bisulfite storage and feed system is in place to dechlorinate contact basin effluent for recycled water use.

This project will convert existing gaseous chlorine disinfection facility to liquid sodium hypochlorite disinfection facility and convert existing gaseous sulfur dioxide facility to liquid sodium bisulfite dechlorination system. The existing gaseous chlorine and sulfur dioxide storage and feed systems need to be removed so there will be no hazardous gases on site.

The bulk purchased sodium hypochlorite (12.5% solution) will be added to the head of the existing chlorine contact basin to disinfect the plant effluent. Final effluent leaving the chlorine contact basin will be injected and mixed with sodium bisulfite for dechlorination. The dechlorinated tertiary effluent leaving the existing chlorine contact basins either to Bay discharge or to offsite recycled water storage tank. The existing sodium bisulfite system will remain in use for recycled water dechlorination. The converted disinfection and dechlorination chemical systems will involve hypochlorite and bisulfite storage, metering, controls, and distribution piping to incorporate into the existing system.

Through our research of this project and in conversations with your team, HDR believes that a successful project will result in a **safe, reliable, and trouble-free disinfection system**. It will meet Sunnyvale WPCF's operational, financial, schedule, and sustainability goals which include:

- Practical disinfection system options and a strategy for justifying the selection of the best option.
- Clearly detailed systems that optimize construction, operations, costs, and sustainability objectives.
- An evaluation and design of hypochlorite storage options that considers costs and benefits of using existing facilities versus an outside storage facility.
- Effective construction services and project commissioning to provide systems that meet your operations schedule and that function as intended.

Task 2 – Assessing disinfection monitoring and compliance improvements including a condition assessment on existing outfall

The goal of this task is to recommend improvement needs and an implementation plan that leads to more reliable process control and compliance monitoring system for final effluent disinfection.

Based on the description in the project RFP, current compliance monitoring has been suspected to provide unreliable readings due to the fact that the final effluent chlorine residual analyzer(s) is too close to the dechlorination feed point.

The task will include:

- A study of the existing disinfection system process control system including flow pacing and/or residual pacing chlorine dose control strategy.
- A condition assessment of existing residual chlorine analyzers and its control system, i.e. response of the metering pumps to the residual concentration variations.
- A study of the existing compliance monitoring system including post-dechlorination chlorine residual monitoring location, completeness of dechlorination prior to compliance monitoring, and reliability of residual chlorine analyzers for low concentration readings after dechlorination.
- A condition assessment of the existing outfall (from the chlorine contact basin exit to the Bay) and evaluation if relocation of compliance monitoring point is a viable option.

Task 3 – Evaluating alternatives of concurrent recycled water disinfection

The goal of this task is to explore viable alternatives and recommend an implementation plan that leads to a dedicated chlorination and dechlorination system for the recycled water flow so there will be no interruption of disinfection operation for Bay discharge flow when recycled water production is in demand.

The current disinfection facility does not allow simultaneously produce recycled water and Bay discharge. The disinfection requirements are different for the two processes, but share the same chlorine contact basin.

	Bay Discharge	Recycled Water Project
Turbidity	10 NTU	2 NTU
Dechlorination	Sulfur dioxide	Sodium busulfite
Chlorine Residual	0	Need chlorine residual in purple pipe
Flow	Peak 40 mgd	Up to 1.2 mgd

Disinfection requirement for Bay Discharge and Recycled Water

Currently, disinfection of Bay discharge or recycled water has to be done as a batch mode, and operators have to switch back and forth manually on daily basis when recycled water production is in demand.

The task will include a study of the existing disinfection flow piping and the contact basin flow control mechanism; and provide potential alternatives for

separated disinfection systems that can be operated independently for Bay discharge flow and recycled water stream.

Task 4 – Evaluating alternatives for TDS reduction in recycled water

The recycled water produced at the Sunnyvale WPCP must meet the regulatory requirements for non-potable recycled water, however, the salt concentration, represented by Total Dissolved Solids (TDS) in the recycled water is high. TDS concentration of recycled water produced at Sunnyvale WPCP doubles and occasionally triples typical potable water salt content. The high salt concentration is problematic for salt-intolerant plant species, i.e. turf in golf course; and undesirable for most industrial uses since additional treatment is required.

The potential sources of the high TDS is currently under investigation by a consultant preparing a Recycled Water Master Plan for the WPCP. HDR will coordinate with the planning consultant in effort for identifying the source of high salt content in plant final effluent.

The goal of this task is to explore viable alternatives and recommend an implementation plan that leads to operational changes and potential facility improvement to reduce the recycled water TDS for particular end users.

Chlorine Contact Channels at the Sunnyvale SWPCP Facility

Project Approach

HDR understands the challenges associated with design and construction of sodium hypochlorite disinfection systems. Meeting the goals that ensure Sunnyvale has a successful project requires a consulting team that has:

- ☑ **A thorough understanding of all of the capital and O&M requirements** associated with sodium hypochlorite disinfection and sodium bisulfite dechlorination methods. This provides Sunnyvale practical implementation for your disinfection system.
- ☑ **Bench top dose-response study experience** to establish solid design criteria for hypochlorite and bisulfite facility storage and feed system design.
- ☑ **Significant and recent experience evaluating and designing hypochlorination and dechlorination systems** to develop a design that accounts for construction, operations, costs and sustainability objectives.
- ☑ **Design experience with indoor and outdoor installations** to understand the costs and benefits of each option.
- ☑ **Operation experience of chlorination and dechlorination systems** to optimize the process control and provide reliable compliance monitoring strategy.
- ☑ **Construction Services teams and Operations Specialists that will assist staff** to provide a seamless and trouble-free conversion of the chemical supply, storage, distribution, disinfection, and dechlorination systems.

The HDR approach – **developed by a team that has done large sodium hypochlorite conversion projects** – will allow the project team to gain support for the recommended improvements from all stakeholders.

A thorough understanding of all of the capital and O&M requirements associated with sodium hypochlorite disinfection and sodium bisulfite dechlorination methods provides practical implementation of your disinfection system.

Our preliminary design approach will focus on three (3) key things.

First, a chlorine dose-response study must be performed so we can establish solid design criteria, such as effective hypochlorite doses to meet the effluent pathogen limit for both Bay discharge and reuse.

Hypochlorite dosage will be different from the gaseous chlorine dosages in terms of pathogen reduction; both chlorine demand and chlorine residual requirements will be different.

The dose-response curves can be used to determine the chlorine demand and chlorine dose over a period of contact time; and the rate at which pathogens are inactivated over the contact time with various hypochlorite doses.

HDR staff has hands -on experiences of carrying out bench-scale chlorine dose-response tests for a number of WWTPs with various types of effluent. The results from the bench-top testing provided a design basis in terms of chlorine residual required to achieve target discharge limit and sodium hypochlorite dosage to compensate the demand in the plant final effluent.

Example results of bench-scale testing done by HDR on WWTP effluent are presented in Figure 9-1.

The effective hypochlorite dose range will be used to size the hypochlorite storage tanks and metering pump capacity, and develop an optimal chemical delivery frequency. The chlorine residual information will allow an estimate of bisulfite dosage based on stoichiometry ratio for dechlorination. The estimated bisulfite dosage will

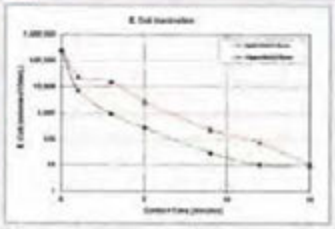
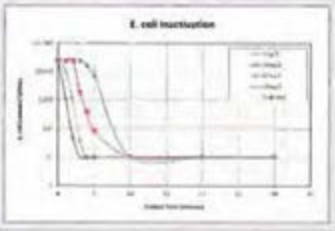
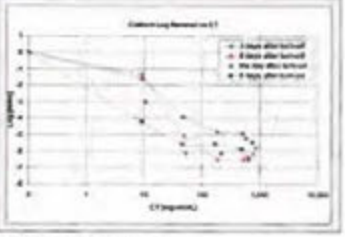
Dose Studies on Primary Bypass Flows		
Little Blue Valley Sewer District Atherton WWTP (400 MGD)		
Metropolitan St. Louis Sewer District Bissell Point WWTP (420 MGD)		
Sacramento Regional County Sanitation District WWTP (330 MGD)		

Figure 9-1: Example results of barrel scale testing

be used to size the bisulfite storage tanks and metering pumps and develop bisulfite delivery frequency.

Other water quality parameters related to the Hypochlorination practice need to be tested. For example gaseous chlorine lowers the pH of the final effluent, while hypochlorite will increase the pH of the final effluent. Hypochlorite addition will add TDS concentration to the final effluent as well.

Second, evaluation of existing disinfection systems need to be performed, particularly on remaining chemical storage and chemical metering systems that will be needed prior to implementing conversion to liquid chemicals at the WPCF include:

- Comparison of construction of new outside storage tankage versus reusing existing interior chemical building space.
- Negative impacts such as scaling and off-gassing in the long pipe runs necessary to deliver disinfection and dechlorination chemicals from one storage location to the existing chlorine contact basin.
- Recommendation of a method to maintain full-time (24/7) disinfection and dechlorination during construction.
- Identifying the method of removing the existing gas chlorine system with full consideration of safety, security, and risk to the plant and surrounding community.

