REQUEST FOR PROPOSALS

FOR

Testing and Evaluation of an Alternative Treatment Process for Removal of Chromium-6 from Groundwater and Water System Planning

Project No. 110823

City of Coachella
53990 Enterprise Way
Coachella, CA 92236

Issued: November 08, 2023

Proposals Due: Monday, January 08, 2024 @ 5pm

INSTRUCTIONS TO PROPOSERS

I. GENERAL

The City of Coachella ("City") has prepared this Request for Proposals ("RFP") and is requesting proposals from qualified and interested consultant firms[1] ("Proposers") to provide the following:

Testing and Evaluation of an Alternative Treatment Process for Removal of Chromium-6 from Groundwater and Water System Planning

The purpose of the Proposal is to demonstrate the qualifications, competence and capacity of Respondents to perform the work or provide the services described in this RFP, in conformity with the requirements of this RFP. The Proposal should demonstrate the qualifications of the Respondent and of the particular staff to be assigned to this project. It should also specify a specific approach that will meet the RFP requirements.

The successful Respondent will be expected to execute the Professional Services Agreement included in this RFP.

II. BACKGROUND

The City of Coachella, is a general-law City that provides water service through the Coachella Water Authority (CWA), a joint powers authority formed as a component of the City of Coachella and the Housing Authority of the City of Coachella, and manages municipal wastewater in its service area through its subsidiary Coachella Sanitary District. The City was incorporated in 1946 and encompasses approximately 32 square miles and has a sphere of influence that encompasses 53 square miles in the eastern Coachella Valley approximately 40 miles south of Palm Springs, California.

Coachella Water Authority's existing water system consists of different pressure zones, groundwater wells, storage reservoirs, booster pumping stations, and distribution facilities. The current water system is divided into two (2) pressure zones, the Low Zone and the 150 Zone. CWA has one principal source of water supply, local groundwater pumped from CWA owned and operated wells. There are currently six (6) wells within the City's distribution system; of which, all six (6) wells are currently operational. The total pumping capacity of active wells is approximately 11,400 gallons per minute (gpm) or 16.5 million gallons per day (MGD). CWA has three (3) storage reservoirs within the City, with a total reservoir storage capacity of approximately 10.5 MG. In addition, CWA operates two booster pumping stations. CWA's distribution system network consists of approximately 120 miles of pipeline, which range from 4-inches to 36-inches in diameter. The current system serves approximately 9,000 residential and commercial customers.

Chromium is naturally occurring constituent in the Coachella Valley groundwater. In 2014, California's Division of Drinking Water (DDW) established a hexavalent chromium (Cr6) maximum contaminant level (MCL) of 10 ug/L. DDW retracted the Cr6 MCL in September 2017 because it was determined the Water Board "failed to demonstrate Cr6 compliance as economically feasible." In March 2022, DDW proposed a draft MCL of 10 ug/L for Cr6.

[1]Use of the term "firm" shall mean individual proprietorship, partnership, Limited Liability Company, corporation or joint venture.

CWA currently has 6 active groundwater wells, all of which have Cr6 concentrations above the proposed MCL. In 2016 the City completed the Coachella Water Authority Hexavalent Chromium Treatment Facilities Project Basis of Design Report. In 2022 the City through work performed via the Coachella Valley Water District analyzed Cr6 reduction using SnCl2 (0.5 mg/L dose as Sn) in a chlorinated system (0.5 mg/L as free Cl2).

Attachment I: Coachella Water Authority Hexavalent Chromium Treatment Facilities Project Basis of Design Report.

Attachment II: In 2022 the City through work performed via the Coachella Valley Water District analyzed Cr6 reduction using SnCl2 (0.5 mg/L dose as Sn) in a chlorinated system (0.5 mg/L as free Cl2).

III. PUBLIC WORKS PREVAILING WAGE AND DIR CONTRACTOR REGISTRATION

Certain labor categories under this project may be subject to prevailing wages as identified in the State of California Labor Code commencing at sections 1720 et seq. and 1770 et seq. If applicable, employees working in these categories at the site must be paid not less than the basic hourly rates of pay and fringe benefits established by the California Department of Industrial Relations ("DIR"). Copies of the State of California wage schedules are available for review at www.dir.ca.gov/dlsr/. In addition, a copy of the prevailing rate of per diem wages will be made available at the City's office upon request. The successful Proposer shall post a copy of the prevailing wage rates at each job site. It shall be mandatory upon the Proposer to whom the Agreement is awarded, and upon any subcontractors, to comply with all Labor Code provisions, which include but are not limited to the payment of not less than the said specified prevailing wage rates to all workers employed by them in the execution of the Agreement, employment of apprentices, hours of labor and debarment of contractors and subcontractors.

Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the DIR. No proposal will be accepted nor any contract entered into without proof of the Proposer's and subcontractors' current registration with the DIR to perform public work. If awarded a contract, the Proposer and its subcontractors, of any tier, shall maintain active registration with the DIR for the duration of the project. Notwithstanding the foregoing, the contractor registration requirements mandated by Labor Code Sections 1725.5 and 1771.1 shall not apply to work performed on a public works project that is exempt pursuant to the small project exemption specified in Labor Code Sections 1725.5 and 1771.1. The contract awarded pursuant to this proposal may also be subject to compliance monitoring and enforcement by the DIR.

IV. CITY CONTACT

The principal contact for the City will be Castulo Estrada, Utilities Manager, (760) 501-8113, (cestrada@coachella.org), who will coordinate the assistance to be provided by the City to the Proposer.

V. REQUESTS FOR CLARIFICATION

All questions, requests for interpretations or clarifications, either administrative or technical must be requested in writing and directed to the City Contact, identified above. All written questions, if answered, will be answered in writing, conveyed to all interested firms, and posted on the City's

website. Oral statements by any persons should be considered unverified information unless confirmed in writing. To ensure a response, questions must be received in writing by 2:00 p.m. local time on Monday, December 11, 2023. The City will provide any necessary addendums by December 20, 2023.

VI. PROPOSAL REQUIREMENTS

Proposal responses must adhere to the requirements set forth in this section, both for content and sequence. Failure to adhere to these requirements or the inclusion of conditions, limitations or misrepresentations may be cause for rejection of the submittal. One hardcopy proposal on paper, properly bound, appropriately tabbed and labeled is required using 8-1/2" X 11" sheets (foldouts are acceptable for charts, etc.) and font size large enough to be easily legible, but not smaller than 10 point. **The proposal may be no more than a total of twenty (20) pages**, including a table of contents, organization chart, staff resumes, appendices, and cover letter. NOTE: Dividers, front and back cover sheets. An electronic version of the proposal shall accompany the hardcopy proposal submittal on USB flash drive. The proposal shall be must be submitted according to the following order:

A. Cover Letter. Provide a cover letter and introduction, including the name and address of the organization and individual submitting the proposal, together with the name, address, telephone and fax numbers, and e-mail address of the contact person who will be authorized to represent the organization, and an expression of the Proposer's ability and desire to meet the requirements of this RFP. The letter must be signed by an individual authorized to bind the firm contractually.

B. Proposer Statement of Qualifications. Describe the Proposer's resources, experience, and capabilities as they relate to providing the Services. Submit in the order identified below:

1. Executive Summary**.** An executive summary should briefly describe the Proposer's qualifications and ability to perform the Services.

2. Qualifications and Experience. The proposal should:

   a. Provide a description of how the Proposer's experience, technical and professional skills will meet the goals and fulfill the general functions identified in this RFP.

   b. Any key staff members who would be involved in the performance of the scope of work. Provide their resumes, describe their experience, and identify their proposed role for the Services.

   c. State the number of years the firm has conducted business.

   d. Provide a description of the three most relevant contracts held within the last 7 years.

3. References. The Proposer shall provide a minimum of three (3) client references, preferably city, county, or special district governments for whom the Proposer has previously performed services of similar type and scope within the last seven (7) years.

4. Subcontractors. The Proposer shall identify functions that are likely to be subcontracted and identify the subcontractor that is anticipated to perform each function, if known at this time.

C. Proposed Method to Accomplish the Work. Describe the technical and management approach to providing the Services to the City. Proposer should take into account the scope of the Services, goals of the City, and general functions required.

D. Certification of Proposal. This section shall state: "The undersigned hereby submits its proposal and, by doing so, agrees to furnish services to the City in accordance with the Request for Proposals (RFP), and to be bound by the terms and conditions of the RFP."

E. Cost Proposal. Proposer shall submit a detailed schedule of hourly rates for all staff positions that would be assigned to the proposed Services. Any additional proposed costs should also be described in this section.

F. Proposal Considerations

G. No Deviations from the RFP. In submitting a proposal in response to this RFP, Proposer is certifying that it takes no exceptions to this RFP including, but not limited to, the Agreement attached hereto as Exhibit "B". If any exceptions are taken, such exceptions must be clearly noted in the proposal and may be reason for rejection of the proposal. As such, Proposer is directed to carefully review the proposed Agreement and, in particular, the insurance and indemnification provisions therein.

H. Collusion. By submitting a Proposal, each Proposer represents and warrants that its Proposal is genuine and not a sham or collusive or made in the interest of or on behalf of any person not named therein; that the Proposer has not directly or indirectly induced or solicited any other person to submit a sham Proposal, or any other person to refrain from submitting a Proposal; and that the Proposer has not, in any manner, sought collusion to secure any improper advantage over any other person submitting a Proposal.

I. Conflicts of Interest. Proposers shall comply with all regulations and laws dealing with conflict of interest disclosure and reporting. Proposers shall not be engaged if a conflict of interest exists.

J. Withdrawal of Proposals. A Proposer may withdraw its proposal before the expiration of the time for submission of proposals by notifying and requesting the City's representative remove the Proposer's submission.

K. Financial Health and Reputation. The City reserves the right to consider the financial responsibility and general complexity of each Proposer, as well as its reputation within the industry to determine if the Proposer has the apparent ability to meet and complete successfully the requirements of the work. Upon request, the Proposer shall provide a financial statement, audited if necessary, in addition to any other information requested by the City.

L. Confidentiality of Proposal. Proposals submitted in response to this RFP shall be held confidential by City and shall not be subject to disclosure under the California Public Records Act (Cal. Government Code section 6250 et seq.) until after either City and the successful Proposer have completed negotiations and entered into an Agreement or City has rejected all proposals. All correspondence with the City including responses to this RFP will become the

exclusive property of the City and will become public records under the California Public Records Act. The City will have no liability to the Proposer or other party as a result of any public disclosure of any proposal or the Agreement. If a Proposer desires to exclude a portion of its proposal from disclosure under the California Public Records Act, the Proposer must mark it as such and state the specific provision in the California Public Records Act which provides the exemption as well as the factual basis for claiming the exemption. For example, if a Proposer submits trade secret information, the Proposer must plainly mark the information as "Trade Secret" and refer to the appropriate section of the California Public Records Act which provides the exemption as well as the factual basis for claiming the exemption. If a request is made for information marked "Confidential", "Trade Secret" or "Proprietary" ("Proprietary Information"), the City will provide Proposers who submitted the information with reasonable notice to seek protection from disclosure by a court of competent jurisdiction. Proposer shall have five (5) working days after receipt of such notice to give City written notice of Proposer's objection to the City's release of Proprietary Information. Proposer shall indemnify, defend and hold harmless the City, and its officers, directors, employees, and agents from and against all liability, loss, cost or expense (including attorney's fees) arising out of a legal action brought to compel the release of Proprietary Information. Proposals which indiscriminately identify all or most of the proposal as exempt from disclosure without justification may be deemed unresponsive and disqualified from further participation in this RFP.

VII. EVALUATION CRITERIA

The proposal evaluation criteria will be as outlined below: (**Total 100pts.**)

- Understanding of Work to be performed (Scope of Services); see Exhibit A **20 pts**
- Demonstrated quality of firm and professional staff technical skill, experience, performance and approach; **20 pts**
- Familiarity with City, County and State Procedures; references **15 pts**
- Firm's and Professional Staff References/Satisfaction of Clients; **20 pts**
- Completeness and quality of the Proposal; **10 pts**
- The price which the Proposer proposes to charge, including whether the price is fair, reasonable and competitive, hourly rate schedule **15 pts**

During the evaluation process, the City reserves the right, where it may serve the City's best interest, to request additional information or clarifications from Proposers, or to allow corrections of errors or omissions. It is the City's intent to select Proposers best evidencing demonstrated competence and professional qualification to perform the Services.

Following the City's ranking and determination of the prequalified list of Proposers, the City reserves the right to contract with any or none of the prequalified firms.

Upon selection of Proposers, the City will endeavor to negotiate a mutually agreeable agreement with the selected Proposer(s). The City reserves the right to contract for services in the manner that most benefits the City. After negotiating a proposed Agreement that is fair and reasonable, City staff will make the final recommendation to the City Council concerning the proposed Agreement(s). The City Council has the final authority to approve or reject the Agreement(s).

VIII. SUBMITTAL INSTRUCTIONS

The proposal must be received no later than **5 pm** local time, on or before **Monday, January 08, 2024** at the office of:

Attention: Castulo Estrada

City of Coachella
53462 Enterprise Way
Coachella, CA 92236

The envelope should clearly indicate **"Proposal for Testing and Evaluation of an Alternative Treatment Process for Removal of Chromium-6 from Groundwater and Water System Planning"** and Proposer's name and address shall appear in the upper left hand corner of the envelope. If more than one envelope is required, each envelope shall be legibly numbered below the name of the Proposer, e.g. Envelope 1 of 3, as required.

The City will not be responsible for proposals that are delinquent, lost, incorrectly marked, sent to an address other than that given herein, or sent by mail or courier service and not signed for by the City. Proposals received after this date will be returned to the Proposers unopened. Faxed or electronically submitted proposals will not be accepted.

IX. PROTESTS

A. Protest Contents. Protests based on the content of the RFP shall be submitted to the City no later than ten (10) calendar days prior to the scheduled proposal submittal deadline. If necessary, the proposal submittal deadline may be extended pending a resolution of the protest. Proposer may protest a contract award if the Proposer believes that the award was inconsistent with City policy or this RFP is not in compliance with law. A protest must be filed in writing with the City (email is not acceptable) within five (5) business days after receipt of notification of the intended contract award. Any protest submitted after 5 p.m. of the fifth business day after notification of the intended contract award will be rejected by the City as invalid and the Proposer's failure to timely file a protest will waive the Proposer's right to protest the contract award. The Proposer's protest must include supporting documentation, legal authorities in support of the grounds for the protest and the name, address and telephone number of the person representing the Proposer for purposes of the protest. Any matters not set forth in the protest shall be deemed waived.

B. City Review. The City will review and evaluate the basis of the protest provided the protest is filed in strict conformity with the foregoing. The City shall provide the Proposer submitting the protest with a written statement concurring with or denying the protest. Action by the City relative to the protest will be final and not subject to appeal or reconsideration. The procedure and time limits set forth in this section are mandatory and are the Proposer's sole and exclusive remedy in the event of protest. Failure to comply with these procedures will constitute a waiver of any right to further pursue the protest, including filing a Government Code claim or legal proceedings.