HDR will ***characterize the primary economic and non-economic factors associated with chemical storage and feed options, allowing Sunnyvale to arrive at well-informed and defensible conclusions.*** To do this, we must **know the questions that need to be answered before starting work.** Therefore, with the preliminary design task we will establish criteria for an alternative evaluation using the Net Present Value spreadsheet, which includes both economic and non-economic factors. Criteria will be based on HDR's recent experiences at similar plants (such as San Jose/Santa Clara WPCP), Sunnyvale WPCP's project goals, and on criteria from the Facilities Master Plan. Table 9-1, shows the preliminary non-economic factors that might be included in the evaluation criteria. Determining evaluation criteria and their relative importance prior to initiating the evaluation will support an equitable comparison process, and will focus efforts on elements of alternatives that directly affect decision-making. Early identification of evaluation criteria also ensures that the alternatives will be developed to a sufficient level of detail to permit meaningful evaluation of critical factors. In addition to identifying appropriate non-economic criteria, early preliminary design efforts will focus on developing a comprehensive inventory of costs associated with operation, maintenance, and administration of the hypochlorite disinfection and bisulfite dechlorination systems, as well as completely characterizing existing facilities (both permanent and temporary).

Third, the **preliminary design phase** will evaluate implementation options that facilitate meeting Sunnyvale's goals. Questions that will be considered include:

- What is the most economical way to install

Table 9-1: Non-Economic Evaluation Criteria
Technical
Proven Performance
Reliability/Permit Compliance
Simplicity
Flexibility
Risk Hazard
Operations and Maintenance
Level of Operator Attention
Level of Maintenance
Level of Safety
Energy/Chemical Requirement
Availability of Chemicals
Budget Constraints
Community/Environment Impacts
Noise
Aesthetics
Air Quality
Traffic
Implementation
Phasing Opportunity
Operation During Construction
Ease of Construction
Compatibility with Site

Table 9-1, shows the preliminary non-economic factors that might be included in the evaluation criteria.

chemical feed piping? Can new chemical piping be easily added along existing piping routes with the existing gas and solution piping remaining in operation? If sending a dilute sodium hypochlorite solution to the injection points, what is the potential for calcium carbonate scaling which is typically associated with mixing hypochlorite with water containing some hardness? What measures are needed to address this issue? And are the mitigation measures and cost of continuously pumping No.3 water more expensive than installing new concentrated (neat) hypochlorite piping all the way to the points of injection?

Can the existing chemical building be used to receive and store sodium hypochlorite and bisulfite, and delay or eliminate the need for additional tanks onsite while maintaining the existing gas system in operation during construction? If so, does the building need major modifications to accommodate new tankage and containment?

Significant and recent experience evaluating and designing disinfection and dechlorination systems to develop a design that accounts for construction, operations, costs, and sustainability objectives.

While sodium hypochlorite is not as hazardous as chlorine gas, design of a hypochlorite disinfection system brings a unique set of challenges and considerations. ***Design of a chemical feed system that ensures safe and economical operation is critical***. HDR has substantial experience in the design of sodium hypochlorite disinfection facilities. ***We will apply this experience to ensure that your disinfection facility is well-designed, safe, easy to operate and maintain, and continues to meet your goals long after the construction dust has settled***.

Critical Design Issues

Issue: Sodium hypochlorite is a corrosive chemical, frequently causing leaks in PVC piping joints, and can significantly shorten storage tank life of tanks made from improper materials.

Solution: Through experience at St. Louis MSD Meramec WWTP, New York North River WWTP, City of Portland's Columbia Boulevard Wastewater Treatment Plant (CBWWTP), Clean Water Services' Durham Advanced Wastewater Treatment Facility, and elsewhere, HDR has developed an installation specification for Schedule 80 PVC hypochlorite piping systems that requires using an adhesive specifically developed for hypochlorite and caustic service, beveling the pipe end, and adhering to specific ASTM pipe joining and installation procedures. This results in solvent fusion pipe joint welds that significantly decrease the risk of leaks.

Issue: Sodium hypochlorite feed systems will suffer from scaling with the addition of high strength ("neat" – typically 12.5%) hypochlorite to unsoftened dilution water. The residual caustic soda in the neat hypochlorite elevates the carrier water pH and creates conditions for precipitation of calcium carbonate depending on the level of chemical hardness in the water. There is also the added cost and motor horsepower to continuously provide No.3 dilution water under a relatively high pressure.

Solution: By delivering neat hypochlorite all the way from storage to the points of injection, scaling problems can be eliminated, and pumping costs associated with providing No.3 dilution water can be avoided.

Issue: Degradation in neat hypochlorite strength and serious off-gassing in long pipelines with intermittent flow.

Solution: Neat hypochlorite is delivered to all application points in a continuously recirculating supply and return loop with the loop discharging back to the hypochlorite storage tank. This prevents "dead ends" and periods of low or no flow, which can result in excessive off-gassing in the piping as well as accelerated degradation of the hypochlorite and crystallization as it sits idle in the pipeline. Metering pumps are located along the loop as needed to keep them as close as possible to their feed points. A continuously recirculating loop will maintain "fresh" hypochlorite to each of the metering pumps and sweep accumulated oxygen bubbles back to the storage tanks to vent to the atmosphere.

Hypochlorite Disinfection System Remote Storage and Pumping Piping - Columbia Blvd. WWTP, Portland OR

This will be an important consideration and an advantage in feeding hypochlorite to the Chlorine Contact Basin. The loop piping would deliver neat hypochlorite in between storage, discharge effluent feed point and recycled stream feed point and avoid separate storage at the recycled stream feed point, requiring only metering pumps for injection at that location.

Issue: Gas accumulation is a major problem in hypochlorite systems. Oxygen gas can accumulate in piping causing "vapor lock," which greatly reduces or if severe enough, stops the flow of hypochlorite. It also causes "vapor binding" in pumps. Gas accumulation can also lead to a buildup of excessive pressure in valves and piping even exceeding their pressure rating.

Solution: To prevent vapor lock, avoid high points in piping (if at all possible). However, with the typical routing of pipe associated with hypochlorite feed systems, some high points usually are required. Air "degassing" valves (as opposed to "air release valves") greatly mitigate or eliminate collection of gas at these piping high points. Velocities must be maintained above three feet per second to sweep bubbles through minor high points.

HDR and its clients have successfully avoided pump vapor binding at Portland's CBWWTP and Clean Water Services' Durham Advanced Wastewater Treatment Facility, by using peristaltic pumps, which can easily pass gas bubbles. At the Hampton Roads Sanitation District (Virginia Beach, VA), venting of 90 diaphragm pumps in its multiple feed systems has successfully addressed gas accumulation.

Maintaining a positive up-slope between the pump suction and its storage tank also is essential to avoid pump vapor binding. This allows gas bubbles that develop in the suction pipe when the pump is idle to vent back to the tank.

Issue: Gas accumulation can also lead to a buildup of excessive pressure in ball valves and piping even exceeding their pressure rating causing a rupturing of the valve or piping.

Solution: Provide diaphragm valves or significantly less expensive PVC vented ball valves that prevent buildup of pressure in the valve. Also provide pressure relief valves between piping sections that can be isolated at both ends of the section.

Issue: Providing adequate turndown on chemical feed pumps can be a problem in plants with large fluctuations in flows such as will be the case at the WPCF, when recycled stream is taken away from the final effluent in parallel disinfection scenario. This difficulty often results

in overfeeding chemicals at low flow, and difficulty in maintaining adequate residuals at high flows increasing operating costs and difficulty of operation.

Solution: With peristaltic pumps, different size tubing can be used to achieve a variety of flow rates at a given pump speed. Pumps and tubing can be selected to meet the maximum chlorination requirements of each flow scenario, rather than attempting to size a single pump for the entire range of applications. Having a clear understanding of the speed signal that is acceptable to the pump VFD and the limitations of the control system is crucial in ensuring that adequate turndown is achieved.

Issue: To maintain plant disinfection at all times, sequencing responsibilities must be clearly conveyed to all parties during construction, including the contractor and Owner.

Solution: HDR has developed a sequence of construction specification that provides a summarized listing of all key project work events that will affect the operation of the existing and new facilities throughout construction. On the following page is an excerpt ("Sequence of Construction") from a similar project HDR designed at the Columbia Boulevard WWTP.

HDR staff know from first-hand experience what works and what doesn't work when it comes to delivering hypochlorite and bisulfite to the final application point.

Design experience with indoor and outdoor installations to understand the costs and benefits of each option.

Two basic storage options will be considered during the preliminary design concept development phase:

- Using the existing chemical building to house the new hypochlorite system.
- Installation of new outside storage tanks at the plant use the existing pads outside the existing chlorine building.

Both of these options should be closely examined for their economic, safety, and reliability characteristics as well as their impacts on keeping the existing gas system operating while the new hypochlorite system is installed and put into operation. Plant aesthetics and mitigating visual impacts are also important considerations.

Dry Weather Hypochlorine Residual Control Screen at Columbia Blvd. WWTTP

Based on preliminary analysis, continuing to use the existing chemical building for a sodium hypochlorite system appears to be an attractive option, however, it does limit Sunnyvale WPCP's ability to phase a transition from gaseous to sodium hypochlorite. Therefore, it is important to also carefully examine options for providing new hypochlorite storage facilities.

One option is to demolish sulfur dioxide building and install hypochlorite storage tanks in the sulfur dioxide room, while using bisulfite storage and feed system for entire plant effluent dechlorination during construction. No tampering with the gaseous chlorine system during construction. The chlorine building demolish can be done after liquid system commissioning.

Locating hypochlorite and bisulfite storage tanks just west of the chemical building on some currently empty pads would have the following advantages:

- Maximize the use of the exiting structure. There are six, 10-foot diameter concrete pads in a containment area.
- Chemical delivery could have easy access because the outdoor pads are located along the plant main access road.
- This location is adjacent to the existing chlorine building and sulfur dioxide building, the feed piping corridor might be able to accommodate the

Sequence of Construction

1. Following is a suggested general work sequence for the construction of critical work items. The sequence is intended to achieve the goal of continuous use of the affected facilities except for specifically described shutdowns. Work elements shown are not necessarily on a critical path and may be done simultaneously. Critical work elements shown are not necessarily complete and others may occur as the work proceeds. The Contractor shall submit a detailed work sequence schedule to accomplish the work in accordance with Section 01310.
   a. A separate, specific, and highly detailed work sequence schedule shall be submitted for the switchovers of the PEWW and SE disinfection systems to accomplish the work outlined in Section 17900. This schedule shall outline all necessary tasks and state a specific starting and ending day and time.
2. All of the Owner's facilities are to remain operational at all times unless specifically designated for shutdown in the following sequence. **Shutdowns of facilities are shown in bold**. *Shutdown times and other time periods are* shown *in italics and are for consecutive 7-day weeks, 24-hour day periods, workday hours, or as otherwise indicated.* No shutdown of facilities will occur without adequate prior demonstration to the Engineer that all equipment, materials, and supplies are on site and operable.
   a. Shutdowns and switchovers of the PEWW and SE disinfection systems must start on a Monday morning and have the Engineer's and the City's prior approval. Approval shall be subject to the upcoming weather forecast; switchover work cannot take place during periods of inclement weather.
3. The Owner will perform activities that are underlined. All other activities shall be performed by the Contractor as part of an approved work sequence schedule. Installation of equipment shall include all electrical and control systems, and startup and commissioning activities as specified in Section 01650.
4. Sequence of events:
   a. Order and process shop drawings for new pumps, valves, piping (including double containment piping), and electrical and instrumentation hardware.
   b. Complete installation of Phase 1 work elements listed above, including a temporary control panel for SE hypochlorite metering pumps (HMP) in Tunnel Blue as shown.
   c. **Shut down gaseous chlorination system to PEWW disinfection**. ***(Maximum of 5 days commencing on a Monday morning).***
   d. **During Shutdown**:
      1) Perform all work in accordance with approved work sequence schedule.
      2) Remove existing PEWW control panel.
      3) Install new PEWW control panel and complete all power and interconnection wiring.
   e. Complete PCS #1 startup through Acceptance Testing per Section 01650 using temporary control panel for SE HMP's and permanent control panel for PEWW HMP's.
   f. Assume operation of hypochlorite loop system and delivery of hypochlorite to Loop Storage Tanks.
   g. **Shut down PLC control of SE HMP's** ***(Maximum of 3 days commencing on a Monday morning).***
   h. **During Shutdown**:
      1) Perform all work in accordance with approved work sequence schedule.
      2) Switch SE HMP's to Local/Manual control.
      3) **Shut down gaseous chlorination system to SE disinfection**.
      4) Operate the SE HMP's in Local/Manual to provide disinfection of SE.
      5) Relocate temporary control panel to the existing SE control panel housing in Tunnel Blue along with rerouting of residual chlorine signal wiring.
      6) Complete all reconnection of existing wiring. Complete all new power and interconnection wiring.
   i. Assume operation of SE and PEWW HMP's with PLC control.
   j. Purge entire existing gaseous chlorine system of chlorine gas.
   k. Remove chlorine gas tank car(s) from Receiving Building.
   l. Complete installation of Phase 2 work elements listed above.
   m. Complete PCS #2 startup through Acceptance Testing per Section 01650.
   n. Assume operation of hypochlorite transfer system and regular delivery of hypochlorite to Receiving Building Storage Tanks.

Example Sequence of Construction from Columbia Boulevard WWTP

new hypochlorite and bisulfite feed piping.

- Storage tanks could be mounted vertically, which would require less footprint at a lower cost than horizontally mounted tanks potential required for indoor installation.
- Locating storage at the existing chemical building allows the existing structure to be reused at some cost savings, but temporary disinfection facilities probably would be required so that the existing system could be demolished prior to construction of the new hypochlorite system.

Some general considerations for location and types of **chemical storage tanks** are listed in Table 9-2.

Construction Services teams and Operations Specialists that will assist Sunnyvale staff on this project to provide a "seamless" and trouble-free conversion of the chemical supply, storage, distribution, disinfection, anddechlorination systems.

The design process outlined in the Scope of Work included in this proposal allows us to address identified issues to produce a design that meets your needs. However, we understand that this project really begins when a construction contract is awarded. It is critical that Sunnyvale's new disinfection system starts and operates with no problems to immediately gain the confidence of plant staff. HDR will be with plant staff through project commissioning to answer questions, review submittals, and provide an O&M manual that clearly describes the intent and operation of the facilities. We will provide additional start-up services to ensure that the system functions properly from the first day of operation.

HDR's long-term support to treatment plants such as City of Portland's CBWWTP, and the City of Las Vegas Water Pollution Control Plant, has given our team the ability to understand and meet the needs of an operating plant and its staff during construction and project commissioning. We will support Sunnyvale staff through these phases to quickly answer questions and review submittals, thereby ensuring your staff can manage the construction schedule and cost with the desired results. Prior to startup of the new facilities we will provide an O&M manual that clearly describes the intent and

Table 9-2: Considerations for location and types of chemical storage tanks

Issues	Comments
Inside vs. Outside Storage	▪ Hypochlorite storage requires UBC fire rated separation between the storage facility and any other structures within 20 feet. ▪ Inside storage per the UFC requires a fire sprinkler system for the building. Placing the tanks inside a building allows for some degree of control of the sodium hypochlorite solution temperatures, limiting degradation. ▪ Outdoor storage does not significantly compromise hypochlorite storage and degradation if the tanks are opaque or insulated and storage is limited to less than 3-4 weeks on site. Without these precautions, degradation can be as high as 1 percent per week. ▪ Rainwater in the storage area must be dealt with, but can be handled with proper design of sump pumps
Types of Storage Tanks	▪ High-density linear polyethylene (HDLPE) tanks provide excellent chemical compatibility with hypochlorite at a cost less than fiberglass reinforced plastic (FRP), but are limited in size to a maximum of approximately 10,000 gallons due to their lower structural strength. HDLPE tanks can be opaque or insulated. They have a standard warranty of 5 years for outside storage. Structural strength can be increased by use of cross-linked polyethelene (XLPE), which is considered the PE tank with the most strength, while HDLPE is considered to have better chemical compatibility, but not as strong, and some call it "brittle." A combination of the two materials using an outer shell of layered XLPE and an inner liner of HDPLE has been used successfully to maximize the size of PE tank that can be used. ▪ FRP is not compatible in direct contact with hypochlorite but with a Nexus veil wall lining to protect the FRP tanks they provide a high strength tank very suitable for hypochlorite storage. They become more economical in larger sizes and are typically used for tanks in excess of 10,000 gallons. The typical warranty for FRP tanks provided for outside storage is 1 to 2 years, but systems designed by HDR with this type of tank have typically been shown to be in excellent condition after 5 years of service with hypochlorite. Regular inspections every 4 to 5 years with minor repairs as needed has shown to greatly extend the life of FRP tanks in this application. Hampton Roads Sanitation District (Virginia Beach) installed about 20 FRP tanks 10 years ago that were in excellent shape when last inspected in 2005.

operation of the facilities.

In addition, HDR will perform the task of coordinating and conducting start-up of your facilities and providing operator training. Many clients have found this to be an invaluable step in the design and construction project. It provides a mechanism for holding the contractor accountable for making sure that in addition to having individual pieces of equipment function properly, the *entire system* functions as designed. This result is achieved through a "start-up checklist" prepared by our operations specialists. The checklist itemizes each process parameter, and records the control action, expected result, and actual result for actions initiated at the local control level and any remote operating location. HDR can provide these checklists for use by Sunnyvale WPCP's inspectors, participate in or lead the start-up process, and provide training to operations staff once a successful start-up has been documented.

HDR has three Operations Specialists who can be onsite before, during and after project commissioning as often as necessary to ensure successful implementation of the Sodium Hypochlorite Conversion project. All three Operations Specialists are certified Level 4 wastewater treatment plant operators and managers who have assisted with the design, construction and startup of hypochlorite and bisulfite storage and feed systems. We know from first-hand experience what works and what doesn't work when it comes to delivering hypochlorite and bisulfite to the final application point.

Successful commissioning of the Sodium Hypochlorite Conversion project will require close cooperation and scheduling between the WPCP's construction management staff, HDR Operations Specialists, the Plant O&M staff, the General Contractor, and Subcontractors.