X. ADDENDA

The City reserves the right to revise the RFP prior to the time set to receive proposals. Revisions, if any, shall be made by addenda posted on the City's website. All addenda issued by the City

shall be included in the proposal and made part of the RFP. Proposers are responsible for ensuring that they have received any and all addenda. Each Proposer should contact the City to verify that it has received all addenda issued, if any, prior to the bid opening. Failure to acknowledge receipt of all addenda may result in bid rejection.

XI. GENERAL CONDITIONS

A. Amendments to Proposals. Unless specifically requested by the City, no amendment, addendum or modification will be accepted after a proposal has been submitted to City. If a change to a proposal that has been submitted is desired, the submitted proposal must be withdrawn and the replacement proposal submitted prior to the deadline stated herein for receiving proposals.

B. Non-Responsive Proposals. A proposal may be considered non-responsive if conditional, incomplete, or if it contains alterations of form, additions not called for, or other irregularities that may constitute a material change to the proposal.

C. Costs for Preparing. The City will not compensate any Proposer for the cost of preparing any proposal, and all materials submitted with a proposal shall become the property of the City. The City will retain all proposals submitted and may use any idea in a proposal regardless of whether that proposal is selected.

D. Cancellation. City reserves the right to cancel this request for proposals at any time prior to contract award without obligation in any manner for proposal preparation, interview, fee negotiation or other associated marketing costs.

E. Price Validity. Prices provided by Proposers are valid for 90 days from the proposal due date. The City intends to award the contract within this time but may request an extension from the Proposers to hold pricing, until negotiations are complete and the contract is awarded.

F. No Commitment to Award. Issuance of request for qualifications and receipt of proposals does not commit the City to award a contract. City expressly reserves the right to postpone the proposal for its own convenience, to accept or reject any or all proposals received, to negotiate with more than one Proposer concurrently, or to cancel all or part of this request for proposals.

G. Right to Negotiate and/or Reject Proposals. City reserves the right to negotiate any price or provision, task order or service, accept any part or all of any proposals, waive any irregularities, and to reject any and all, or parts of any and all proposals, whenever, in the sole opinion of City, such action shall serve its best interests and those of the tax-paying public. The Agreement, if any is awarded, will go to the Proposer whose proposal best meets City's requirements.

END INSTRUCTIONS TO PROPOSERS

EXHIBIT "A"

PROPOSED SCOPE OF SERVICES

The following provides a general outline of the scope of services to be provided to CWA. Project tasks may include, but are not necessarily limited to:

The selected consultant shall develop a work plan which may include a testing program and evaluation of a water treatment process utilizing stannous chloride and potentially other alternative treatment processes to remove chromium- 6 from groundwater to levels sufficiently below the proposed State of California's MCL of 10 ppb. The consultant must also identify and include an evaluation of potential impacts and mitigation measures resulting from the recommended process.

The Department of Water Resources (DWR) has secured funding for the City to analyze an Alternative Treatment Process for Removal of Chromium-6 from Groundwater and Water System Planning. DWR requires the development of a work plan which may include the following tasks:

A: Administration
B: Permitting and Environmental Documentation
C: Planning and Design
D: Construction
E: Schedule

The consultant shall work with the City and DWR to finalize a proposed work plan and schedule and help finalize the Funding Agreement between the City and DWR. The consultant shall prepare a Preliminary Design Report which includes an Executive Summary of the proposed work plan, evaluation, recommendations, and estimated costs for full-scale implementation at 6 well sites. The consultant shall every other week and/or monthly calls with and between the City, DDW and DWR as the phase of the project dictates.

Other tasks may include:

- Conduct a water system evaluation with a focus on Cr6 impacted sources.

- Review of CWA operations, treatment processes and performance where applicable, and water quality results.

- Identify wells with potential compliance challenges, potential treatment and non-treatment solutions. As part of the evaluation, include advances/improvements to best available technology (BAT) by the Division of Drinking Water (DDW), and stannous chloride unknowns and required next steps for this approach to be a full-scale application consideration for DDW.

- Update past treatment cost estimates. Update may include previous reports/studies.

- Consider the site-specific water quality, production, and site details of each of the identified wells and develop a roadmap for compliance solutions and corresponding treatment

facility configurations to achieve compliance with the potential revised Cr6 MCL.

- Review and compile the water quality and production data provided by CWA and present summaries by well site.

- Make preliminary assessments of the potential for individual wellhead treatment to fit on the well site and likely potential combined treatment options at nearby existing well(s) or tank sites.

EXHIBIT "B"

CITY OF COACHELLA
DRAFT PROFESSIONAL SERVICES AGREEMENT

1. PARTIES AND DATE.

This Agreement is made and entered into this _____ day of _____, 20___, by and between the City of Coachella, a municipal corporation organized under the laws of the State of California with its principal place of business at 1515 6th Street, Coachella, California 92236, County of Riverside, State of California ("City") and [***INSERT NAME OF COMPANY], a [INSERT TYPE OF BUSINESS; I.E., CORPORATION (INCLUDE STATE OF INCORPORATION), LIMITED LIABILITY COMPANY, SOLE PROPRIETORSHIP, ETC.***], with its principal place of business at [***INSERT ADDRESS***] ("Consultant"). City and Consultant are sometimes individually referred to herein as "Party" and collectively as "Parties."

2. RECITALS.

2.1 Consultant.

Consultant desires to perform and assume responsibility for the provision of certain professional services required by the City on the terms and conditions set forth in this Agreement. Consultant represents that it is experienced in providing [***INSERT TYPE***] services to public clients, is licensed in the State of California, and is familiar with the plans of City.

2.2 Project.

City desires to engage Consultant to render such professional services for the [***INSERT NAME OF PROJECT, AND CONTRACT NUMBER, IF APPLICABLE***] project ("Project") as set forth in this Agreement.

3. TERMS.

3.1 Scope of Services and Term.

3.1.1 General Scope of Services. Consultant promises and agrees to furnish to the City all labor, materials, tools, equipment, services, and incidental and customary work necessary to fully and adequately supply the professional [***INSERT TYPE***] consulting services necessary for the Project ("Services"). The Services are more particularly described in Exhibit "A" attached hereto and incorporated herein by reference. All Services shall be subject to, and performed in accordance with, this Agreement, the exhibits attached hereto and incorporated herein by reference, and all applicable local, state and federal laws, rules and regulations.

3.1.2 Term. The term of this Agreement shall be from [***INSERT DATE***] to [***INSERT DATE***], unless earlier terminated as provided herein. The City shall have the unilateral option, at its sole discretion, to renew this Agreement automatically for no more than [INSERT NUMBER] additional one-year terms.***] Consultant shall complete the Services within the term of this Agreement, and shall meet any other established schedules and deadlines. The Parties may, by mutual, written consent, extend the term of this Agreement if necessary to complete the Services.

3.2 Compensation.

3.2.1 Compensation. Consultant shall receive compensation, including authorized reimbursements, for all Services rendered under this Agreement at the rates set forth in Exhibit "C" attached hereto and incorporated herein by reference. The total compensation shall not exceed **[***INSERT AMOUNT WRITTEN OUT]** ($**[***INSERT NUMBER]**) without written approval of the City Council or City Manager, as applicable. Extra Work may be authorized, as described below, and if authorized, will be compensated at the rates and manner set forth in this Agreement.

3.2.2 Payment of Compensation. Consultant shall submit to City a monthly invoice which indicates work completed and hours of Services rendered by Consultant. The invoice shall describe the amount of Services provided since the initial commencement date, or since the start of the subsequent billing periods, as appropriate, through the date of the invoice. City shall, within 30 days of receiving such invoice, review the invoice and pay all non-disputed and approved charges. If the City disputes any of Consultant's fees, the City shall give written notice to Consultant within thirty (30) days of receipt of an invoice of any disputed fees set forth therein. Payment shall not constitute acceptance of any Services completed by Consultant. The making of final payment shall not constitute a waiver of any claims by the City for any reason whatsoever.

3.2.3 Reimbursement for Expenses. Consultant shall not be reimbursed for any expenses unless authorized in writing by City, or included in Exhibit "C" of this Agreement.

3.2.4 Extra Work. At any time during the term of this Agreement, City may request that Consultant perform Extra Work. As used herein, "Extra Work" means any work which is determined by City to be necessary for the proper completion of the Project, but which the Parties did not reasonably anticipate would be necessary at the execution of this Agreement. Consultant shall not perform, nor be compensated for, Extra Work without written authorization from the City.

3.3 Responsibilities of Consultant.

3.3.1 Independent Contractor; Control and Payment of Subordinates. The Services shall be performed by Consultant or under its supervision. Consultant will determine the means, methods and details of performing the Services subject to the requirements of this Agreement. City retains Consultant on an independent contractor basis and not as an employee. Any personnel performing the Services on behalf of Consultant shall not be employees of City and shall at all times be under Consultant's exclusive direction and control. Neither City, or any of its officials, officers, directors, employees or agents shall have control over the conduct of Consultant or any of Consultants officers, employees or agents, except as set forth in this Agreement. Consultant shall pay all wages, salaries, and other amounts due such personnel in connection with their performance of Services under this Agreement and as required by law. Consultant shall be responsible for all reports and obligations respecting such additional personnel, including, but not limited to: social security taxes, income tax withholding, unemployment insurance, disability insurance, and workers' compensation insurance.

3.3.2 Schedule of Services. Consultant shall perform the Services in a prompt and timely manner and in accordance with the Schedule of Services set forth in Exhibit "B"

attached hereto and incorporated herein by reference. Consultant represents that it has the professional and technical personnel required to perform the Services expeditiously. Upon request of City, Consultant shall provide a more detailed schedule of anticipated performance to meet the Schedule of Services.

3.3.3 Conformance to Applicable Requirements. All work prepared by Consultant shall be subject to the approval of City.

3.3.4 Substitution of Key Personnel. Consultant has represented to City that certain key personnel will perform and coordinate the Services under this Agreement. Should one or more of such personnel become unavailable, Consultant may substitute other personnel of at least equal competence upon written approval of City. In the event that City and Consultant cannot agree as to the substitution of key personnel, City shall be entitled to terminate this Agreement for cause. The key personnel for performance of this Agreement are as follows: [***INSERT NAME AND TITLE***].

3.3.5 City's Representative. The City hereby designates [***INSERT NAME AND TITLE***], or his/her designee, to act as its representative in all matters pertaining to the administration and performance of this Agreement ("City's Representative"). City's Representative shall have the power to act on behalf of the City for review and approval of all products submitted by Consultant but not the authority to enlarge the Scope of Services or change the total compensation due to Consultant under this Agreement. The City Manager shall be authorized to act on City's behalf and to execute all necessary documents which enlarge the Scope of Services or change the Consultant's total compensation subject to the provisions contained in this Agreement. Consultant shall not accept direction or orders from any person other than the City Manager, City's Representative or his/her designee.

3.3.6 Consultant's Representative. Consultant hereby designates [***INSERT NAME AND TITLE***], or his/her designee, to act as its representative for the performance of this Agreement ("Consultant's Representative"). Consultant's Representative shall have full authority to represent and act on behalf of the Consultant for all purposes under this Agreement. The Consultant's Representative shall supervise and direct the Services, using his/her best skill and attention, and shall be responsible for all means, methods, techniques, sequences, and procedures and for the satisfactory coordination of all portions of the Services under this Agreement.

3.3.7 Coordination of Services. Consultant agrees to work closely with City staff in the performance of Services and shall be available to City's staff, consultants and other staff at all reasonable times.

3.3.8 Standard of Care; Performance of Employees. Consultant shall perform all Services under this Agreement in a skillful and competent manner, consistent with the standards generally recognized as being employed by professionals in the same discipline in the State of California. Consultant represents and maintains that it is skilled in the professional calling necessary to perform the Services. Consultant warrants that all employees and subconsultants shall have sufficient skill and experience to perform the Services assigned to them. Consultant represents that it, its employees and subconsultants have all licenses, permits, qualifications and approvals of whatever nature that are legally required to perform the Services, and that such licenses and approvals shall be maintained throughout the term of this Agreement. Consultant

shall perform, at its own cost and expense and without reimbursement from the City, any services necessary to correct errors or omissions which are caused by the Consultant's failure to comply with the standard of care provided for herein. Any employee of the Consultant or its subconsultants who is determined by the City to be uncooperative, incompetent, a threat to the adequate or timely completion of the Project, a threat to the safety of persons or property, or any employee who fails or refuses to perform the Services in a manner acceptable to the City, shall be promptly removed from the Project by the Consultant and shall not be re-employed to perform any of the Services or to work on the Project.

3.3.9 Period of Performance.

3.3.9.1 Consultant shall perform and complete all Services under this Agreement within the term set forth in Section 3.1.2 above ("Performance Time"). Consultant shall also perform the Services in strict accordance with any completion schedule or Project milestones described in Exhibits "A" or "B" attached hereto, or which may be separately agreed upon in writing by the City and Consultant ("Performance Milestones"). Consultant agrees that if the Services are not completed within the aforementioned Performance Time and/or pursuant to any such Performance Milestones developed pursuant to provisions of this Agreement, it is understood, acknowledged and agreed that the City will suffer damage.

3.3.9.2 Neither City nor Consultant shall be considered in default of this Agreement for delays in performance caused by circumstances beyond the reasonable control of the non-performing Party. For purposes of this Agreement, such circumstances include a Force Majeure Event. A Force Majeure Event shall mean an event that materially affects a Party's performance and is one or more of the following: (1) Acts of God or other natural disasters; (2) terrorism or other acts of a public enemy; (3) orders of governmental authorities (including, without limitation, unreasonable and unforeseeable delay in the issuance of permits or approvals by governmental authorities that are required for the services); (4) strikes and other organized labor action occurring at the site and the effects thereof on the services, only to the extent such strikes and other organized labor action are beyond the control of Consultant and its subcontractors, and to the extent the effects thereof cannot be avoided by use of replacement workers; and (5) pandemics, epidemics or quarantine restrictions. For purposes of this section, "orders of governmental authorities," includes ordinances, emergency proclamations and orders, rules to protect the public health, welfare and safety, and other actions of a public agency applicable to the services and Agreement.

3.3.9.3 Should a Force Majeure Event occur, the non-performing Party shall, within a reasonable time of being prevented from performing, give written notice to the other Party describing the circumstances preventing continued performance and the efforts being made to resume performance of this Agreement. Force Majeure Events and/or delays, regardless of the Party responsible for the delay, shall not entitle Consultant to any additional compensation. Notwithstanding the foregoing in this section, the City may still terminate this Agreement in accordance with the termination provisions of this Agreement.

3.3.10 Laws and Regulations; Employee/Labor Certification.

3.3.10.1 Compliance with Laws. Consultant shall keep itself fully informed of and in compliance with all local, state and federal laws, rules and regulations in any manner affecting the performance of the Project or the Services, including all Cal/OSHA

requirements, and shall give all notices required by law. Consultant shall be liable for all violations of such laws and regulations in connection with the Services and this Agreement. All violations of such laws and regulations shall be grounds for the City to terminate the Agreement for cause.

3.3.10.2 Employment Eligibility; Consultant. Consultant certifies that it fully complies with all requirements and restrictions of state and federal law respecting the employment of undocumented aliens, including, but not limited to, the Immigration Reform and Control Act of 1986, as may be amended from time to time and shall require all subconsultants and sub-subconsultants to comply with the same. Consultant certifies that it has not committed a violation of any such law within the five (5) years immediately preceding the date of execution of this Agreement, and shall not violate any such law at any time during the term of the Agreement.

3.3.10.3 Equal Opportunity Employment. Consultant represents that it is an equal opportunity employer and it shall not discriminate against any subconsultant, employee or applicant for employment because of race, religion, color, national origin, handicap, ancestry, sex or age. Such non-discrimination shall include, but not be limited to, all activities related to initial employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination. Consultant shall also comply with all relevant provisions of City's Minority Business Enterprise program, Affirmative Action Plan or other related programs or guidelines currently in effect or hereinafter enacted.

3.3.10.4 Air Quality. To the extent applicable, Consultant must fully comply with all applicable laws, rules and regulations in furnishing or using equipment and/or providing services, including, but not limited to, emissions limits and permitting requirements imposed by the South Coast Air Quality Management District (SCAQMD) and/or California Air Resources Board (CARB). Consultant shall indemnify City against any fines or penalties imposed by SCAQMD, CARB, or any other governmental or regulatory agency for violations of applicable laws, rules and/or regulations by Consultant, its subconsultants, or others for whom Consultant is responsible under its indemnity obligations provided for in this Agreement.

3.3.10.5 Water Quality Management and Compliance. Consultant shall keep itself and all subcontractors, staff, and employees fully informed of and in compliance with all local, state and federal laws, rules and regulations that may impact, or be implicated by the performance of the Services including, without limitation, all applicable provisions of the City's ordinances regulating water quality and storm water; the Federal Water Pollution Control Act (33 U.S.C. § 1251, *et seq.*); the California Porter-Cologne Water Quality Control Act (Water Code § 13000 *et seq*.); and any and all regulations, policies, or permits issued pursuant to any such authority. Consultant must additionally comply with the lawful requirements of the City, and any other municipality, drainage district, or other local agency with jurisdiction over the location where the Services are to be conducted, regulating water quality and storm water discharges. City may seek damages from Consultant for delay in completing the Services caused by Consultant's failure to comply with the laws, regulations and policies described in this Section, or any other relevant water quality law, regulation, or policy.

3.3.10.6 Safety. Consultant shall execute and maintain its work so as to avoid injury or damage to any person or property. In carrying out its Services, the Consultant shall at all times be in compliance with all applicable local, state and federal laws, rules and regulations, and shall exercise all necessary precautions for the safety of employees appropriate to the nature of the work and the conditions under which the work is to be performed.

3.3.11 Insurance.

3.3.11.1 Time for Compliance. Consultant shall not commence work under this Agreement until it has provided evidence satisfactory to the City that it has secured all insurance required under this section. In addition, Consultant shall not allow any subconsultant to commence work on any subcontract until it has provided evidence satisfactory to the City that the subconsultant has secured all insurance required under this section. Failure to provide and maintain all required insurance shall be grounds for the City to terminate this Agreement for cause.

3.3.11.2 Types of Insurance Required. As a condition precedent to the effectiveness of this Agreement for work to be performed hereunder, and without limiting the indemnity provisions of the Agreement, the Consultant, in partial performance of its obligations under such Agreement, shall procure and maintain in full force and effect during the term of the Agreement the following policies of insurance. If the existing policies do not meet the insurance requirements set forth herein, Consultant agrees to amend, supplement or endorse the policies to do so.

(A) Commercial General Liability: Commercial General Liability Insurance which affords coverage at least as broad as Insurance Services Office "occurrence" form CG 00 01, or the exact equivalent, with limits of not less than $1,000,000 per occurrence and no less than $2,000,000 in the general aggregate. Defense costs shall be paid in addition to the limits. The policy shall contain no endorsements or provisions (1) limiting coverage for contractual liability; (2) excluding coverage for claims or suits by one insured against another (cross-liability); (3) products/completed operations liability; or (4) containing any other exclusion(s) contrary to the terms or purposes of this Agreement.

(B) Automobile Liability Insurance: Automobile Liability Insurance with coverage at least as broad as Insurance Services Office Form CA 00 01 covering "Any Auto" (Symbol 1), or the exact equivalent, covering bodily injury and property damage for all activities with limits of not less than $1,000,000 combined limit for each occurrence.

(C) Workers' Compensation: Workers' Compensation Insurance, as required by the State of California and Employer's Liability Insurance with a limit of not less than $1,000,000 per accident for bodily injury and disease.

(D) Professional Liability (Errors & Omissions): Professional Liability insurance or Errors & Omissions insurance appropriate to Consultant’s profession with limits of not less than $1,000,000. Covered professional services shall specifically include all work to be performed under the Agreement and delete any exclusions that may potentially affect the work to be performed (for example, any exclusions relating to lead, asbestos, pollution, testing, underground storage tanks, laboratory analysis, soil work, etc.). If coverage is written on a claims-made basis, the retroactive date shall precede the effective date of the initial Agreement and continuous coverage will be maintained or an extended reporting period will be exercised for a period of at least five (5) years from termination or expiration of this Agreement.

3.3.11.3 Insurance Endorsements. Required insurance policies shall contain the following provisions, or Consultant shall provide endorsements on forms approved by the City to add the following provisions to the insurance policies:

(A) Commercial General Liability: (1) Additional Insured: The City, its officials, officers, employees, agents, and volunteers shall be additional insureds with regard to liability and defense of suits or claims arising out of the performance of the Agreement. Additional Insured Endorsements shall not (1) be restricted to "ongoing operations"; (2) exclude "contractual liability"; (3) restrict coverage to "sole" liability of Consultant; or (4) contain any other exclusions contrary to the terms or purposes of this Agreement. For all policies of Commercial General Liability insurance, Consultant shall provide endorsements in the form of ISO CG 20 10 10 01 and 20 37 10 01 (or endorsements providing the exact same coverage) to effectuate this requirement. (2) Cancellation: Required insurance policies shall not be canceled or the coverage reduced until a thirty (30) day written notice of cancellation has been served upon the City except ten (10) days shall be allowed for non-payment of premium.

(B) Automobile Liability. (1) Cancellation: Required insurance policies shall not be canceled or the coverage reduced until a thirty (30) day written notice of cancellation has been served upon the City except ten (10) days shall be allowed for non-payment of premium.

(C) Professional Liability (Errors & Omissions): (1) Cancellation: Required insurance policies shall not be canceled or the coverage reduced until a thirty (30) day written notice of cancellation has been served upon the City except ten (10) days shall be allowed for non-payment of premium. (2) Contractual Liability Exclusion Deleted: This insurance shall include contractual liability applicable to this Agreement. The policy must “pay on behalf of” the insured and include a provision establishing the insurer’s duty to defend.

(D) Workers' Compensation: (1) Cancellation: Required insurance policies shall not be canceled or the coverage reduced until a thirty (30) day written notice of cancellation has been served upon the City except ten (10) days shall be allowed for non-payment of premium. (2) Waiver of Subrogation: A waiver of subrogation stating that the insurer waives all rights of subrogation against the City, its officials, officers, employees, agents, and volunteers.

3.3.11.4 Primary and Non-Contributing Insurance. All policies of Commercial General Liability and Automobile Liability insurance shall be primary and any other insurance, deductible, or self-insurance maintained by the City, its officials, officers, employees, agents, or volunteers shall not contribute with this primary insurance. Policies shall contain or be endorsed to contain such provisions.

3.3.11.5 Waiver of Subrogation. All required insurance coverages, except for the professional liability coverage, shall contain or be endorsed to waiver of subrogation in favor of the City, its officials, officers, employees, agents, and volunteers or shall specifically allow Consultant or others providing insurance evidence in compliance with these specifications to waive their right of recovery prior to a loss. Consultant hereby waives its own right of recovery against City, and shall require similar written express waivers and insurance clauses from each of its subconsultants.

3.3.11.6 Deductibles and Self-Insured Retentions. Any deductible or self-insured retention must be approved in writing by the City and shall protect the City, its officials, officers, employees, agents, and volunteers in the same manner and to the same extent as they

would have been protected had the policy or policies not contained a deductible or self-insured retention.

3.3.11.7 Evidence of Insurance. The Consultant, concurrently with the execution of the Agreement, and as a condition precedent to the effectiveness thereof, shall deliver either certified copies of the required policies, or original certificates on forms approved by the City, together with all endorsements affecting each policy. Required insurance policies shall not be in compliance if they include any limiting provision or endorsement that has not been submitted to the City for approval. The certificates and endorsements for each insurance policy shall be signed by a person authorized by that insurer to bind coverage on its behalf. At least fifteen (15 days) prior to the expiration of any such policy, evidence of insurance showing that such insurance coverage has been renewed or extended shall be filed with the City. If such coverage is cancelled or reduced and not replaced immediately so as to avoid a lapse in the required coverage, Consultant shall, within ten (10) days after receipt of written notice of such cancellation or reduction of coverage, file with the City evidence of insurance showing that the required insurance has been reinstated or has been provided through another insurance company or companies.

3.3.11.8 Acceptability of Insurers. Each such policy shall be from a company or companies with a current A.M. Best's rating of no less than A:VII and authorized to transact business of insurance in the State of California, or otherwise allowed to place insurance through surplus line brokers under applicable provisions of the California Insurance Code or any federal law.

3.3.11.9 Enforcement of Agreement Provisions (non estoppel). Consultant acknowledges and agrees that actual or alleged failure on the part of the City to inform Consultant of non-compliance with any requirement imposes no additional obligation on the City nor does it waive any rights hereunder.

3.3.11.10 Requirements Not Limiting. Requirement of specific coverage or minimum limits contained in this Section are not intended as a limitation on coverage, limits, or other requirement, or a waiver of any coverage normally provided by any insurance.

3.3.11.11 Additional Insurance Provisions

(A) The foregoing requirements as to the types and limits of insurance coverage to be maintained by Consultant, and any approval of said insurance by the City, is not intended to and shall not in any manner limit or qualify the liabilities and obligations otherwise assumed by the Consultant pursuant to this Agreement, including but not limited to, the provisions concerning indemnification.

(B) If at any time during the life of the Agreement, any policy of insurance required under this Agreement does not comply with these specifications or is canceled and not replaced, City has the right but not the duty to obtain the insurance it deems necessary and any premium paid by City will be promptly reimbursed by Consultant or City will withhold amounts sufficient to pay premium from Consultant payments. In the alternative, City may cancel this Agreement.

(C) The City may require the Consultant to provide complete copies of all insurance policies in effect for the duration of the Project.

(D) Neither the City nor any of its officials, officers, employees, agents or volunteers shall be personally responsible for any liability arising under or by virtue of this Agreement.

(E) The limits set forth herein shall apply separately to each insured against whom claims are made or suits are brought, except with respect to the limits of liability. Further the limits set forth herein shall not be construed to relieve the Consultant from liability in excess of such coverage, nor shall it limit the Consultant's indemnification obligations to the City and shall not preclude the City from taking such other actions available to the City under other provisions of the Agreement or law.

(F) Consultant shall report to the City, in addition to Consultant's insurer, any and all insurance claims submitted by Consultant in connection with the Services under this Agreement.

3.3.11.12 Insurance for Subconsultants. Consultant shall include all subconsultants engaged in any work for Consultant relating to this Agreement as additional insureds under the Consultant's policies, or the Consultant shall be responsible for causing subconsultants to purchase the appropriate insurance in compliance with the terms of these Insurance Requirements, including adding the City, its officials, officers, employees, agents, and volunteers as additional insureds to the subconsultant's policies. All policies of Commercial General Liability insurance provided by Consultant's subconsultants performing work relating to this Agreement shall be endorsed to name the City, its officials, officers, employees, agents and volunteers as additional insureds using endorsement form ISO CG 20 38 04 13 or an endorsement providing equivalent coverage. Consultant shall not allow any subconsultant to commence work on any subcontract relating to this Agreement until it has received satisfactory evidence of subconsultant's compliance with all insurance requirements under this Agreement, to the extent applicable. The Consultant shall provide satisfactory evidence of compliance with this section upon request of the City.

3.4 Labor Code Requirements.

3.4.1 Prevailing Wages. Consultant is aware of the requirements of California Labor Code Section 1720, et seq., and 1770, et seq., as well as California Code of Regulations, Title 8, Section 16000, et seq., ("Prevailing Wage Laws"), which require the payment of prevailing wage rates and the performance of other requirements on "public works" and "maintenance" projects. If the Services are being performed as part of an applicable "public works" or "maintenance" project, as defined by the Prevailing Wage Laws, and if the total compensation is $1,000 or more, Consultant agrees to fully comply with such Prevailing Wage Laws. City shall provide Consultant with a copy of the prevailing rates of per diem wages in effect at the commencement of this Agreement. Consultant shall make copies of the prevailing rates of per diem wages for each craft, classification or type of worker needed to execute the Services available to interested parties upon request, and shall post copies at the Consultant's principal place of business and at the project site. It is the intent of the parties to effectuate the requirements of sections 1771, 1774, 1775, 1776, 1777.5, 1813, and 1815 of the Labor Code within this Agreement, and Consultant shall therefore comply with such Labor Code sections to

the fullest extent required by law. Consultant shall defend, indemnify and hold the City, its officials, officers, employees, agents, and volunteers free and harmless from any claim or liability arising out of any failure or alleged failure to comply with the Prevailing Wage Laws.

3.4.2 Registration/DIR Compliance. If the Services are being performed on a public works project of over $25,000 when the project is for construction, alteration, demolition, installation, or repair work, or a public works project of over $15,000 when the project is for maintenance work, in addition to the foregoing, then pursuant to Labor Code sections 1725.5 and 1771.1, the Consultant and all subconsultants must be registered with the Department of Industrial Relations ("DIR"). Consultant shall maintain registration for the duration of the Project and require the same of any subconsultants.

3.4.3 Compliance Monitoring. This Project may also be subject to compliance monitoring and enforcement by the DIR. It shall be Consultant's sole responsibility to comply with all applicable registration and labor compliance requirements, including the submission of payroll records directly to the DIR. Any stop orders issued by the DIR against Consultant or any subconsultant that affect Consultant's performance of services, including any delay, shall be Consultant's sole responsibility. Any delay arising out of or resulting from such stop orders shall be considered Consultant caused delay and shall not be compensable by the City. Consultant shall defend, indemnify and hold the City, its officials, officers, employees and agents free and harmless from any claim or liability arising out of stop orders issued by the DIR against Consultant or any subconsultant.

3.4.4 Labor Certification. By its signature hereunder, Consultant certifies that it is aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for Worker's Compensation or to undertake self-insurance in accordance with the provisions of that Code, and agrees to comply with such provisions before commencing the performance of the Services.

3.5 Termination of Agreement.

3.5.1.1 Grounds for Termination. City may, by written notice to Consultant, terminate the whole or any part of this Agreement at any time and without cause by giving written notice to Consultant of such termination, and specifying the effective date thereof, at least seven (7) days before the effective date of such termination. Upon termination, Consultant shall be compensated only for those Services which have been adequately rendered to City, and Consultant shall be entitled to no further compensation. Consultant may not terminate this Agreement except for cause. The rights and remedies of the City provided in this section shall not be exclusive and are in addition to any other rights and remedies provided by law, equity or under this Agreement.