One potential area for misunderstanding between the Plant O&M staff and the Contractor is that the term "startup" means different things to different people. To the equipment supplier it may mean running the equipment for 15 minutes and finishing the mandatory paperwork. To the Contractor it may mean nothing failed and thus no re-work is required. To the Owner it means that the unit process works without glitches. To an HDR Operations Specialist it means that the unit process or system is operating properly with the process liquid under full automatic control and that the O&M staff fully understands the design intent, is comfortable with operating the equipment, and can maintain the equipment properly.

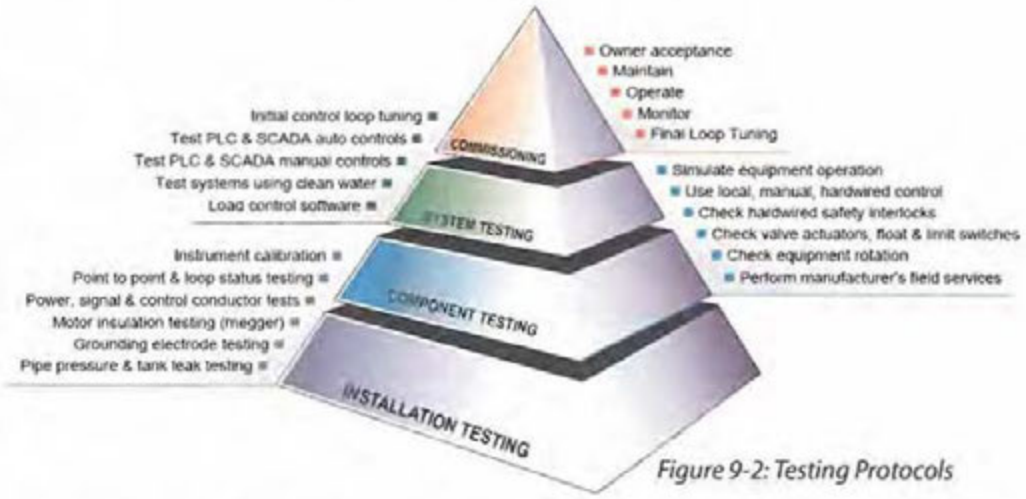


Figure 9-2: Testing Protocols

Commissioning a system or systems is a method of achieving, verifying and documenting that the system performance meets the design intent as well as the functional and operational needs of the facility operator. There are numerous checkpoints for each stage of the construction and commissioning process, therefore set procedures and written checklists will be followed so that each stage of the process can be documented. Detailed commissioning checklists will be prepared by HDR to provide specific tasks for HDR's Operations Specialists, the Plant O&M staff, Sunnyvale WPCP's Construction Management Staff, the General Contractor, and the Subcontractors. Figure 9-2 provides an overview of the protocol of various levels of testing that will be followed and forms the "pyramid" of a successful project commissioning. The ultimate goal of commissioning is for the plant staff to effectively and efficiently operate the new assets in a whole plant context meeting targeted performance objectives. HDR's Operations Specialists have the experience and capability to achieve this objective.

Definition and Measurement of Project Success

Success will be measured against whether your project goals are met – during and throughout the project.

The previous sections described the unique abilities and approaches that HDR will bring to this project to make it successful. We will achieve success because the HDR team has:

- A thorough understanding of all of the capital and O&M requirements associated with sodium hypochlorite disinfection and sodium bisulfite dechlorination methods to provide practical disinfection system options.
- Significant and recent experience evaluating and designing disinfection and dechlorination systems to develop a design that accounts for construction, operations, costs, and sustainability objectives.
- Design experience with indoor and outdoor installations to understand the costs and benefits of each option.
- Construction Services teams and Operations Specialists that will assist Sunnyvale staff in this project to provide a "seamless" and trouble-free conversion of the chemical supply, storage, distribution, disinfection, and dechlorination systems.

By selecting HDR, Sunnyvale will receive a safe, reliable, and trouble-free disinfection system meeting your operational, financial, schedule, and sustainability goals.

Ability to Perform

HDR Engineering has the resources and systems to deliver a successful sodium hypochlorite facility to the City of Sunnyvale. We have a consistent history of meeting schedules and budgets while maintaining technical excellence. Company policies are directed towards assisting project managers in the timely completion of projects. Resources are allocated as necessary to ensure conformance to this policy.

HDR maintains close control over project costs by means of detailed initial cost projections, appropriate personnel allocations, accurate scheduling and strict adherence to scheduling requirements, periodic project reviews, and close communication among project participants.

Budget and Schedule Management

HDR has sophisticated budget and schedule tools, in addition to management techniques and procedures, to ensure a successful project for the City of Sunnyvale. These time-tested, proven management techniques and procedures (detailed below) consistently deliver high quality services and work products for our clients.

Schedule Management

HDR will use multiple methods and tools to achieve affective schedule control, they include:

- ☑ MS Project scheduling software (the enclosed project schedule was prepared in this format).
- ☑ HDR's **Workplan** software which identifies who is working on the project.

- ☑ Develop a schedule of deliverable dates for each phase of the project.
- ☑ Prepare a 3-month look-ahead schedule and provide to each team member (see below). This would include key milestones, submittals, meetings, QA/QC activities, Bi-monthly meetings and other information.

Budget Control

HDR consistently meets our budget commitments. Company policies are directed toward assisting Project Managers to meet schedules and control budgets. The following budget tools will be used:

- ☑ Cost information is available on a weekly basis to manage the project.
- ☑ **Project Manager Dashboard** is a tool tied to the accounting program that summarizes all costs that are charged to a project, including subconsultants.

- ☑ **Workplan** is also resource loaded and provides a quick summary of work progress.
- ☑ Regular, detailed reviews by the QA/QC Committee to assess progress and identify potential cost saving measures.
- ☑ Strict adherence to the predesign schedule. Preparation and maintenance of a decision log.
- ☑ Preparation of a detailed cost estimate at the predesign stage and update of the schedule as the design progresses.
- ☑ HDR's "Design-to-Goal" approach to cost control. This approach constantly updates the construction cost estimate. If the costs exceed the budget, then

the HDR team will meet with City staff to identify potential cost saving ideas. The construction cost estimates will be prepared by members of HDR's Design – Build group.

Key Personnel Workload and Time Commitment

All members of our team have adequate time available to complete your project successfully within the time frame indicated in the schedule, and are fully committed to this project. This team can begin work upon receipt of a notice to proceed. Table10-1 below indicates the workload and time commitments for our key Personnel.

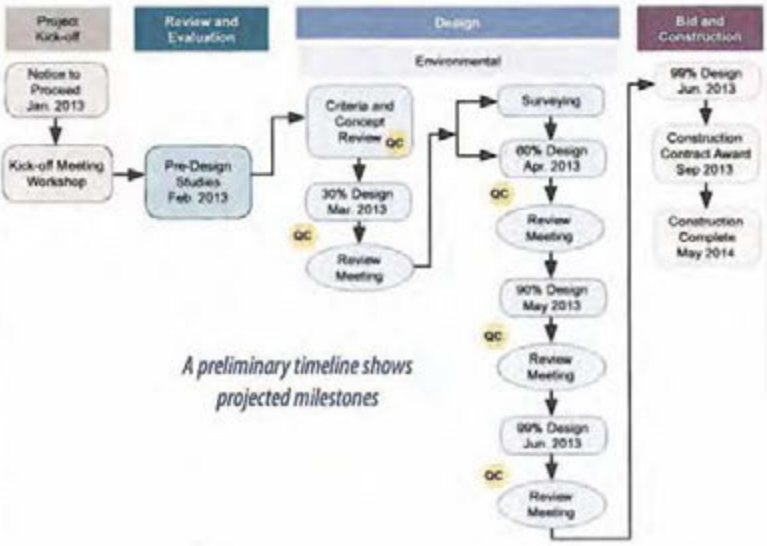
Table 10-1: Key Team Members' Workload and Availability

Key Personnel	Current Workload	Project Availability %
Joe Wojslaw, PE Project Manager	▪ City of Los Angeles BOS - TOS-S46 CM ▪ West Basin Municipal Water District - Hyperion Sec. Effluent	50%
June Leng, Ph.D., PE Project Engineer	▪ MSD High Rate Clarification Treatment Eval. ▪ ALCONSAN Disinfection Piloting Project ▪ Pinole WWTP Improvement Project	60%
Dave Reardon, PE Principal-in Charge	▪ EBMUD - Food Waste Digester ▪ Napa Sanitary District - FOG Engineering Services for Design Construction	15%
John Koch, PE QA/QC Process Design	▪ Orange County Water District Solids Improvement	10%
Craig Olson, PE QA/QC Constructability	▪ Rio Dell WWTP Upgrade ▪ Napa Sanitary District Influent PSEP	10%
Gary Fuller, PE QA/QC Disinfection Sys.	▪ City of St. Helens Membrane Filtration Water Treatment Facility	10%

Project Schedule

We have developed a preliminary project schedule for completing the design and construction of the Sodium Hypochlorite Disinfection Project. Key assumptions used in developing this schedule include:

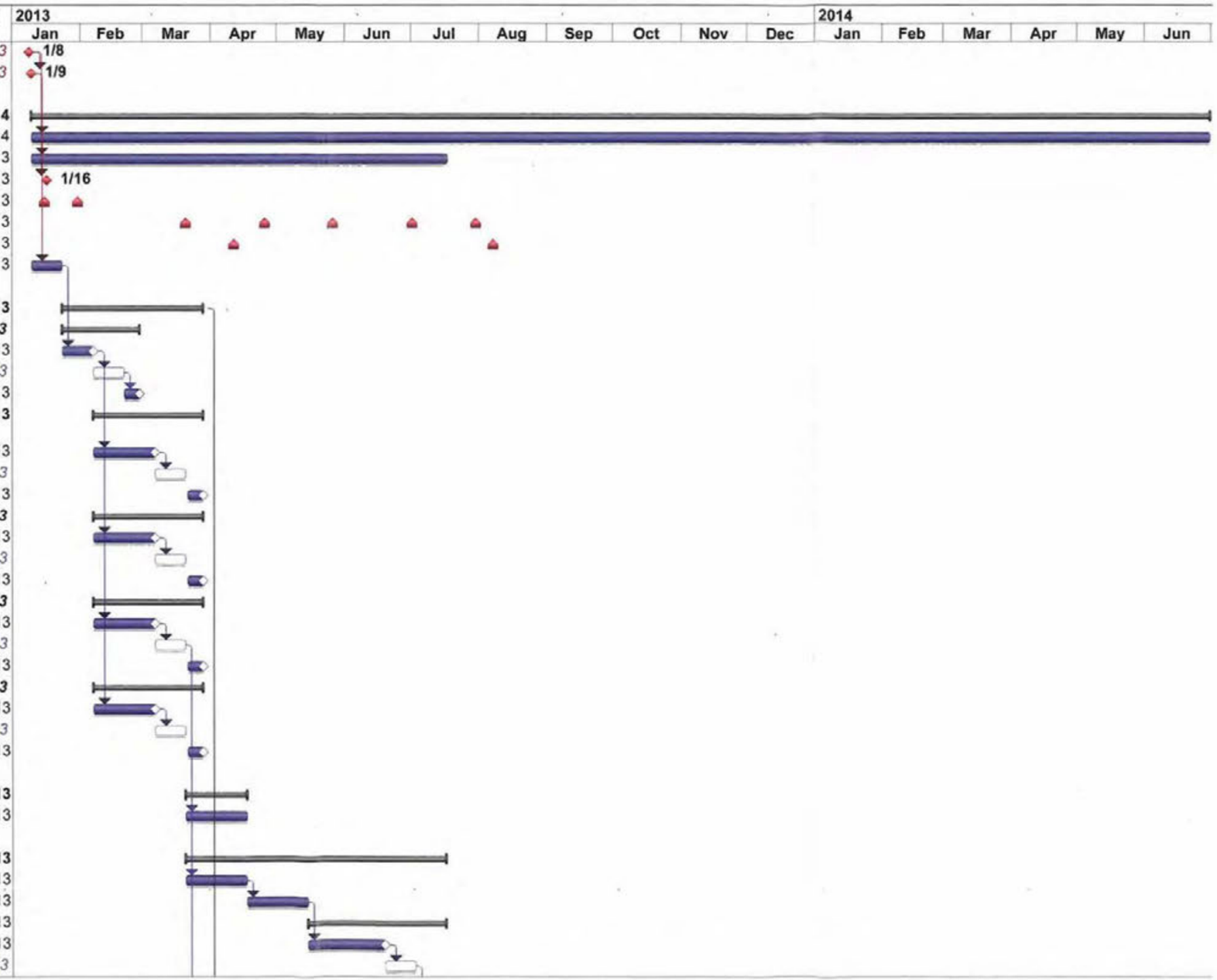
- NTP issued by January 2013
- Project Kick-Off January 2013
- Pre-Design Studies Complete by February 2013
- 30% Design Submittal by March 2013
- 60% Design Submittal by April 2013
- 90% Design Submittal by May 2013
- 99% Design Submittal by June 2013
- 100% Bid Package by July 2013
- Construction Contract Award September 2013
- Construction Complete - May 2014



A preliminary timeline shows projected milestones

Project Schedule

ID	Task Name	Start	Finish
1	*Council Approval (2/Month - Tuesdays)*	*1/8/13*	*1/8/13*
2	*Consultant Notice to Proceed*	*1/9/13*	*1/9/13*
3			
4	**Project Management**	**1/10/13**	**6/30/14**
5	Project Management and Coordination	1/10/13	6/30/14
6	QA/QC Program	1/10/13	7/17/13
7	Kick-off Meeting	1/16/13	1/16/13
8	Site Visits	1/16/13	1/31/13
11	Reviews and Progress Meetings	3/21/13	7/31/13
20	Design Presentations	4/12/13	8/8/13
23	Request for Information	1/10/13	1/23/13
24			
25	**Pre-Design Study and Basis of Design Report**	**1/24/13**	**3/28/13**
26	***Condition Assessment***	***1/24/13***	***2/27/13***
27	Draft Report	1/24/13	2/6/13
28	*City Review*	*2/7/13*	*2/20/13*
29	Final Report	2/21/13	2/27/13
30	***Conversion from Gaseous Chlorine to Liquid Chlorine***	**2/7/13**	**3/28/13**
31	Draft Report	2/7/13	3/6/13
32	*City Review*	*3/7/13*	*3/20/13*
33	Final Report	3/22/13	3/28/13
34	***Operational Improvements***	***2/7/13***	***3/28/13***
35	Draft Report	2/7/13	3/6/13
36	*City Review*	*3/7/13*	*3/20/13*
37	Final Report	3/22/13	3/28/13
38	***Simultaneous Production of Recycled Water***	***2/7/13***	***3/28/13***
39	Draft Report	2/7/13	3/6/13
40	*City Review*	*3/7/13*	*3/20/13*
41	Final Report	3/22/13	3/28/13
42	***Reduction of TDS in Recycled Water***	***2/7/13***	***3/28/13***
43	Draft Report	2/7/13	3/6/13
44	*City Review*	*3/7/13*	*3/20/13*
45	Final Report	3/22/13	3/28/13
46			
47	**Surveying**	**3/21/13**	**4/17/13**
48	Field/Topographic Survey & Basemapping	3/21/13	4/17/13
49			
50	**Geotechnical**	**3/21/13**	**7/17/13**
51	Subsurface Explorations	3/21/13	4/17/13
52	Laboratory Testing	4/18/13	5/15/13
53	Geotechnical Report	5/16/13	7/17/13
54	Draft Report	5/16/13	6/19/13
55	*City Review*	*6/20/13*	*7/3/13*

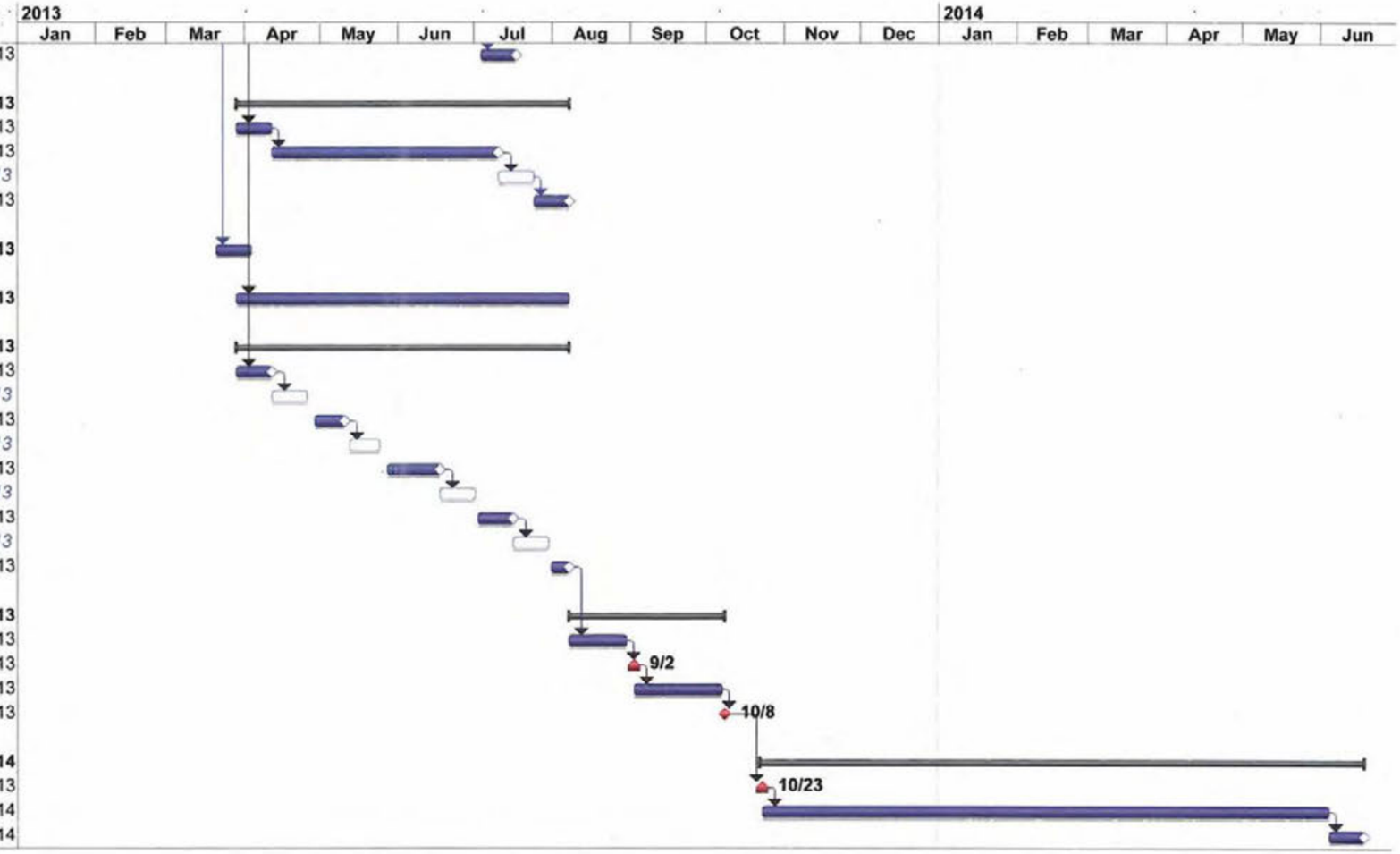


City of Sunnyvale
Sodium Hypochlorite Disinfection System for the Water Pollution Control Plant, Project No. UY-12/09-15