3.5.1.2 Effect of Termination. If this Agreement is terminated as provided herein, City may require Consultant to provide all finished or unfinished Documents and Data and other information of any kind prepared by Consultant in connection with the performance of Services under this Agreement. Consultant shall be required to provide such document and other information within fifteen (15) days of the request.

3.5.1.3 Additional Services. In the event this Agreement is terminated in whole or in part as provided herein, City may procure, upon such terms and in such manner as it may determine appropriate, services similar to those terminated.

3.6 Indemnification.

3.6.1 To the fullest extent permitted by law, Consultant shall defend (with counsel of City's choosing), indemnify and hold the City, its officials, officers, employees, volunteers, and agents free and harmless from any and all claims, demands, causes of action, costs, expenses, liability, loss, damage or injury of any kind, in law or equity, to property or persons, including wrongful death, in any manner arising out of, pertaining to, or incident to any acts, errors or omissions, or willful misconduct of Consultant, its officials, officers, employees, subcontractors, consultants or agents in connection with the performance of the Consultant's Services, the Project or this Agreement, including without limitation the payment of all damages, expert witness fees and attorney's fees and other related costs and expenses except such loss or damage caused by the sole negligence or willful misconduct of the City. Consultant's obligation to indemnify shall survive expiration or termination of this Agreement and shall not be restricted to insurance proceeds, if any, received by Consultant, the City, its officials, officers, employees, agents, or volunteers.

3.6.2 If Consultant's obligation to defend, indemnify, and/or hold harmless arises out of Consultant's performance as a "design professional" (as that term is defined under Civil Code section 2782.8), then, and only to the extent required by Civil Code section 2782.8, which is fully incorporated herein, Consultant's indemnification obligation shall be limited to claims that arise out of, pertain to, or relate to the negligence, recklessness, or willful misconduct of the Consultant, and, upon Consultant obtaining a final adjudication by a court of competent jurisdiction, Consultant's liability for such claim, including the cost to defend, shall not exceed the Consultant's proportionate percentage of fault.

3.7 General Provisions.

3.7.1 Accounting Records. Consultant shall maintain complete and accurate records with respect to all costs and expenses incurred under this Agreement. All such records shall be clearly identifiable. Consultant shall allow a representative of City during normal business hours to examine, audit, and make transcripts or copies of such records and any other documents created pursuant to this Agreement. Consultant shall allow inspection of all work, data, documents, proceedings, and activities related to the Agreement for a period of three (3) years from the date of final payment under this Agreement.

3.7.2 Independent Contractors and Subcontracting.

3.7.2.1 Use of Consultants. Consultant is aware of statutory and case law regarding classification of workers as independent contractors, including California Labor Code Section 2750.3 and Dynamex Operations West, Inc. v. Superior Court, 4 Cal. 5th 903 (2018). To ensure that Consultant is in compliance with the California Labor Code, Consultant shall only utilize its employees to provide the Services. Consultant may not provide the services through any independent contractor, subcontractor or subconsultant ("Subcontractor(s)") unless approved by the City as set forth in Section 3.7.2.2 below. Consultant represents and warrants that all personnel who perform the Services on Consultant's behalf are Consultant's employees,

and that Consultant complies with all applicable laws, rules and regulations governing its employees, including, but not limited to, the California Labor Code, Unemployment Insurance Code and all applicable Industrial Welfare Commission Wage Orders.

3.7.2.2 Prior Approval Required. Consultant shall not use any Subcontractor to provide the Services, or any portion of the work required by this Agreement, without prior written approval of City. In the event that City authorizes Consultant to use a Subcontractor, Consultant shall enter into a written agreement with the Subcontractor, which must include all provisions of the Agreement, including a restriction on the Subcontractor's use of further independent contractors, subcontractors or subconsultants without the City's prior written consent.

3.7.3 Delivery of Notices. All notices permitted or required under this Agreement shall be given to the respective parties at the following address, or at such other address as the respective parties may provide in writing for this purpose:

Consultant: [***INSERT BUSINESS NAME***]
[***INSERT STREET ADDRESS***]
[***INSERT CITY STATE ZIP***]
ATTN: [***INSERT NAME AND TITLE***]

City: City of Coachella
53462 Enterprise Way
Coachella, CA 92236
ATTN: [***INSERT NAME AND TITLE***]

Such notice shall be deemed made when personally delivered or when mailed, forty-eight (48) hours after deposit in the U.S. Mail, first class postage prepaid and addressed to the party at its applicable address. Actual notice shall be deemed adequate notice on the date actual notice occurred, regardless of the method of service.

3.7.4 Ownership of Materials and Confidentiality.

3.7.4.1 Documents & Data; Licensing of Intellectual Property. This Agreement creates a non-exclusive and perpetual license for City to copy, use, modify, reuse, or sublicense any and all copyrights, designs, and other intellectual property embodied in plans, specifications, studies, drawings, estimates, and other documents or works of authorship fixed in any tangible medium of expression, including but not limited to, physical drawings or data magnetically or otherwise recorded on computer diskettes, which are prepared or caused to be prepared by Consultant under this Agreement ("Documents & Data"). All Documents & Data shall be and remain the property of City, and shall not be used in whole or in substantial part by Consultant on other projects without the City's express written permission. Within thirty (30) days following the completion, suspension, abandonment or termination of this Agreement, Consultant shall provide to City reproducible copies of all Documents & Data, in a form and amount required by City. City reserves the right to select the method of document reproduction and to establish where the reproduction will be accomplished. The reproduction expense shall be borne by City at the actual cost of duplication. In the event of a dispute regarding the amount of compensation to which the Consultant is entitled under the termination provisions of this Agreement, Consultant shall provide all Documents & Data to City upon payment of the undisputed amount. Consultant

shall have no right to retain or fail to provide to City any such documents pending resolution of the dispute. In addition, Consultant shall retain copies of all Documents & Data on file for a minimum of fifteen (15) years following completion of the Project, and shall make copies available to City upon the payment of actual reasonable duplication costs. Before destroying the Documents & Data following this retention period, Consultant shall make a reasonable effort to notify City and provide City with the opportunity to obtain the documents.

3.7.4.2 Subconsultants. Consultant shall require all subconsultants to agree in writing that City is granted a non-exclusive and perpetual license for any Documents & Data the subconsultant prepares under this Agreement. Consultant represents and warrants that Consultant has the legal right to license any and all Documents & Data. Consultant makes no such representation and warranty in regard to Documents & Data which were prepared by design professionals other than Consultant or its subconsultants, or those provided to Consultant by the City.

3.7.4.3 Right to Use. City shall not be limited in any way in its use or reuse of the Documents and Data or any part of them at any time for purposes of this Project or another project, provided that any such use not within the purposes intended by this Agreement or on a project other than this Project without employing the services of Consultant shall be at City's sole risk. If City uses or reuses the Documents & Data on any project other than this Project, it shall remove the Consultant's seal from the Documents & Data and indemnify and hold harmless Consultant and its officers, directors, agents and employees from claims arising out of the negligent use or re-use of the Documents & Data on such other project. Consultant shall be responsible and liable for its Documents & Data, pursuant to the terms of this Agreement, only with respect to the condition of the Documents & Data at the time they are provided to the City upon completion, suspension, abandonment or termination. Consultant shall not be responsible or liable for any revisions to the Documents & Data made by any party other than Consultant, a party for whom the Consultant is legally responsible or liable, or anyone approved by the Consultant.

3.7.4.4 Indemnification. Consultant shall defend, indemnify and hold the City, its directors, officials, officers, employees, volunteers and agents free and harmless, pursuant to the indemnification provisions of this Agreement, for any alleged infringement of any patent, copyright, trade secret, trade name, trademark, or any other proprietary right of any person or entity in consequence of the use on the Project by City of the Documents & Data, including any method, process, product, or concept specified or depicted.

3.7.4.5 Confidentiality. All ideas, memoranda, specifications, plans, procedures, drawings, descriptions, computer program data, input record data, written information, and other Documents & Data either created by or provided to Consultant in connection with the performance of this Agreement shall be held confidential by Consultant. Such materials shall not, without the prior written consent of City, be used by Consultant for any purposes other than the performance of the Services. Nor shall such materials be disclosed to any person or entity not connected with the performance of the Services or the Project. Nothing furnished to Consultant which is otherwise known to Consultant or is generally known, or has become known, to the related industry shall be deemed confidential. Consultant shall not use City's name or insignia, photographs of the Project, or any publicity pertaining to the Services or the Project in any magazine, trade paper, newspaper, television or radio production or other similar medium without the prior written consent of City.

3.7.4.6 Confidential Information. The City shall refrain from releasing Consultant's proprietary information ("Proprietary Information") unless the City's legal counsel determines that the release of the Proprietary Information is required by the California Public Records Act or other applicable state or federal law, or order of a court of competent jurisdiction, in which case the City shall notify Consultant of its intention to release Proprietary Information. Consultant shall have five (5) working days after receipt of the release notice to give City written notice of Consultant's objection to the City's release of Proprietary Information. Consultant shall indemnify, defend and hold harmless the City, and its officers, directors, employees, and agents from and against all liability, loss, cost or expense (including attorney's fees) arising out of a legal action brought to compel the release of Proprietary Information. City shall not release the Proprietary Information after receipt of an objection notice unless either: (1) Consultant fails to fully indemnify, defend (with City's choice of legal counsel), and hold City harmless from any legal action brought to compel such release; and/or (2) a final and non-appealable order by a court of competent jurisdiction requires that City release such information.

3.7.5 Cooperation; Further Acts. The Parties shall fully cooperate with one another, and shall take any additional acts or sign any additional documents as may be necessary, appropriate or convenient to attain the purposes of this Agreement.

3.7.6 Entire Agreement. This Agreement contains the entire agreement of the Parties with respect to the subject matter hereof, and supersedes all prior negotiations, understandings or agreements.

3.7.7 Attorneys' Fees. If either party commences an action against the other party, either legal, administrative or otherwise, arising out of or in connection with this Agreement, the prevailing party in such litigation shall be entitled to have and recover from the losing party reasonable attorneys' fees and all costs of such action.

3.7.8 Governing Law. This Agreement shall be governed by the laws of the State of California. Venue shall be in Riverside County. In addition to any and all contract requirements pertaining to notices of and requests for compensation or payment for extra work, disputed work, claims and/or changed conditions, Consultant must comply with the claim procedures set forth in Government Code sections 900 et seq. prior to filing any lawsuit against the City. Such Government Code claims and any subsequent lawsuit based upon the Government Code claims shall be limited to those matters that remain unresolved after all procedures pertaining to extra work, disputed work, claims, and/or changed conditions have been followed by Consultant. If no such Government Code claim is submitted, or if any prerequisite contractual requirements are not otherwise satisfied as specified herein, Consultant shall be barred from bringing and maintaining a valid lawsuit against the City.

3.7.9 Time of Essence. Time is of the essence for each and every provision of this Agreement.

3.7.10 City's Right to Employ Other Consultants. City reserves right to employ other consultants in connection with this Project.

3.7.11 Successors and Assigns. This Agreement shall be binding on the successors and assigns of the parties.

3.7.12 Assignment or Transfer. Consultant shall not assign, sublet, or transfer this Agreement or any rights under or interest in this Agreement without the written consent of the City, which may be withheld for any reason. Any attempt to so assign or so transfer without such consent shall be void and without legal effect and shall constitute grounds for termination. Consultant shall not subcontract any portion of the Services required by this Agreement, except as expressly stated herein, without prior written approval of City. Subcontracts, if any, shall contain a provision making them subject to all provisions stipulated in this Agreement.

3.7.13 Construction; References; Captions. Since the Parties or their agents have participated fully in the preparation of this Agreement, the language of this Agreement shall be construed simply, according to its fair meaning, and not strictly for or against any Party. Any term referencing time, days or period for performance shall be deemed calendar days and not work days. All references to Consultant include all personnel, employees, agents, and subconsultants of Consultant, except as otherwise specified in this Agreement. All references to City include its elected officials, officers, employees, agents, and volunteers except as otherwise specified in this Agreement. The captions of the various articles and paragraphs are for convenience and ease of reference only, and do not define, limit, augment, or describe the scope, content, or intent of this Agreement.

3.7.14 Amendment; Modification. No supplement, modification, or amendment of this Agreement shall be binding unless executed in writing and signed by both Parties.

3.7.15 Waiver. No waiver of any default shall constitute a waiver of any other default or breach, whether of the same or other covenant or condition. No waiver, benefit, privilege, or service voluntarily given or performed by a Party shall give the other Party any contractual rights by custom, estoppel, or otherwise.

3.7.16 No Third-Party Beneficiaries. There are no intended third party beneficiaries of any right or obligation assumed by the Parties.

3.7.17 Invalidity; Severability. If any portion of this Agreement is declared invalid, illegal, or otherwise unenforceable by a court of competent jurisdiction, the remaining provisions shall continue in full force and effect.

3.7.18 Prohibited Interests. Consultant maintains and warrants that it has not employed nor retained any company or person, other than a bona fide employee working solely for Consultant, to solicit or secure this Agreement. Consultant warrants that it has not paid nor has it agreed to pay any company or person, other than a bona fide employee working solely for Consultant, any fee, commission, percentage, brokerage fee, gift or other consideration contingent upon or resulting from the award or making of this Agreement. Consultant further agrees to file, or shall cause its employees or subconsultants to file, a Statement of Economic Interest with the City's Filing Officer as required under state law in the performance of the Services. For breach or violation of this warranty, City shall have the right to rescind this Agreement without liability. For the term of this Agreement, no member, officer or employee of City, during the term of his or her service with City, shall have any direct interest in this Agreement, or obtain any present or anticipated material benefit arising therefrom.

3.7.19 Authority to Enter Agreement. Consultant has all requisite power and authority to conduct its business and to execute, deliver, and perform the Agreement. Each Party

warrants that the individuals who have signed this Agreement have the legal power, right, and authority to make this Agreement and bind each respective Party.

3.7.20 Counterparts. This Agreement may be signed in counterparts, each of which shall constitute an original.

3.7.21 Survival. All rights and obligations hereunder that by their nature are to continue after any expiration or termination of this Agreement, including, but not limited to, the indemnification obligations, shall survive any such expiration or termination.

[SIGNATURES ON NEXT PAGE]

SIGNATURE PAGE TO PROFESSIONAL SERVICES AGREEMENT BETWEEN THE CITY OF COACHELLA AND [*INSERT NAME***]**

IN WITNESS WHEREOF, each of the Parties has caused this Agreement to be executed on the day and year first above written.

CITY OF COACHELLA

Approved By:

_____

[INSERT NAME]
[INSERT TITLE]

Approved as to Form:

_____

Best Best & Krieger LLP
City Attorney

Attested By:

_____

City Clerk

[INSERT NAME OF CONSULTANT]

[If Corporation, TWO SIGNATURES, President OR Vice President AND Secretary OR Treasurer REQUIRED]

By: _____

Its: _____

Printed Name: _____

By: _____

Its: _____

Printed Name: _____

EXHIBIT "A"
SCOPE OF SERVICES

[***INSERT SCOPE***]

EXHIBIT "B"
SCHEDULE OF SERVICES

[***INSERT SCHEDULE***]

EXHIBIT "C"
COMPENSATION

[***INSERT RATES & AUTHORIZED REIMBURSABLE EXPENSES***]

ATTACHMENT I

COACHELLA WATER AUTHORITY HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT BASIS OF DESIGN REPORT.

Hazen

Coachella Water Authority
Hexavalent Chromium Treatment Facilities Project Basis of Design Report

November 2016

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Acronyms

Acronym	Definition
ACI	American Concrete Institute
AFF	Above Finished Floor
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ATS	Automatic Transfer Switch
AWWA	American Water Works Association
BATs	Best Available Technology
BEP	Best Efficiency Point
BHP	Brake Horsepower
BMP	Best Management Practices
BODR	Basis of Design Report
BR	Brine Regeneration
BV	Bed Volume
BW	Backwash
CAP	Corrective Action Plan
CBC	California Building Code
CC	Chemical Coagulation
CEC	California Energy Commission
CEQA	California Environmental Quality Act
cf	Cubic Feet
CMU	Concrete Masonry Unit
CVWD	Coachella Valley Water District
CVWD CRRF	CVWD Central Resin Regeneration Facility
CWA	Coachella Water Authority
CWA RRF	CWA Resin Regeneration Facility
cy	cubic yard
DDW	State Water Resources Control Board Division of Drinking Water
DWSRF	Drinking Water State Revolving Fund
EC	Electrocoagulation
FLA	Full Load Amps
FR	Fast Rinse
FRP	Fiberglass Reinforced Plastic
FRR	Fast Rinse Recycle
FTE	Full Time Equivalent
FVNR	Full Voltage Non-Reversing
GAC	Granular Activated Carbon

Acronym	Definition
gpm	Gallons Per Minute
H&S	Hazen and Sawyer
HMI	Human-Machine Interface
HVAC	Heating Ventilation and Air Conditioning
IBC	International Building Code
IEEE	Institute of Electrical Manufacturers Association
IID	Imperial Irrigation District
IX	Ion Exchange
kW	Kilowatt
LID	Low Impact Development
LLRW	Low Level Radioactive Waste
LT	Long Term
MCL	Maximum Contaminant Level
MG	Million Gallons
NDMA	N-Nitrosodimethylamine
NEC	National Electric Code
NEFPA	National Fire Protection Association
NEMA	National Electric Manufacturers Association
NIST	National Institute of Standards and Technology
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
pcf	pounds per cubic foot
PHD	Peak Hour Demand
PID	Process and Instrumentation Diagram
PLC	Programmable Logic Controllers
PRV	Pressure Reducing Valve
PVC	Polyvinyl Chloride
RCF	Reduction-Coagulation-Filtration
RCRA	Resource Conservation and Recovery Act
RO	Reverse Osmosis
RRT	Regenerated Resin Transfer
RVSS	Reduced Voltage Solid State
SBA	Strong Base Anion Exchange
SCADA	Supervisory Control and Data Acquisition
SCAQMD	Southern California Air Quality Management District
SDI	Steel Deck Institute
SE	Service Entrance
SJI	Steel Joist Institute
SR	Slow Rinse

Acronym	Definition
SRT	Spent Resin Transfer
SSR	Slow Rinse Recycle
ST	Short Term
STLC	Soluble Threshold Limit Concentration
Study	Chromium-6 Treatment and Compliance Study
SWBD-MAIN	Switchboard-Main
SWBD-REGEN	Switchboard-Regen
SWPPP	Storm Water Pollution Prevention Program
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TTD	Tanker Truck Disinfection
TTPC	Total Threshold Limit Concentration
UL	Underwriters' Laboratory
VFD	Variable Frequency Drive
WBA	Weak Base Anion Exchange
WWTP	Wastewater Treatment Plant

1. Overview

Chromium is a naturally occurring constituent in Coachella Valley groundwater. Chromium is commonly present in the environment in two forms: Cr(III) and Cr(VI). While Cr(III) is an essential nutrient for humans, Cr(VI) is mobile, soluble, and is considered a probable human carcinogen. The State of California adopted a new maximum contaminant level (MCL) of 10 parts per billion (ppb) for Cr(VI) in drinking water, effective July 1, 2014. CWA currently has 6 active groundwater wells, all of which have Cr(VI) concentrations above the new MCL.

Coachella Water Authority (CWA) conducted a Chromium-6 Treatment and Compliance (Study)[1], to determine the optimal approach for CWA to comply with current, proposed, and reasonably anticipated Federal and State drinking water regulations. It was determined that treatment would be required to comply with the Cr(VI) MCL. Best Available Technologies (BATs) for removing Cr(VI) include: ion exchange (strong base anion exchange, SBA or weak base anion exchange, WBA), reduction-coagulation-filtration (RCF), and reverse osmosis (RO). Of these BATs, SBA was selected by CWA as the preferred technology based on costs, waste disposal, operations and maintenance complexity, space requirement and compatibility with neighborhoods, water loss, flexibility for removing constituents that are currently regulated or on the regulatory horizon, and maximizing the use of groundwater supply sources.

During the development of the Study, the State Water Resources Control Board Division of Drinking Water (DDW) issued a Compliance Order (No. 05-20-15R-001 dated April 30, 2015) to CWA for violation of the Cr(VI) MCL. In response, CWA submitted a Corrective Action Plan (CAP) describing actions to be taken to return the system to compliance.

On September 4, 2015, Senate Bill 385 (SB385) was signed by the Governor, authorizing the Division to grant additional time for public water systems to come into compliance without being deemed in violation of the MCL. Specifically, SB385 requires a Compliance Plan that will bring the system into compliance as soon as possible, but no later than January 1, 2020. The Division accepted CWA's CAP as an initial draft Compliance Plan and is in the process of rescinding Compliance Order No. 05-20-15R-001, so that CWA is not reported as having incurred a Cr(VI) MCL violation.

Out of the six active CWA wells that have Cr(VI) concentrations above the MCL, five will employ the SBA treatment technology and the remaining well, Well 11, will be taken off line due to increased sanding and decreasing production. Periodically, the SBA resin capacity for Cr(VI) will diminish and the spent resin will require regeneration. The spent resin from each of the wellhead treatment sites will be regenerated at an offsite facility. This treatment approach, SBA treatment at well sites and an offsite regeneration facility, offers advantages to CWA in terms of simplicity of operations at a large number of sites including minimal truck traffic, footprint at small well sites, lower capital cost, and flexibility to relocate treatment vessels to other sites in the future if groundwater quality or regulatory requirements change.

[1] Chromium-6 Treatment and Compliance Study for Coachella and Indio Water Authorities, Hazen and Sawyer, August 2015

CWA is evaluating multiple options for resin regeneration. A neighboring water agency, the Coachella Valley Water District (CVWD) has plans to construct a Centralized Resin Regeneration Facility for their wells (CVWD CRRF). CWA could send resin to the CVWD CRRF or construct a CWA resin regeneration facility (CWA RRF). This Basis of Design Report (BODR) covers the SBA treatment sites and the options for the regeneration facility.

1.1 Treatment Sites

The existing wells to be treated with SBA technology are listed in **Table 1-1**. This table also includes the future Well 20, which will be added to the 150 Zone, assuming that it will require treatment. An SBA treatment facility will be located at each existing well site. The locations of the wells are detailed on the drawings included in **Appendix A**. Resin regeneration will be conducted at an offsite facility, either the CVWD CRRF or a CWA RRF (**Table 1-2**). The location of the CWA RRF is shown on the drawings included in **Appendix A**.

Table 1-1: SBA Well Sites

Well No.	Location	Pressure Zone	Nominal Capacity [gpm][1]
Well 12	Mecca Avenue, Coachella, CA.	Low	2,000
Well 16	Tyler Lane, Coachella, CA.	Low	2,000
Well 17	48-463 Van Buren Street, Coachella, CA.	Low	2,200
Well 18	86-250 Avenue 48, Coachella, CA.	150[2]	2,000
Well 19	48-281 Playa Del Amor, Coachella, CA.	Low	2,000
Well 20 (future)	*TBD*	*150*	*TBD*

[1] Source: Draft 2017 Water Master Plan, TKE Engineering, Inc.
[2] There is a dual zone booster pump station located at Well 18 that can serve both the Low and 150 pressure zones.

Table 1-2: Resin Regeneration Site Options

Site	Location
CVWD CRRF	Avenue 63 and Fillmore St
CWA RRF	Avenue 52 and Education Way
CWA RRF (Alternative)[1]	87075 Avenue 54

[1]The existing CWA Wastewater Treatment Plant (WWTP) could be an alternate location for the CWA RRF.

1.2 Design Concept

The SBA system removes Cr(VI) and other anions such as nitrate, sulfate, perchlorate, uranium, arsenic, vanadium and selenium from the drinking water using resin beads. Over time, the resin becomes saturated and treated water concentrations rise, exceeding the treatment target. The capacity of the SBA resin for Cr(VI) can be restored by regeneration, which will be conducted at an offsite facility. As part of the Study and a subsequent SBA operations evaluation, CWA found this approach to be cost-effective and operationally preferable to performing resin regeneration at each well site. Specific advantages include:

- The regeneration process is complex and requires multiple tanks and automated valves. Providing this equipment in one location compared to multiple systems at each well site reduces capital cost.
- Some wells are in residential neighborhoods and adjacent to public parks where CWA prefers to keep on-site operational procedures to a minimum.
- An offsite regeneration facility allows for a single point of delivery for salt and other treatment chemicals. It also provides a single point for residual waste handling.

Resin will be extracted from the vessels at a frequency of approximately once every few weeks to once every few months, brought to the RRF for regeneration, and then loaded back into the resin vessels at the well sites. There are multiple options for managing waste residuals at the RRF:

- **Option A – No Brine Generation**: In this option, CWA does not generate a brine, as the resin from CWA well sites would be transported to the CVWD CRRF for regeneration.
- **Option B – Hazardous brine hauling**: In this option, CWA would contract with a licensed facility to haul, treat, and dispose of the brine.
- **Option C – Brine Treatment**: Various technologies can be used to treat the brine so that it can be disposed to the sewer. The solid waste generated by the brine treatment process is expected to a Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) or a Low Level Radioactive Waste (LLRW), which will be taken off-site to a licensed disposal facility.

1.3 Treatment Process

A process flow diagram for the general SBA treatment is provided in **Appendix A**. The SBA facilities design will include the following main unit processes:

- SBA treatment bypass
- Bag filtration
- SBA Cr(VI) treatment
- Resin relevel
- Well pump to waste
- Disinfection
- Sampling and analysis
- Details of these unit processes are included in **Section 5**.

CWA has the option of utilizing the CVWD CRRF or constructing a CWA RRF. This BODR outlines the CWA RRF preliminary design and compares cost estimates for both approaches. A process flow diagram for the CWA RRF is provided in **Appendix A**. The following main unit processes are included:

- Spent resin transfer
- Resin truck disinfection
- Resin backwash
- Brine make-up
- Brine dilution
- Resin regeneration
- Slow rinse / slow rinse recycle
- Fast rinse
- Regenerated resin transfer
- Spent brine hauling or option for brine treatment with solids handling

The backwash and the last portion of the fast rinse will be sent will be mixed (and combined with treated brine if the brine treatment option is included) and sent to the sewer to supplement the Avenue 54 WWTP flows.

2. Project Schedule

Prior to and since the adoption of the new Cr(VI) MCL, CWA has been proactive in preparing to meet the standard. With the passing of SB358, CWA outlined a plan to achieve compliance at the earliest feasible date. CWA has completed the study phase of that plan with the Study and subsequent SBA operational evaluation to select the treatment approach outlined in this BODR. This section discusses the remaining project phases and schedule as outlined in the Compliance Plan.

2.1 Compliance Plan

CWA's Compliance Plan was approved by DDW and outlines actions that CWA is taking and will take to comply with the Cr6 MCL. The plan is comprised of eight phases: study, funding, design, environmental review, land acquisition, contractor selection, construction, and testing. Milestones referenced from the approved Compliance Plan include:

- Complete Study – March 2016
- Complete CEQA (California Environmental Quality Act) Certification – December 2017
- Design Substantially Complete – December 2017
- Complete Grant/Loans Application – December 2017
- Start Construction – April 2018
- Begin Operating in Compliance with Cr6 Standard – December 2019

These are the milestones included in the current Compliance Plan. As the project develops, CWA provide notification of schedule changes through their quarterly update reports.

2.2 Funding

CWA does not have the available funds to construct the treatment projects that are required for Cr6 compliance. Identifying the funding needed to support the design, environmental planning, and construction of treatment facilities will take time. A rate study is planned that will identify the financial burden that must be passed on to CWA customers. CWA plans to fund the Project using California Drinking Water State Revolving Fund (DWSRF) grants or loans, as well as a grant through one or more of the Proposition 1 programs. CWA submitted pre-applications and planning applications, and will continue to work closely with the State and Federal entities to identify and pursue available grants and financial assistance. A DWSRF loan funding agreement is anticipated in January 2017 to support the planning phases of the Project. A DWSRF Construction Application will be initiated in January 2017, although a funding agreement for the construction phases of the Project is not likely to be complete before April 2018.

2.3 Design and Environmental Review

2.3.1 Preliminary Design

Preliminary design for the project began immediately following the notice to proceed, and a project kickoff meeting was held on August 31, 2016. Following the kickoff meeting, Hazen began preparation of this BODR. Preliminary design meetings were held, and included discussions on process flow diagrams, controls, site layouts, operations, electrical, and hydraulics. A Basis of Design Memorandum and cost estimate for the 15% design was prepared and reviewed with CWA in October 2016 and finalized in November 2016. Geotechnical fieldwork and site surveys are planned for the Detailed Design phase.

2.3.2 Detailed Design

Detailed design will commence with CWA authorization and approval of the BODR. Review packages at the 60% and 90% design are planned with a 100% submittal scheduled for September 2017. The schedule includes approximately 6 months for 60% design, 3 months for 90% design, and 2 months for 100% design.

2.3.3 CEQA and Permitting

California Environmental Quality Act-Plus (CEQA-Plus) documents are being developed in parallel with the preliminary design phase. A mitigated negative declaration is anticipated and the steps within this process include development of Project Descriptions and an Initial Study Document, Notice of Intent and associated documentation, a public review period, and a final notice of determination. The final notice of determination is anticipated in early 2017.

In parallel with the detailed design phase, a permitting plan will be developed to confirm required permits for at the local, regional, state, and federal levels for the SBA well head treatment and the selected resin regeneration option. Hazen will provide support for CWA to apply for all necessary permits. The permit application schedule will take into consideration anticipated regulatory review requirements and will be structured to ensure all necessary approvals are achieved in a manner that aligns with the construction schedule. This will be added to the project schedule pending discussions with the regulatory agencies.

2.4 Land Acquisition

Existing CWA well sites have limited footprint for treatment equipment and at least two wells will require additional land to be acquired. If CWA selects the CWA RRF option, the facility will be located on existing CWA property. Time for land acquisition is included in conjunction with the design phase to allow for property to be acquired and if needed for a siting study to be performed.

2.5 Contractor Selection, Construction, and Testing

Construction is anticipated to commence in April 2018. Completion of the project is expected no later than July 2019. This allows sufficient time for CWA to commission and test the facilities before the January 1, 2020 Compliance deadline. **Figure 2-1** provides details of the proposed project schedule.