Task — Summary — Review Period
Milestone — Meetings/Workshops

Project Schedule

ID	Task Name	Start	Finish
56	Final Report	7/4/13	7/17/13
57			
58	**Environmental**	**3/29/13**	**8/7/13**
59	Project Description	3/29/13	4/11/13
60	Draft Categorical Exemption	4/12/13	7/10/13
61	*City Review*	*7/11/13*	*7/24/13*
62	Final Categorical Exemption	7/25/13	8/7/13
63			
64	**Potholing**	**3/21/13**	**4/3/13**
65			
66	**Permitting and Regulatory Requirements**	**3/29/13**	**8/7/13**
67			
68	**Design Services**	**3/29/13**	**8/7/13**
69	Preliminary Design (30%)	3/29/13	4/11/13
70	*City Review*	*4/12/13*	*4/25/13*
71	60% Design	4/29/13	5/10/13
72	*City Review*	*5/13/13*	*5/24/13*
73	90% Design	5/28/13	6/17/13
74	*City Review*	*6/18/13*	*7/1/13*
75	99% Design	7/3/13	7/16/13
76	*City Review*	*7/17/13*	*7/30/13*
77	100% Bid Package	8/1/13	8/7/13
78			
79	**Bidding Phase**	**8/8/13**	**10/8/13**
80	Advertise for Bid	8/8/13	8/30/13
81	Prebid Meeting	9/2/13	9/2/13
82	Bid Period	9/3/13	10/7/13
83	Award	10/8/13	10/8/13
84			
85	**Construction Phase**	**10/23/13**	**6/19/14**
86	Preconstruction Meeting	10/23/13	10/23/13
87	Construction Period	10/24/13	6/5/14
88	As-Built Drawings	6/6/14	6/19/14

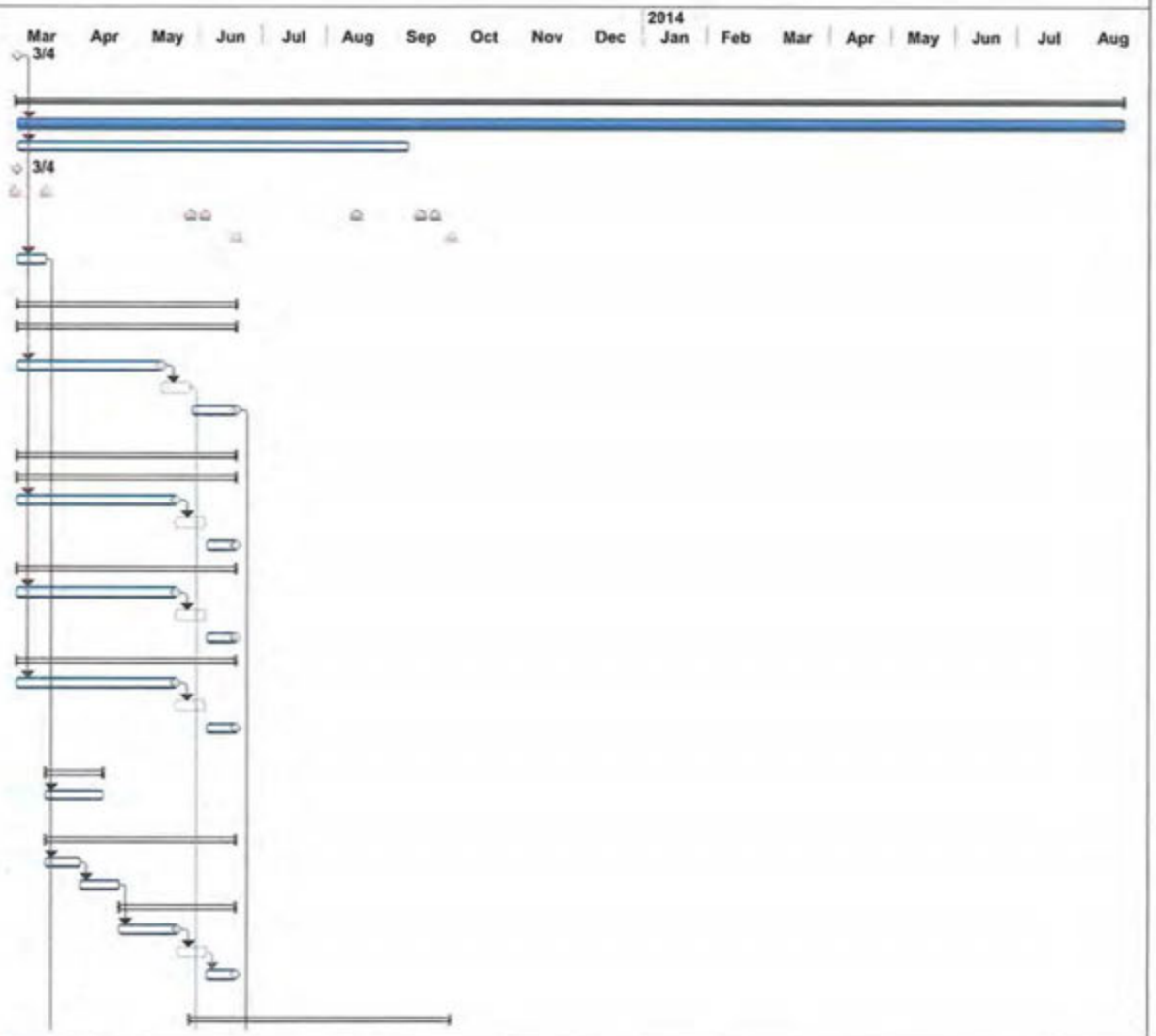


Task | Summary | Review Period
Milestone | Meetings/Workshops

EXHIBIT "A-1"

Project Schedule

ID	Task Name	Start	Finish
1	*Consultant Notice to Proceed*	*3/4/13*	*3/4/13*
2			
3	**Project Management**	**3/4/13**	**8/21/14**
4	Project Management and Coordination	3/5/13	8/21/14
5	QA/QC Program	3/5/13	9/9/13
6	Kick-off Meeting	3/4/13	3/4/13
7	Site Visits	3/4/13	3/19/13
10	Reviews and Progress Meetings	5/28/13	9/23/13
18	Design Presentations	6/19/13	10/1/13
21	Request for Information	3/5/13	3/18/13
22			
23	**Basis of Design Report**	**3/5/13**	**6/18/13**
24	***Conversion from Gaseous Chlorine to Liquid Chlorine***	**3/5/13**	**6/18/13**
25	Draft Report	3/5/13	5/13/13
26	*City Review*	*5/14/13*	*5/27/13*
27	Final Report	5/29/13	6/18/13
28			
29	**Conceptual Feasibility Studies**	**3/5/13**	**6/18/13**
30	***Operational Improvements***	***3/5/13***	***6/18/13***
31	Draft Report	3/5/13	5/20/13
32	*City Review*	*5/21/13*	*6/3/13*
33	Final Report	6/5/13	6/18/13
34	***Simultaneous Production of Recycled Water***	***3/5/13***	***6/18/13***
35	Draft Report	3/5/13	5/20/13
36	*City Review*	*5/21/13*	*6/3/13*
37	Final Report	6/5/13	6/18/13
38	***Reduction of TDS in Recycled Water***	***3/5/13***	***6/18/13***
39	Draft Report	3/5/13	5/20/13
40	*City Review*	*5/21/13*	*6/3/13*
41	Final Report	6/5/13	6/18/13
42			
43	**Surveying**	**3/19/13**	**4/15/13**
44	Field/Topographic Survey & Basemapping	3/19/13	4/15/13
45			
46	**Geotechnical**	**3/19/13**	**6/18/13**
47	Subsurface Explorations	3/19/13	4/4/13
48	Laboratory Testing	4/5/13	4/23/13
49	Geotechnical Report	4/24/13	6/18/13
50	Draft Report	4/24/13	5/21/13
51	*City Review*	*5/22/13*	*6/4/13*
52	Final Report	6/5/13	6/18/13
53			
54	**Environmental**	**5/28/13**	**9/30/13**



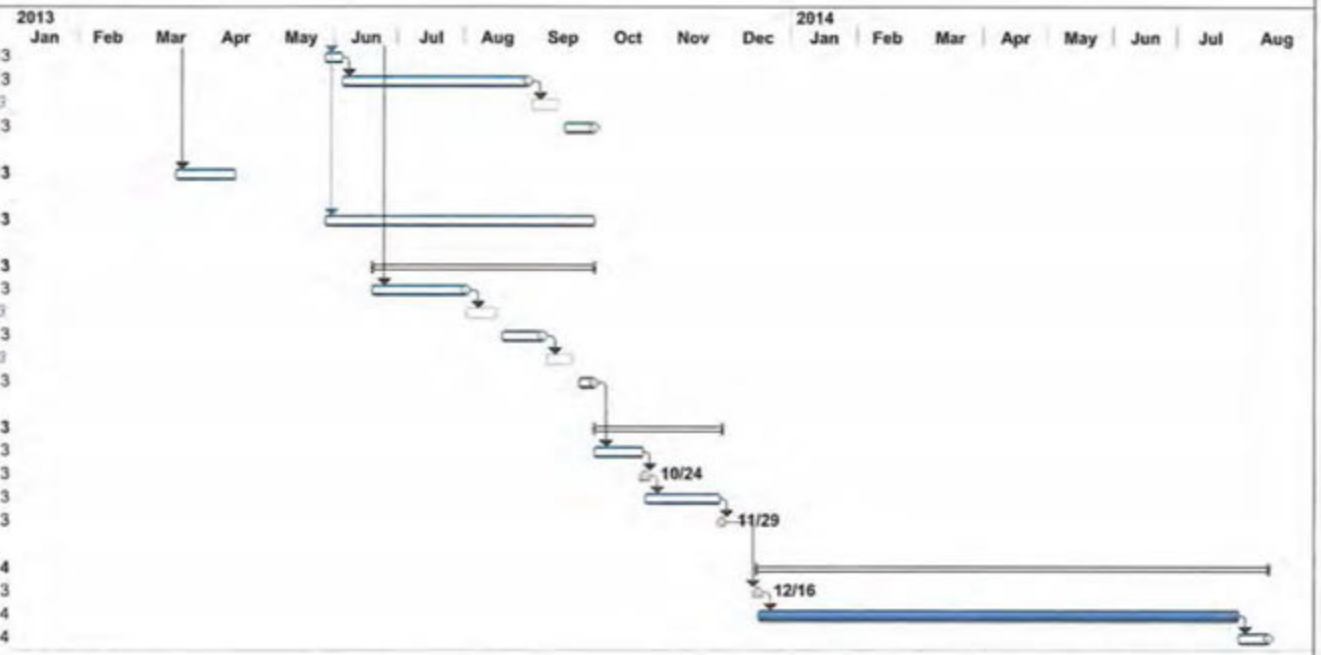
City of Sunnyvale
Sodium Hypochlorite Disinfection System for the Water Pollution Control Plant, Project No. UY-12/09-15

Task | Milestone | Summary | Meetings/Workshops | Review Period

12190\Contracts

Project Schedule

ID	Task Name	Start	Finish
55	Project Description	5/28/13	6/4/13
56	Draft Categorical Exemption	6/5/13	8/30/13
57	*City Review*	*9/2/13*	*9/13/13*
58	Final Categorical Exemption	9/17/13	9/30/13
59			
60	**Potholing**	**3/19/13**	**4/15/13**
61			
62	**Permitting and Regulatory Requirements**	**5/28/13**	**9/30/13**
63			
64	**Design Services**	**6/19/13**	**9/30/13**
65	75% Design	6/19/13	8/1/13
66	*City Review*	*8/2/13*	*8/15/13*
67	100% Design	8/19/13	9/6/13
68	*City Review*	*9/9/13*	*9/20/13*
69	Final Bid Package	9/24/13	9/30/13
70			
71	**Bidding Phase**	**10/1/13**	**11/29/13**
72	Advertise for Bid	10/1/13	10/23/13
73	Prebid Meeting	10/24/13	10/24/13
74	Bid Period	10/25/13	11/28/13
75	Award	11/29/13	11/29/13
76			
77	**Construction Phase**	**12/16/13**	**8/12/14**
78	Preconstruction Meeting	12/16/13	12/16/13
79	Construction Period	12/17/13	7/29/14
80	As-Built Drawings	7/30/14	8/12/14



City of Sunnyvale
Sodium Hypochlorite Disinfection System for the Water Pollution Control Plant, Project No. UY-12/09-15

Task | Summary | Review Period
Milestone | Meetings/Workshops

12190\Contracts

EXHIBIT "B"

ESTIMATED WORK EFFORT AND COST

City of Sunnyvale

Proposal for Sodium Hypochlorite Disinfection System for the Water Pollution Control Plant, Project No. UY-12/09-15

HDR Engineering, Inc.

Tasks		Labor															Subconsultants[1]				ODCs[2]	Total
Task #	Task Description	Principal	Tech Specialist (QA/QC)	Project Manager	Project Engineer	Civil/ Demo	Permitting	Haz Mat	Structural Engineer	Mechanical Engineer	Electrical Engineer	Operations	CAD Tech	Admin/ Clerical	Total Hours	Total Labor Costs	Geotech	Surveying	Corrosion	Potholing	Other Direct Costs	Total Fee
		Reardon	*Koch*	*Wojslaw*	*Leng*	*Chen, Grey*	*Shore*	*Kading*	*Tavangar, Li*	*Kontonickas*	*Smithey*	*Bower*	*Agnew*	*TBD*			*Jacobs*	*Witson*	*V&A*	*Exaro*		
		$ 279	$ 251	$ 275	$ 174	$ 170	$ 109	$ 201	$ 224	$ 191	$ 182	$ 192	$ 132	$ 111								
1	**Project Management**	**8**	**40**	**80**	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**0**	**6**	**16**	**156**	**$37,947**	**$0**	**$0**	**$0**	**$0**	**$4,449**	**$42,395**
1.1	Project Management and Coordination			32									2	8	42	$9,951					$1,500	$11,451
1.2	QA/QC Program	8	40	4										2	54	$13,594					$449	$14,043
1.3	Kick-off Meeting			4									2	2	8	$1,585					$300	$1,885
1.4	Site Visits (up to 2)			8							2				10	$2,564					$600	$3,164
1.5	Reviews and Progress Meetings (up to 5)			24						2	2			2	30	$7,567					$1,000	$8,567
1.6	Design Presentations (up to 2)			8									2	2	12	$2,685					$600	$3,285
2	**Conceptual Feasibility Studies and Basis of Design Report**	**0**	**0**	**44**	**84**	**0**	**0**	**0**	**0**	**22**	**2**	**29**	**20**	**12**	**213**	**$40,841**	**$0**	**$0**	**$29,984**	**$2,623**	**$766**	**$74,214**
2.1	Conversion from Gaseous Chlorine to Liquid Chlorine (see item 8)			0	0					0		0		0	0	$0					$0	$0
2.2	Operational Improvements			4	4						2	6		4	20	$3,757			$15,376	$3,623	$74	$21,830
2.3	Simultaneous Production of Recycled Water			20	40					20		3		4	87	$17,309					$300	$17,609
2.4	Reduction of TDS in Recycled Water			20	40					2		20	20	4	106	$19,775			$14,608		$392	$34,775
3	**Surveying**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$0**	**$0**	**$16,139**	**$0**	**$0**	**$0**	**$16,139**
3.1	Field/Topographic Survey & Basemapping														0	$0		$16,139				$16,139
4	**Geotechnical**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$0**	**$15,776**	**$0**	**$0**	**$0**	**$0**	**$15,776**
4.1	Subsurface Explorations (up to 3 borings)														0	$0	$6,416					$6,416
4.2	Laboratory Testing														0	$0	$2,830					$2,830
4.3	Geotechnical Report														0	$0	$6,531					$6,531
5	**Environmental**	**0**	**0**	**14**	**14**	**0**	**32**	**4**	**0**	**0**	**0**	**0**	**0**	**22**	**86**	**$13,033**	**$0**	**$0**	**$0**	**$0**	**$3,500**	**$16,533**
5.1	Project Description			2	2		2							4	10	$1,561					$500	$2,061
5.2	Cultural Resources						2								2	$219					$200	$419
5.3	Air Conformity Analysis						2								2	$219					$200	$419
5.4	Biological Resources						2								2	$219					$200	$419
5.5	SWRCB Consultation			2	2		2								6	$1,117					$300	$1,417
5.3	Administrative Draft Initial Study			4	4		6	4						6	24	$3,921					$600	$4,521
5.4	Public Draft Initial Study/Mitigated Negative Declaration			2	2		4							4	12	$1,780					$600	$2,380
5.5	Final Initial Study/Mitigated Negative Declaration			2	2		4							4	12	$1,780					$600	$2,380
5.6	Environmental Document Review Meetings (up to 3)			2	2		8							4	16	$2,217					$300	$2,517
6	**Potholing**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$0**	**$0**	**$0**	**$0**	**$7,869**	**$0**	**$7,869**
6.1	Potholing (up to [illegible] potholes)														0	$0				$7,869		$7,869
7	**Permitting and Regulatory Requirements**	**0**	**0**	**2**	**2**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**$2,648**	**$0**	**$0**	**$0**	**$0**	**$500**	**$3,148**