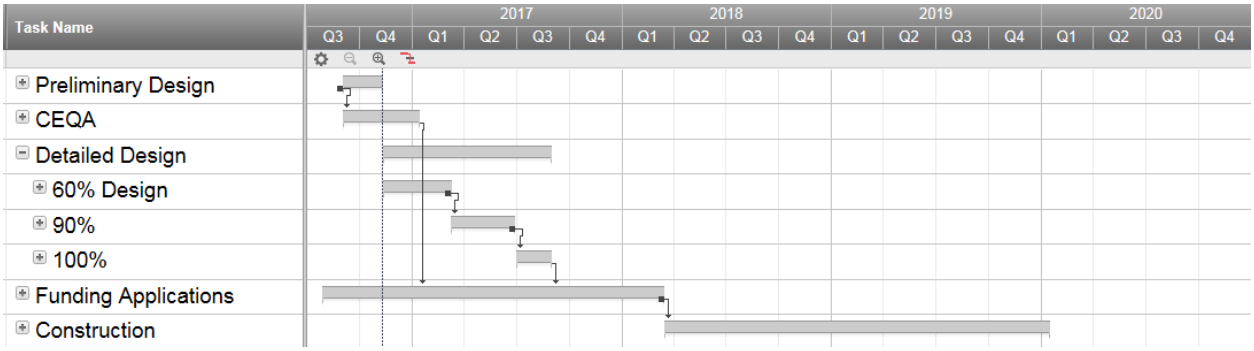


Figure 2-1: Proposed Project Schedule

3. Project Permits

This section details potential permits that may be necessary for the construction and operation of the project. Permits encompass state, regional, and local municipalities. Hazen will provide support for CWA to apply for all necessary permits. The permitting plan will take into consideration anticipated regulatory review requirements and will be structured to ensure all necessary approvals are achieved in a manner that aligns with the construction schedule.

The CEQA process was initiated in September 2016. Upcoming steps within this process will include preparation of an Initial Study and a final notice of determination. The notice of determination is anticipated in early January 2017.

Table 3-1 at the end of this section details all anticipated permits for the SBA Treatment and CWA RRF. The table also includes potentially exempt permits to be confirmed with each governing organization.

3.1 State Permits

3.1.1 SWRCB NPDES General Construction Permit

A National Pollutant Discharge Elimination System (NPDES) general construction permit from the State Water Resources Control Board is required for construction activity taking place within a "larger common plan of development" and resulting in land disturbance of more than one acre. Construction activity includes clearing, grading, excavation, stockpiling, and reconstruction of existing facilities involving removal and replacement. Items required to obtain a permit include a notice of intent form, risk assessment, post-construction calculations, a site map, the storm water pollution prevention plan, a certification statement, and a fee. The SBA Treatment and CWA RRF are part of a larger plan of development and thus will require a State Water Resources Control Board (SWRCB) NPDES General Construction Permit.

3.1.2 SWRCB NPDES Stormwater Permit (Existing)

The City is a co-permittee of the CV MS4 Phase 1 NPDES CAS617002 program and the permit states that CWA will have complete onsite retention. As a Co-permittee, CWA would not require CVRWQCB oversight, but we must ensure BMP documentation for impact to the volume and type of flows from the SBA treatment sites or CWA RRF site.

3.1.3 DTSC / Certified Unified Program Agencies Permit

Aspects of the project that may require a Department of Toxic Substances Control / Certified Unified Program Agencies Permit include the SBA resin treated at the CWA RRF. A standardized permit or permit by rule from the Department of Toxic Substances Control / Certified Unified Program Agencies is required for a facility that manages waste not regulated under the Resource Conservation and Recovery Act (RCRA), but is regulated as a hazardous waste by the State of California. Items required to obtain a

permit include an application, a site plan, engineered plans, a unit description information sheet (for each hazardous waste storage and/or treatment units), and a fee. The permit application process is carried out through the Standardized Permits and Corrective Action Branch.

3.1.4 CDPH Radioactive Material License

A radioactive material license is required from the California Department of Public Health for a facility that produces uranium at a rate greater than 150 pounds per year. The CWA RRF is anticipated to produce more than this if the spent brine treatment option is selected. To obtain a radioactive material license, an application form should be filled out detailing the radioactive material and the facility's means and methods to handle such waste.

3.2 Regional Permits

3.2.1 SQAQMD Permit to Construct and Operate

Permits to construct and operate from the South Coast Air Quality Management District (SCAQMD) are required for new and installed equipment. SCAQMD Rule 219 details equipment that do not require a written permit. Items required to obtain a permit include an application form, CEQA applicability form, potential supplemental forms (for certain equipment types), and a fee. Aspects of the project that may require SCAQMD permits to construct and operate include the emergency backup generator at Well 16 and equipment at the CWA CRF reaction/settling tank, backup power generator, and tanks equipped with air mixing including the feed water storage tank, slow rinse water tank, brine recycle tanks, and emergency back-up generator. The trucking of resin from the wells to the resin regeneration facility may also fall under this permit requirement.

If the equipment is exempt per Rule 219, SCAQMD Rule 222 details equipment that is subject to other filing requirements. The Rule 222 Filing Program provides forms to be filled out and sent in for specific equipment.

3.2.2 Riverside County Department of Environmental Health Business Plan

A business plan is required to be submitted to the Riverside County Department of Environmental Health for businesses that handle hazardous materials above minimum threshold quantities as defined by the Riverside County Ordinance or California Health and Safety Code. Aspects of the project that will need be captured in the plan include the CWA RRF.

3.2.3 Riverside County Department of Environmental Health California Accidental Release

A California Accidental Release Prevention Program (CalARP) registration is required to be submitted to the Riverside County Department of Environmental Health for facilities that store large quantities of regulated substances. Items required to register include an application including information on stored

regulated substances. The chemicals at the CWA RRF include sodium hypochlorite, which is not include in the CalARP regulated substances list, and hydrochloric acid if CWA selects the brine treatment option at the CWA RRF. It is not anticipated that this portion of the project will require registration with CalARP. If needed the City has a current CalARP permit at the City's Bagdouma Pool, which serves as the current location for storage of sodium hypochlorite for the City's pools and wells.

3.2.4 Riverside County Department of Environmental Health Hazardous Waste Generator Permit

A hazardous waste generator permit is required to be submitted to the Riverside County Department of Environmental Health for facilities that generate, store, accumulate, consolidate, treat, or dispose of hazardous waste. Items required to obtain a permit include an application form, an Emergency Response Plan, and a Training Plan. The City currently holds a hazardous waste generator permit for the Bagdouma Pool storage site. An additional hazardous waste generator permit would be required for the CWA RRF site.

3.2.5 Riverside County Department of Environmental Health Treatment Notification

A treatment notification must be submitted to the Riverside County Department of Environmental Health for all facilities that treat hazardous waste onsite. Additionally, all treatment units operating at this facility require a separate treatment notification submittal. Items required to submit the treatment notification include an onsite hazardous waste treatment notification – facility form, an onsite hazardous waste treatment notification – unit form, process pages, and a site plan. Aspects of the project that may require a treatment notification include the CWA RRF facility and associated treatment units.

3.2.6 Local Permits

CWA is exempt from local permitting requirements with the exception of local encroachment permits. The SBA Treatment sites and CWA RRF siting do not fall under local encroachments permit and thus are not anticipated to require any local permitting.

Table 3-1: Permitting Overview

Governing Organization	Permit	Required Submittals[1]	SBA Treatment Sites	CWA RRF
STATE				
Department of Toxic Substances Control (DTSC)/ Certified Unified Program Agencies (CUPA)	Standardized Permit or Permit by Rule	Application, Site Plan, Engineered Plans, Unit Description Information Sheet, Fee		x
California Department of Public Health	Radioactive Material License	Application		x
State Water Resources Control Board	NPDES General Construction Permit	Notice of Intent Form, Risk Assessment, Post-Construction Calculations, Site Map, Storm Water Pollution Prevention Plan, Certification Statement, Fee	x	x
	NPDES Stormwater Permit (Existing)	BMP documentation		
	Water Supply Permit - DDW (Amendment)	Request submitted to Colorado River Basin Regional Water Quality Control Board	x	
	California Regional Water Quality Control Board, Colorado River Basin Region	Waste Discharge Requirements		x
REGIONAL				
South Coast Air Quality Management District	Permit to Construct and Operate	Application, CEQA Applicability Form, Supplemental Forms for Certain Equipment, Fee	x	x
Riverside County Department of Environmental Health	Business Plan	Application, Operation Plan		x
	Hazardous Waste Generator Permit	Application, Emergency Response Plan, Training Plan		x
	Treatment Notification	Facility Form, Onsite Hazardous Waste Treatment notification Unit Form, Process Documentation, Site Plan		x
Riverside County Transportation Department	Encroachment Permit	Application, Engineered Plans, Fee	x	x
Riverside County Flood Control and Water Conservation District	Encroachment Permit	Completed Checklist, Application Engineered Plans, As-Built Drawings with Proposed Mark-Ups, Fee, Copy of CEQA documentation, Additional Stormwater-related Submittals	x	x

[1]List generated through organization website. Required submittals to be confirmed through discussion with organization.

4. Site/Civil Requirements

4.1 Site Design

4.1.1 Overall Site Descriptions

This project includes five (5) Strong Base Anion (SBA) treatment sites and an option for a CWA Resin Regeneration Facility (RRF). The existing footprint for SBA Treatment at CWA wells ranges from 0.1 acres to 2.75 acres. Two of the five well sites will require land acquisition for site area expansion to accommodate the proposed treatment equipment. Each SBA treatment site is currently within a continuous perimeter of either a concrete masonry unit (CMU) block wall (Wells 17 and 19) or chain link fence (Wells 12, 16, 18) – with the exception of lands to be acquired – with manual access gates. Each well site generally contains a well pump and associated piping located in a well house or under a shade canopy. Varying between the wells is chlorine disinfection, a generator, surge anticipator valve, and a pond for well pump to waste.

The CWA RRF is proposed to be placed on a 5.4 acre parcel of land on the south side of the intersection of Avenue 52 and Education Way in Coachella, CA. The facility will consist of a regeneration area, an option for a brine treatment area, and an electrical and control room. There will also be a fenced perimeter and an automated sliding gate entrance off Avenue 52 for controlled access. Approximately 3.5 acres of the parcel would be needed for the CWA RRF facility components. The CWA RRF is generally located on the eastern portion of the site separate from existing Coachella Sanitation Division (CSD) equipment located on site, consisting of an agriculture lift station and an abandoned clarifier structure.

4.1.2 Site Access

Each well site currently has a padlocked vehicle gate. Well 19 is currently the only site that utilizes a man gate for an additional access point. All five of the well site are accessible to CWA personnel through publicly available roads requiring no supplementary passwords, access keys, etc.

An asphalt driveway allowing for all-weather vehicle and equipment access will be provided at each site. Each site will also have a concrete pad designed to collect incidental liquid spills from the resin trucks and capture runoff from the site. All other areas of each well site will use gravel surfacing or remain as existing. Well 16 will require additional paving for trucks to access the well site since current access is through a dirt road and Well 17 will require some paving for the new entrance. Well 12 will require minor improvements to the access drive off Mecca Street to allow for adequate truck access through the gate.

The SBA well sites will require evaluation to determine proper access for truck entry and exit. All existing vehicle gates will be replaced with sliding automated entry gates, and a man gate will be installed if not currently present. Each well site will have at least one vehicle entrance gate. A second automatic vehicle gate may be added if required to allow for convenient vehicle access to the site (refer to **Table 4-1**).

Table 4-1: Well Gate Upgrades

Well	Replace Existing Gate with Automatic Gate	Add Second Automatic Gate
12	X	
16	X	
17	X	X
18	X	
19	X	X

The Resin Regeneration Facility will be located south on a 5.4 acre parcel of land on the south side of the intersection of Avenue 52 and Education Way in Coachella, CA. The Resin Regeneration Facility will be accessed through an improved driveway entrance located on northeastern portion of the parcel. The entrance will be secured with an automated sliding gate. The 25-foot wide roadway will run south to a covered delivery area for resin trucks to load and unload. The roadway will widen at this point to allow traffic to bypass the delivery area and then continue south to an open paved areas which will be used by resin trucks turning to exit the facility, and for any necessary access to the Brine Treatment Building located at the south end of the site. The roadway widths and layout will also be designed to meet the requirements for fire and emergency vehicle access to the site.

Vehicles entering and exiting the site on a daily basis will include CWA employees and technicians, and resin trucks containing spent and regenerated resin. There will also be truck delivery of chemicals and salt for the regeneration process.

4.1.3 Proposed Construction

To include the SBA treatment systems, each well site will require extensive modification. Modifications to the well sites will include the addition of treatment vessels, bag filters, chemical equipment, onsite piping, and electrical equipment. All perimeter fencing will be converted to CMU block wall with added barbed wire. Site grading will be optimized, as conditions allow, to create positive drainage away from the well location and allowing run off to be collected in a reuse/well blow off pond. SBA sites will also be expanded as listed in **Table 4-2.**

Table 4-2: Well Site Sizes and Proposed Expansion

Well	Current Size (ac)	Proposed Site Size (ac)
12	1.22	No change
16	0.1	1.12
17	0.24	0.46
18	2.73	No change
19	0.33	No change

There are currently existing facilities or infrastructure located on the proposed Resin Regeneration Facility site. The Resin Regeneration Facility will add approximately 1.75 acres of impervious surface, consisting of asphalt pavement and structures, to the existing waste water treatment plant property. The Resin Regeneration facility will consist of two buildings: the Regeneration, Granular Activated Carbon (GAC), and Electrical Control Building, and a Brine Treatment Building. There will be ten vessels of varying sizes, and two pumps for brine regeneration. The proposed structures will be situated on the eastern and southern portions of the site to avoid the immediate demolition of the existing structures.

4.1.4 Landscaping and Signage

No landscaping is proposed as part of this project within the Resin Regeneration Facility, SBA well site perimeters, or screening vegetation outside of the perimeter walls. If implemented, landscaping shall conform to California's water conservation guidelines and City of Coachella Urban Water Management Plan. The Resin Regeneration Facility will likely required screening in the form of landscaping along the property frontage at Avenue 52. The City of Coachella Planning Department will be contact for verification of screening requirements at the 60% design stage of the project.

On site signage will be required, providing labeling, information, and safety warning signs as dictated necessary for well site and SBA operation. Existing signage is adequate for new construction. Chemical safety warning signs may be needed to be replaced based on existing chemicals.

The Resin Regeneration Facility will require facility name signage located at the entrance on Avenue 52. Signage required for plant operation, traffic patterns, deliveries, and specific entrance and exit signs will be provided. Additionally, adequate chemical safety labeling of chemicals available at the facility will be provided.

4.1.5 Exterior Lighting and Walls/Fencing

Exterior site lighting will be provided where appropriate for operation and maintenance, safety, and security. Low level interior lighting will be installed for safety and security. Lighting required for operations and maintenance will be switch enabled. On site lighting use will maintain neighboring residential aesthetics.

All SBA well sites will have CMU block wall. There will be no changes to existing block wall while all existing chain link will be removed and replaced with block wall. Where barbed wire is present on existing chain link fencing, similar barbed wire will be provided on the top of CMU walls where chain link is being replaced. Refer to **Table 4-3** for a summary of wall improvements.

Table 4-3: Wall Improvements

Well	Replace Existing Fencing with Block Wall	Wall Addition
12	X	
16	X	X
17		X
18	X	
19		

SBA facilities will have automatic gates installed to provide safe and secure access from public roadways. Gate operation will be controlled by a keypad, card reader, or similar device for vehicles. Site exit will be operated by a ground control loop allowing automated site exit.

The Resin Regeneration Facility will have a perimeter wall installed surrounding it. Adequate low level exterior lighting will be added to the fencing and on the exterior of each building to provide adequate security. The buildings on site will be pre-engineered metal type with metal siding.

4.1.6 Site Security

Each SBA Facility is located within the proposed site perimeter(s) providing site access and security. Existing security measures are limited to barbed wire, locks on driveways, man gates, and buildings located on well sites.

Proposed security measures for structures are exterior locks and low level exterior lighting. Isolated sites not located directly adjacent to public or private roadways will be provided with additional security measures such as barbed wire, and intrusion alarms for gates and structures with sensitive equipment.

The Resin Regeneration Facility will be surrounded by a perimeter wall with barbed wire as deterrent. Each structure within the facility will utilize exterior locks, low level lighting, and intrusion alarms. Entrance to the Resin Regeneration facility will be through an automated sliding gate, which requires either code, key card, or similar measures to gain access. There will be one entrance to the RRF in the same location as the current entrance to the parcel. To ensure security, low level lighting will be placed on each of the 3 structures associated with the RRF.

4.2 Site Utilities

4.2.1 Water and Sewer Service

Proposed SBA facilities should not require additional water supply. There will be no sanitary, septic, or sewer service facilities added.

Water will be brought to the Resin Regeneration Site from Avenue 52 via a proposed 12-inch line sized to provide capacity for current facility needs as well as excess capacity for future needs of this facility. Wastewater flows at the facility will be generated by restrooms and will be directed to existing sewer in Avenue 52.

4.2.2 Electrical

All SBA sites have existing electrical service and all SBA sites are equipped with emergency generators with the exception of Well 16, where a generator will be added. Electrical service and/or generators may require upgrading as discussed in **Section 9**.

A generator will be located adjacent to the RRF transformer providing emergency backup power in the event of a utility power failure. The generator will diesel powered and located near pavement for easy access for refueling and maintenance operations. The generator will be provided with a double-walled fuel tank for spill containment purposes.

4.3 Stormwater

Stormwater measures for the individual SBA facilities will be designed to comply with applicable portions of the 2014 Whitewater River Region WQMP Guidance document for stormwater design. This guidance document is intended to provide guidelines for desert-appropriate, project-specific post-construction Best Management Practices (BMPs) and for regional and sub-regional Treatment Control and Low Impact Development (LID)/Site Design BMPs. It addresses the management of Urban Runoff quantity and quality to help protect Receiving Waters and identifies the BMPs, including criteria for LID/Site Design and Treatment Control BMPs which may be applicable for a given site.

Stormwater BMP concepts will be incorporated into the design to the extent feasible, including minimizing impervious areas, maximizing permeability, minimizing directly connected impervious areas, creating Self-Retaining or Self-Treating Areas, and conserving natural areas. In the case of the well sites, any stormwater management requirements will likely be met by directing stormwater flows to the on-site ponds for use as a stormwater BMP wherever possible.

The on-site ponds will be used as a stormwater BMP’s for the sites to encourage infiltration and promote groundwater recharge. In general, the design standards outlined in the Riverside County Whitewater River Region Stormwater Quality Best Management Practice Design Handbook for Low Impact Development will be used to design stormwater drainage systems. The on-site ponds will be designed to capture the greater of the design storm event specified in the BMP Design Handbook, or process flow volumes typical to each well site. Excess flows from large-scale stormwater events at each site will be

discharged in a controlled and non-erosive manner and will ultimately flow to the local stormwater collection system.

The process-based sizing of the on-site ponds is based on consideration of the flow volume a resin replacement and start-up flushing scenario, as well as an expected pump to waste volume. Based on these criteria, the required volume of the ponds would be approximately 10,000 gallons. The ponds are typically designed to be 6 feet deep, including 1 foot of freeboard and 5 feet of working depth. A splash pad will be constructed as required for the well pump to waste discharge. On sites where no pump to waste outlet or other storm water discharge point exists, a new drainage outlet and storm piping will be constructed for connection to the nearest existing storm drainage system. Storm water and process water generated during operation of the well will be directed to the on-site ponds. Existing on-site ponds will be maintained or modified as necessary to match the above design criteria as site conditions allow. The water quality of the flow to the ponds is considered the same as before the ion exchange treatment system, and therefore is be suitable for surface water discharge.

4.4 Erosion Control

Though construction at most sites will disturb less than one (1) acre of land, the total project will likely be considered part of "a larger common plan of development" and require each site to apply for coverage under California's General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). As per the requirements of this permit, a Storm Water Pollution Prevention Plan (SWPPP) shall be prepared for each well site and the Resin Regeneration Facility, and the final project-specific WQMP's shall be incorporated by reference or attached to the project's SWPPP as the Post-Construction Management Plan. A copy of the up-to-date SWPPP shall be kept at each project site and be available for review upon request.

The requirements of the construction general permit include the development and certification of a SWPPP include routine inspections, annual reports and certifications, and reports of noncompliance. The SWPPP consists of a soil erosion and sediment control component and a construction site waste control (Good Housekeeping) component.

A general soil erosion and sediment control plan will be developed for each well site and the Resin Regeneration Facility construction project and will include erosion control measures such as limiting ground disturbance, temporary and permanent soil stabilization measures, and temporary and/or permanent ground covers. Due to the sandy soils and windy conditions often experienced in the area, plans to supply water trucks or other appropriate measures for dust control will be an important part of the erosion control planning for each site. Best Available Control Technologies (BACT) will be used through construction activities and a permit will be obtained from the South Coast Air Quality Management Division (SCAQMD) to cover emissions from the site. Excavation, grading, and paving operations shall be scheduled for dry weather periods, if possible. A specific area of the construction site, well away from storm drain inlets or watercourses, shall be designated for material storage and equipment maintenance. Measures will be taken to minimize any soils being tracked onto roadways adjacent to the well and Regeneration sites due to construction activities, and any soils deposited on the adjacent roadways will be cleaned at the end of each work day. Washing the roadways down to remove soil deposits will not be allowed.

The construction site waste control component of the SWPPP consists of requirements for material management to prevent or reduce waste and waste handling. Source reduction shall be practiced by ordering only the amount of materials that are needed to finish the project. Construction site waste include waste building material and rubble, chemical waste, litter, sanitary sewage and septage, contaminated soils and concrete truck washout. Waste handling will also include spill and discharge control and reporting. Finally, it is recommended the Contractor educate employees and sub-contractors about stormwater management requirements and their pollution prevention responsibilities.

5. Strong Base Anion Treatment

The treatment process for each SBA treatment system will include well pumping and metering, bag filters, resin treatment units, and chemical systems. In addition, there will be a pump to waste pond at each SBA treatment site for well pump to waste and resin releveling, i.e., backflowing of the resin treatment units. Refer to **Appendix A** for a process flow diagram of the SBA treatment process.

5.1 Hydraulics and Well Pumps

All five wells considered active for the purpose of this analysis were selected for SBA treatment. Each well will have an individual SBA treatment system on site. The following section outlines the methodology and results of the hydraulic analysis of each and their respective impacts on the system-wide capacity. A summary of the well information is provided in **Table 5-1**. It should be noted that CWA does possess another existing well, Well 11, although it is a lower capacity well at 1,200 gpm with some water quality issues that is planned to be taken offline. CWA is also planning to drill one additional well in the 150 Zone; therefore, the five wells listed in **Table 5-1** will be considered CWA's firm capacity for the purpose of this analysis.

Table 5-1: Well Summary

Well No.	Nominal Capacity (gpm)[1]	Pressure Zone	Well Age, yrs	VFD	Controlled By	Current Overall Field Test Eff
12	2,000	Mecca Reservoir (3.6 MG)[2]	28	No	Reservoir Level	63%
16	2,000	Low Zone	25	No	Timer	67%
17	2,200	Low Zone	11	Yes	System Pressure	77%
18	2,000	Well 18 Reservoir (5.4 MG)[3]	11	No	Reservoir Level	78%
19	2,000	Low Zone	11	Yes	System Pressure	72%

[1] Source: Draft 2017 Water Master Plan, TKE Engineering, Inc.

[2] Well 12 Booster Station boosts from the Mecca Reservoir into the Low Zone.

[3] Well 18 Booster Station can boost from the Well 18 Reservoir to either the Low Zone or the 150 Zone.

5.1.1 Methodology

The wells were analyzed to determine if there would be any capacity or pump operational impacts due to the new treatment facilities at each well site utilizing the existing CWA hydraulic model provided by CWA in September 2016. This model was prepared by TKE Engineering, Inc. as part of the Water Master Plan update and conservatively reflected 2013 demand information as demands have more recently declined. The final Water Master Plan is anticipated in 2017 at which point system impacts due to changing demands may need to be reevaluated. Hazen assumes the accuracy of this model for elements including but not limited to: geometry and connectivity, pipeline and valve diameters, elevations, demand values and allocation, and controls except where otherwise modified by Hazen for the purposes of this analysis. Baseline conditions were established under an existing instantaneous peak hour demand (PHD) scenario, as this is considered the most critical scenario with respect to system supply, with all active wells on and with reservoir levels at 1 foot below the high water level. Subsequent model scenarios were

analyzed with the treatment systems in place under "fouled" headloss conditions to determine the impacts to each pump's operating point and efficiency. Manufacturer pump and bowl efficiency curves, where available, were utilized along with historical field pump test data in order to most accurately estimate pump operating points and overall efficiencies with the treatment system in place.

Headloss curves were generated for each component of treatment including bag filter housings, bag filter elements, Ion Exchange (IX) vessels, and IX resin. An additional minor loss component was added to account for associated valves and fittings. The fouled condition assumptions were 10 psi for fouled bag filters based on industry standard practice and 15 psi at 1,700 gpm for fouled resin based on resin manufacturer recommendation. A total minor loss of 5 psi was added to account for valves and fittings, resulting in a total SBA treatment system headloss of 16.6 psi (38.3 ft) under clean conditions and 29.3 psi (67 ft) under fouled conditions, at a flowrate of 2,000 gpm with parallel bag filters and IX vessels in operation. A summary of the headlosses are provided in **Table 5-2**.

Table 5-2: SBA Headloss Summary

Parameter	Unit	Bag Filter	IX Vessel	IX Resin	Minor Losses	Total
Low Headloss	psi	1.5	2.7	7.4	5	16.6
High Headloss	psi	10	5.5	8.8	5	29.3

Headloss corresponds to a total treatment flow of 2,000 gpm (1,000 gpm across parallel bag filters (2) and parallel IX vessels (2)).

The arrangement of treatment as configured in the hydraulic model is shown in **Figure 5-1**. The process begins with the groundwater, which is modeled as a constant-head reservoir at an elevation based on the most recent field pump test data. The groundwater drawdown is modeled as a valve with a linear flow versus head relation based on the most recent field pump test data. The pump itself follows, which represents the pump impellers, then the column pipe losses, which are simulated by a valve with a flow versus headloss curve based on pump manufacturer data. Finally is the treatment system, which consists of two IX vessels in parallel and they bypass valve, which is a flow control valve set to a flow that is a percentage of the total flow as described in **Section 5.1.7.**

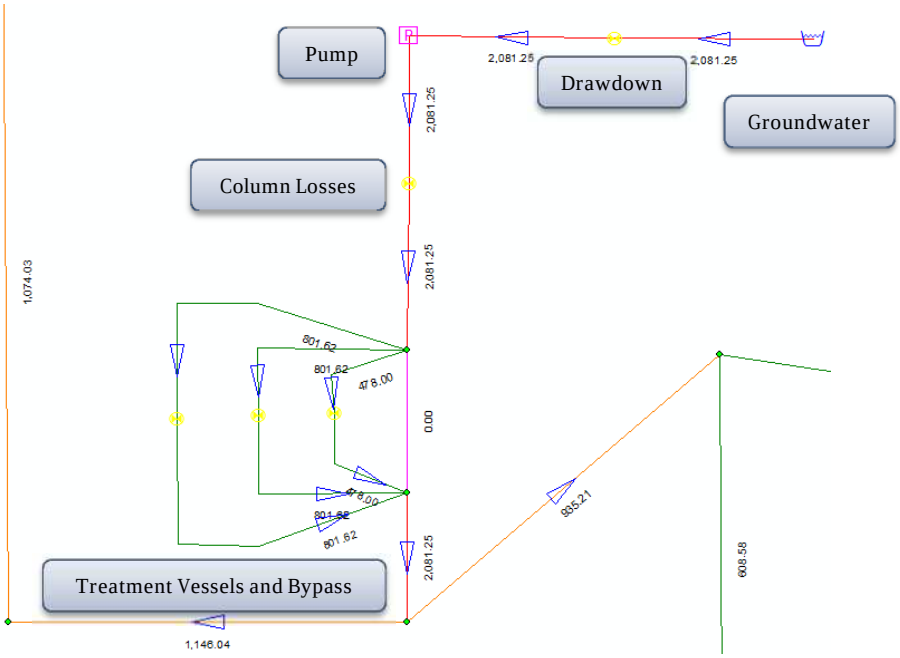
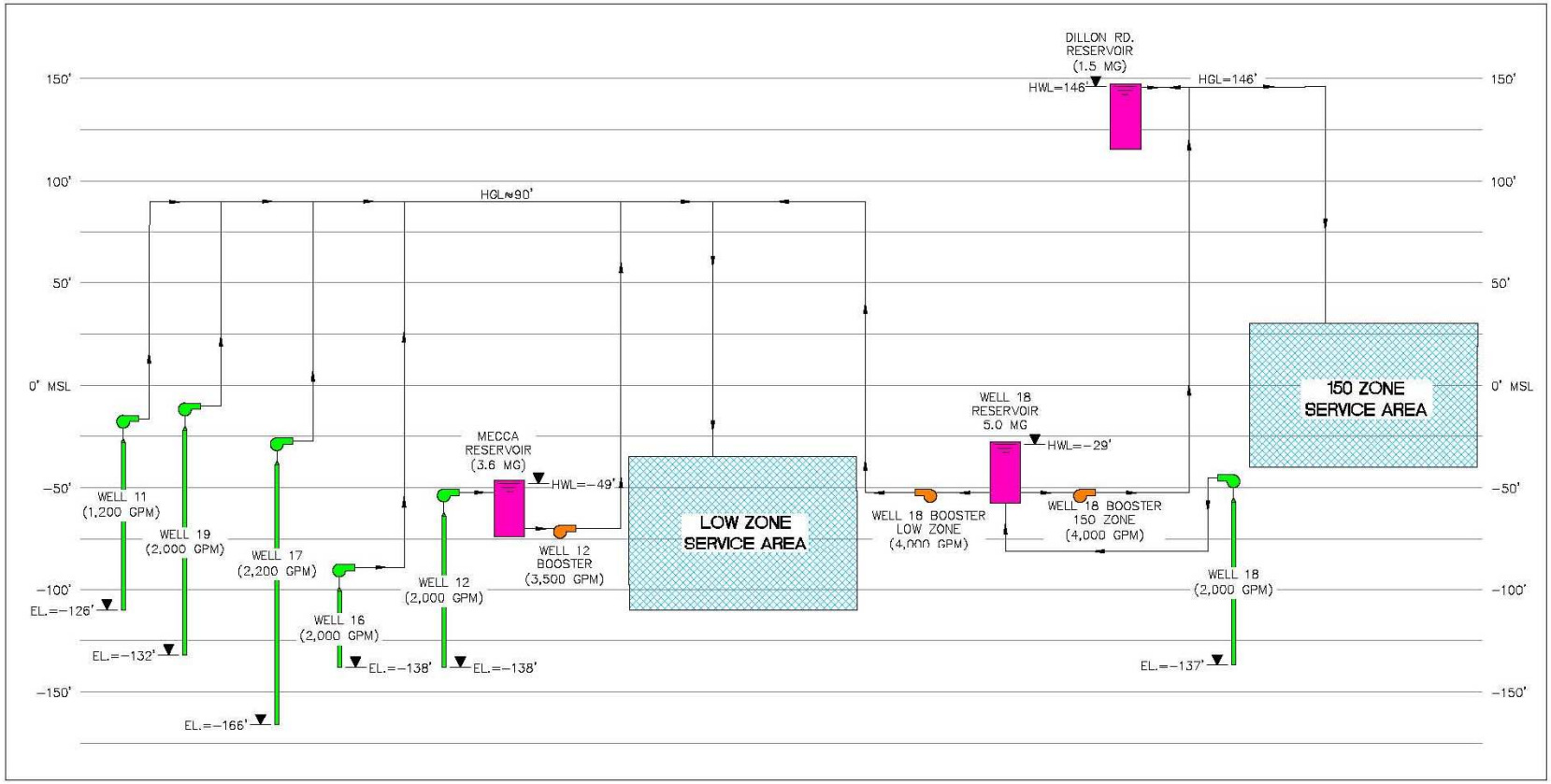