Tasks		Labor															Subconsultants[1]				ODCs[2]	Total
Task #	Task Description	Principal	Tech Specialist (QA/QC)	Project Manager	Project Engineer	Civil/ Demo	Permitting	Haz Mat	Structural Engineer	Mechanical Engineer	Electrical Engineer	Operations	CAD Tech	Admin/ Clerical	Total Hours	Total Labor Costs	Geotech	Surveying	Corrosion	Potholing	Other Direct Costs	Total Fee
7.1	Permitting and Regulatory Requirements			2	2		16								20	$2,648					$500	$3,148
8	**Chlorine BODR (30%)**	**0**	**0**	**12**	**20**	**10.4**	**0**	**0**	**8**	**16**	**14.4**	**2**	**48.8**	**4**	**135.6**	**$23,274**	**$0**	**$0**	**$0**	**$0**	**$1,000**	**$24,274**
8.1	Chlorine BODR (30%)			12	20	10.4			8	16	14.4	2	48.8	4	136	$23,274					$1,000	$24,274
9	**75% Design**	**0**	**0**	**32**	**14**	**26**	**0**	**0**	**20**	**35**	**36**	**0**	**122**	**0**	**285**	**$49,435**	**$0**	**$0**	**$0**	**$0**	**$3,400**	**$52,835**
9.1	75% Plans			16	6	26			20	35	36		122		261	$43,640					$1,000	$44,640
9.2	75% Specifications			8	4										12	$2,897					$1,200	$4,097
9.3	75% Cost Estimate			8	4										12	$2,897					$1,200	$4,097
10		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
10.1	TASK 10 COMBINED INTO Task 9			0	0	0			0	0	0		0		0	$0					$0	$0
10.2				0	0										0	$0					$0	$0
10.3				0	0										0	$0					$0	$0
11	**100% Design**	**0**	**0**	**16**	**6**	**10.4**	**0**	**0**	**8**	**14**	**14.4**	**0**	**48.8**	**0**	**117.6**	**$20,724**	**$0**	**$0**	**$0**	**$0**	**$1,100**	**$21,824**
11.1	100% Plans			8	2	10.4			8	14	14.4		48.8		106	$17,826					$500	$18,326
11.2	100% Specifications			4	2										6	$1,449					$300	$1,749
11.3	100% Cost Estimate			4	2										6	$1,449					$300	$1,749
12	**Final Bid Package**	**0**	**0**	**8**	**6**	**5.2**	**0**	**0**	**4**	**7**	**7.2**	**0**	**24.4**	**0**	**61.8**	**$10,885**	**$0**	**$0**	**$0**	**$0**	**$1,100**	**$11,985**
12.1	Final Plans			4	2	5.2			4	7	7.2		24.4		54	$9,087					$500	$9,587
12.2	Final Specifications			2	2										4	$899					$300	$1,199
12.3	Final Cost Estimate			2	2										4	$899					$300	$1,199
13	**Bidding Services**	**0**	**0**	**8**	**4**	**2**	**0**	**0**	**2**	**2**	**2**	**0**	**0**	**0**	**20**	**$4,430**	**$0**	**$0**	**$0**	**$0**	**$600**	**$5,030**
13.1	Prebid Meeting			4	2										6	$1,449					$400	$1,849
13.2	Bid Period Services			4	2	2			2	2	2				14	$2,982					$200	$3,182
14	**Construction Services**	**0**	**0**	**92**	**52**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**40**	**64**	**248**	**$46,737**	**$0**	**$0**	**$0**	**$0**	**$3,500**	**$50,237**
14.1	Preconstrution Meeting			8	4									8	20	$3,785					$500	$4,285
14.2	Submittals			20	2									6	28	$6,514					$250	$6,764
14.3	Clarifications (up to 20 RFIs)			16	2									18	36	$6,746					$250	$6,996
14.4	Construction Meetings/Site Visits (up to 3)			16	8										24	$5,795					$500	$6,295
14.5	Change Orders			24	8									8	40	$8,882					$500	$9,382
14.6	O&M Manual			4	20									12	36	$5,918					$500	$6,418
14.7	As-Built Drawings			4	8								40	12	64	$9,096					$1,000	$10,096
15	**Additional Services**	**0**	**0**	**4**	**40**	**0**	**0**	**0**	**0**	**0**	**0**	**40**	**0**	**6**	**90**	**$16,422**	**$0**	**$0**	**$0**	**$0**	**$1,500**	**$17,922**
15.1	Optional Post Construction			4	40							40		6	90	$16,422					$1,500	$17,922
	PROPOSAL SUBTOTAL	**8**	**40**	**312**	**242**	**54**	**48**	**4**	**42**	**98**	**80**	**71**	**310**	**124**	**1,433**	**$266,375**	**$15,776**	**$16,139**	**$29,984**	**$10,492**	**$21,415**	**$360,180**

[1] *Includes 5% subconsultant markup.*

[2] *No markup on expenses. Other Direct Costs (ODCs) include travel, technology charges, printing, and shipping. Technology charges include computer, CADD, network, software, and other related technology services, which are assessed at a rate of $3.70 per labor hour expended. These technology charges are rolled into the ODC figure.*

Note: Phone charges are included in overhead.

Description of Revisions to Fee Estimate

- Task 2.1 and 8.1 were combined to create the Revised Chlorine BODR with is now a 30% design effort (Highlighted in Yellow). No change in costs
- In Task 2.2, three potholes from Task 6.1 were moved into Task 2.2. The total potholes are still 12 in number and potholing costs have not changed. Potholing costs shown in green font.
- In Task 2.2, outfall confined space entry costs to inspect the inside of the outfall were added. These costs shown in red were not previously included.
- In Task 2.3 costs were included to examine separation of the CCT for simultaneous production of recycled water. Additional hours have now been included to also study methods to lower the turbidity associated with the recycled water prior to chlorination.
- In Task 2.4, it was assumed that sewer investigation studies would be done by others. It now appears that this work will not be done in time and needs to be included in this contract. Increased costs to measure sewer system conductivity at various points and analyze the data have been added and shown in red font.
- Tasks 9 and 10 have been combined and all costs are now included in Task 9 which now represents the 75% design (Highlighted in Yellow). No change in costs.
- Tasks 11 and 12 have been renamed 100% submittal and Final Bid Package. No Change in costs.
- Costs for an O&M Manual was included in our overall fee, but a separate line item was not illustrated. To see the costs for O&M Manual Task 14.6 was added and funded with costs distributed from Tasks 14.2 and 14.3. (Tasks 14.2, 14.3 and 14.6 are highlighted in light blue). No net change in costs.
- Task 14.6 Optional Post Construction is an Optional Task that was added and is a budget for optional post construction activities as directed by the City.

Exhibit "C"

INSURANCE REQUIREMENTS FOR CONSULTANTS

Consultant shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work by the Consultant, his agents, representatives, or employees.

Minimum Scope and Limits of Insurance: Consultant shall maintain limits no less than:

1. **Commercial General Liability**: $1,000,000 per occurrence and $2,000,000 aggregate for bodily injury, personal injury and property damage. ISO Occurrence Form CG 0001 is required.

2. **Automobile Liability**: $1,000,000 per accident for bodily injury and property damage. ISO Form CA 0001 is required.

3. **Workers' Compensation** and **Employer's Liability**: $1,000,000 per accident for bodily injury or disease.

4. **Errors and Omissions** Liability Insurance appropriate to the Consultants Profession: $1,000,000 per claim and $2,000,000 aggregate.

Deductibles and Self-Insured Retentions

Any deductibles or self-insured retentions must be declared and approved by the City of Sunnyvale. The consultant shall guarantee payment of any losses and related investigations, claim administration and defense expenses within the deductible or self-insured retention.

Other Insurance Provisions

The **general liability** and **automobile liability** policies are to contain, or be endorsed to contain, the following provisions:

1. The City of Sunnyvale, its officials, employees, and agents are to be covered as additional insureds with respects to liability arising out of activities performed by or on behalf of the Consultant; products and completed operations of the Consultant; premises owned, occupied or used by the Consultant; or automobiles owned, leased, hired or borrowed by the Consultant. The coverage shall contain no special limitations on the scope of protection afforded to the City of Sunnyvale, its officers, employees, agents or volunteers.

2. For any claims related to this project, the Consultant's insurance shall be primary. Any insurance or self-insurance maintained by the City of Sunnyvale, its officers, officials, employees, agents and volunteers shall be excess of the Consultant's insurance and shall not contribute with it.

3. Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to the City of Sunnyvale, its officers, officials, employees, agents or volunteers.

4. The Consultant's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

5. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, cancelled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified main, return receipt requested, has been given to the City of Sunnyvale.

Claims Made Coverage

If the General Liability and/or Errors & Omissions coverages are written on a claims-made form:

1. The retroactive date must be shown, and must be before the date of the contract or the beginning of contract work.

2. Insurance must be maintained and evidence of insurance must be provided for at least five years after completion of the contract work.

3. If coverage is canceled or non-renewed, and not replaced with another claims-made policy form with a retroactive date prior to the contract effective date, the Consultant must purchase an extended period coverage for a minimum of five years after completion of contract work.

4. A copy of the claims reporting requirements must be submitted to the City of Sunnyvale for review.

Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII, unless otherwise acceptable to the City of Sunnyvale.

Verification of Coverage

Consultant shall furnish the City of Sunnyvale with original a Certificate of Insurance effecting the coverage required. The certificates are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates are to be received and approved by the City of Sunnyvale prior to commencement of work.