Figure 5-1. Modeled Wellhead Treatment

5.1.2 System Supply

One main hydraulic consequence of adding wellhead treatment is that the additional headloss is required to overcome treatment and this results in some loss of capacity of the well. It is important to compare the available supply under existing conditions and the estimated supply with treatment in place to the water demands, to determine if treatment will create a supply deficiency or worsen an existing deficiency. Supply requirements vary depending on whether a pressure zone is “closed”, or “open”, which is discussed further herein.

CWA’s water distribution system is composed of two pressure zones: the Low Zone, and the 150 Zone. The Low Zone encompasses the vast majority of CWA’s current demands, and is operated as a closed zone with variable frequency drives (VFD) on Wells 17 and 19, and forebay storage with separate booster stations with VFDs for peaking at Wells 12 and 18. The 150 Zone is an open zone that is “floated” off of the Dillon Road Reservoir (1.5 MG) and supplied solely by the Well 18 150 Zone Booster Station. Refer to **Figure 5-2** for a hydraulic schematic.



Source: Draft 2017 Water Master Plan, TKE Engineering, Inc.

Figure 5-2 – Hydraulic Schematic

Typically, open zones are evaluated for their supply based on maximum day demand, as floating storage serves peaking and fire flows, while closed zones are evaluated based on peak hour demand plus fire flow, as there is no storage available to cover peaking and/or fire flows. As CWA has a combination of a closed zone with peaking storage, which may ultimately be converted to an open zone, and an open zone, both maximum day demand and peak hour demand supplies were evaluated, as listed in **Table 5-3** and **Table 5-4**. A fire flow scenario was not simulated as the peak hour demand for the Low Zone would govern over a maximum day demand plus fire flow.

Table 5-3: MDD Supply Evaluation

Pressure Zone	ADD (gpm)	MDD (gpm)	Current Supply (gpm)	MDD Surplus (+) / Deficit (-) (gpm)[1]
Low Zone	4,512	8,572	9,719	1,147
150 Zone	253	481	481	0.00
Total	4,765	9,053	10,200	1,147

[1]Based on model supplied by TKE Engineering, Inc. in September 2016 that included 2013 demand information. Updated demands should be evaluated during the detailed design phase once the Final 2017 Water Master Plan Report is available.

Table 5-4: PHD Supply Evaluation

Pressure Zone	PHD (gpm)	Current Supply / Booster Capacity (gpm)	PHD Surplus (+) / Deficit (-) (gpm)[1]
Low Zone	13,987	13,700	-287
150 Zone	784	4,000	3,216
Total	14,771	-	-

[1]Based on model supplied by TKE Engineering, Inc. in September 2016 that included 2013 demand information. Updated demands should be evaluated during the detailed design phase once the Final 2017 Water Master Plan Report is available.

As shown in **Table 5-3**, the CWA system under MDD conditions has an overall supply surplus of approximately 1,150 gpm. However, under PHD, the Low Zone was found to have a supply deficit of approximately 290 gpm as indicated in **Table 5-4** as a result of the forebay storage being constrained by the Well 12 and Well 18 Booster Stations.

The system supply evaluation revealed that while CWA has adequate supply to cover maximum day demand with all active wells in operation, a peak hour demand deficiency was identified with the Well 12 and Well 18 Booster Stations being constraints on accessing the peaking forebay storage at Well 12 and 18. In the event that Well 11 and/or the newly proposed well in the 150 Zone cannot be relied upon for supply, the firm supply would need to be reduced with the largest well or pump out of service. With the largest well or pump out of service, which would be Well 17 at a nominal capacity of 2,200 gpm, deficiencies would be realized for both MDD and PHD conditions of approximately 1,050 gpm and 1,915 gpm, respectively. In order to take any well out of service during PHD conditions, additional supply or supply transfer must be introduced, which could include re-activating Well 11, including a new future Well 20, increasing booster station capacity, constructing a pressure reducing station near Dillon Road and Highway 111 to supply the Low Zone from the 150 Zone, or a combination thereof. If a pressure

reducing station is added near Dillon Road and Highway 111, the Well 18 150 Zone Booster Station controls would need to be modified to prevent excessive bleeding of the 150 Zone into the Low Zone, which could also improve the Dillion Road Reservoir turnover.

These findings and those presented in the following sections are based on the model supplied by TKE Engineering, Inc. in September 2016 that included 2013 demand information. Updated demands should be evaluated during the detailed design phase once the Final 2017 Water Master Plan Report is available.

5.1.3 Well Impacts

Well impacts were evaluated based on fouled treatment system conditions as this represents the worst-case scenario in terms of service impacts. Well pumps were evaluated based on the criteria listed in **Table 5-5**, which includes general industry standard guidelines for good practice and efficiency in pump operation. It should be noted that the efficiencies presented here are overall efficiencies, or wire to water efficiencies, which includes the total pump field losses and driver losses from the bowls, column piping, shaft and bearings, and motor. The existing model has a roughness coefficient "C" value of 100, a value typically reserved for old or unlined pipes, assigned to all pipes as the materials are currently unknown. As a sensitivity analysis, C values of both 100 and 140 were included in the hydraulic modeling analysis. In addition, resin changeout scenarios were also included, which simulated one vessel being taken out of service, assuming one well at a time.

Table 5-5: Well Pump Evaluation Criteria

Minimum Overall Efficiency	Maximum Allowable Capacity Reduction	% of BEP
60%	30%	70 to 120

A summary of the impacts to well pump operating point and efficiency based on hydraulic modeling results is provided in **Table 5-6** through **Table 5-9**, with individual assessments described herein.

Table 5-6: Well Impacts, C=100, 2 Vessels w/ Bypass

Well No.	Model Ex PHD Flow (gpm)	Ex PHD Eff	Model Trmt (Fouled) PHD Flow (gpm)	Bypass Flow (gpm)	Flow Per Vessel (gpm)	Trmt (Fouled) PHD Eff	Flow Reduction	% of BEP
12	2,277	55%	1,570	330	620	60%	31%	78%
16	2,494	55%	2,285	682	802	60%	8%	114%
17	2,461	70%	2,207	459	874	74%	10%	100%
18	2,074	70%	1,572	593	489	65%	24%	79%
19	2,313	70%	2,082	478	802	71%	10%	104%

Table 5-7: Well Impacts, C=100, 1 Vessel w/ Bypass

Well No.	Model Ex PHD Flow (gpm)	Ex PHD Eff	Model Trmt (Fouled) PHD Flow (gpm)	Bypass Flow (gpm)	Flow Per Vessel (gpm)	Trmt (Fouled) PHD Eff	Flow Reduction	% of BEP
12	2,277	55%	1,146	241	905	40%	50%	57%
16	2,494	55%	2,060	615	1,445	65%	17%	103%
17	2,461	70%	1,898	395	1,503	73%	23%	86%
18	2,074	70%	1,198	452	746	55%	42%	60%
19	2,313	70%	1,801	414	1,387	65%	22%	90%

Table 5-8: Well Impacts, C=140, 2 Vessels w/ Bypass

Well No.	Model Ex PHD Flow (gpm)	Ex PHD Eff	Model Trmt (Fouled) PHD Flow (gpm)	Bypass Flow (gpm)	Flow Per Vessel (gpm)	Trmt (Fouled) PHD Eff	Flow Reduction	% of BEP
12	2,277	55%	1,583	333	625	60%	30%	79%
16	2,494	55%	2,239	668	785	60%	10%	112%
17	2,461	70%	2,154	448	853	74%	12%	98%
18	2,074	70%	1,586	598	494	65%	24%	79%
19	2,313	70%	2,068	475	796	71%	11%	103%

Table 5-9: Well Impacts, C=140, 1 Vessel w/ Bypass

Well No.	Model Ex PHD Flow (gpm)	Ex PHD Eff	Model Trmt (Fouled) PHD Flow (gpm)	Bypass Flow (gpm)	Flow Per Vessel (gpm)	Trmt (Fouled) PHD Eff	Flow Reduction	% of BEP
12	2,277	55%	1,153	242	911	40%	49%	58%
16	2,494	55%	2,000	596	1,404	65%	20%	100%
17	2,461	70%	1,834	382	1,452	73%	25%	83%
18	2,074	70%	1,206	455	751	55%	42%	60%
19	2,313	70%	1,758	404	1,354	65%	24%	88%

5.1.4 Service Pressure Impacts

The additional headlosses incurred due to the addition of treatment will decrease the available service pressures. Baseline results under existing PHD conditions were compared to treatment system conditions under fouled conditions for pipe roughness C factors of 100 and 140. Model results, as shown in **Table 5-10** and **Table 5-11**, indicate pressures decreasing from existing pressures of approximately 34 psi to 24 psi for fouled treatment system conditions and 40 psi to 32 psi, depending on the pipe roughness factor. California Public Utilities Commission General Order 103-A requires a minimum service pressure of 40 psi except that during periods near PHD the pressure may not be less than 30 psi. Based on the borderline and deficient pressures observed, it appears that the distribution system cannot sustain any additional

headloss. Distribution-system side improvements may also serve to maintain minimum system pressure requirements, for example by adding a pressure reducing station from the 150 Zone into the Low Zone or upsizing strategic pipelines.

Table 5-10: Service Pressures, C=100

Scenario	Description	Minimum Service Pressure (psi)	Model Junction ID	Pressure Zone	Location
1	Ex PHD	34.8	J498	Low	San Asis Dr & Soledad Pl
2	Ex PHD w/ Treatment (Fouled)	27.6	J496	Low	San Asis Dr & Soledad Pl
3	Ex PHD w/ Treatment (Fouled) Vessel out of service[1]	24.9	J496	Low	San Asis Dr & Soledad Pl

[1] Simulated Well 17 resin changeout as it was identified as the worst case condition.

Table 5-11: Service Pressures, C=140

Scenario	Description	Minimum Service Pressure (psi)	Model Junction ID	Pressure Zone	Location
1	Ex PHD	40.7	J498	Low	San Asis Dr & Soledad Pl
2	Ex PHD w/ Treatment (Fouled)	34.7	J280	Low	El Greco Ave & Playa Del Amor St
3	Ex PHD w/ Treatment (Fouled) Vessel out of service[1]	32.3	J280	Low	El Greco Ave & Playa Del Amor St

[1] Simulated Well 17 resin changeout as it was identified as the worst case condition.

5.1.5 Horsepower Impacts

In the event that a pump is to be replaced, the estimated brake horsepower (BHP) required is listed in **Table 5-12**. Each pump's motor horsepower will be optimized during pump selection during final design.

Table 5-12: Horsepower Requirements

Well	Existing HP	BHP Req'd
12	100	155
16	250	265
17	200	275
18	100	160
19	200	245

5.1.6 Summary of Hydraulic Recommendations

5.1.6.1 Well 12

The Well 12 pump was observed to have a large flow decrease (ranging from 30 to 50 percent) under fouled treatment system conditions and existing overall efficiency less than 60 percent. If extended period simulation modeling supports it, this well could potentially be run less efficiently for longer periods of time to make up for the lost capacity as this well pumps into a forebay, or additional capacity could be provided elsewhere in the system to offset its reduction. Otherwise, this pump is recommended for replacement.

5.1.6.2 Well 16

The Well 16 was observed to be operating at less than 60 percent overall efficiency and is recommended for replacement. It is recommended to add VFD and an emergency generator at this location as it pumps directly into the Low Zone.

5.1.6.3 Well 17

Operational impacts are minimal, although additional capacity would be required elsewhere in the system to offset the Well 17 capacity reduction, otherwise a new pump will be required.

5.1.6.4 Well 18

Modeling results indicate a significant reduction in capacity under fouled treatment system conditions by approximately 20 to 40 percent. In addition, field testing performed by Layne in February 2016 indicates that the pump is incapable of sustaining a 20 psi increase, recording a field-observed capacity of only 740 gpm under this increased head condition. For these reasons, a new higher head pump is recommended.

CWA has requested that the Well 18 site be planned for the addition of one other well, which could be piped into the Well 18 reservoir. The Well 18 reservoir has a 12-inch and 18-inch inlet to accommodate this additional well.

5.1.6.5 Well 19

Operational impacts are minimal, although additional capacity would be required elsewhere in the system to offset the Well 19 capacity reduction, otherwise a new pump will be required.

5.1.7 Bypass

To minimize use of the ion exchange resin, a percentage of flow will be bypassed around the SBA treatment system. The percentage of the flow that will be bypassed is determined by the historical raw water Cr(VI) level and the anticipated removal through SBA treatment. The bypass percentages are calculated to keep the Cr(VI) level in the blended water at 6 ppb based on a maximum Cr(VI) break though of 2.0 µg/L Refer to **Table 5-13** below for historical raw water Cr(VI) concentrations initial

bypass percentages at each well site. The flow split between the bypass and the SBA treatment system will be controlled by a flow control valve located downstream of the split on the bypass piping. Each well site will be equipped with raw water flow meters in the feed piping to each ion exchange vessel as well as a flow meter in the bypass piping.

Each individual IX vessel loaded with resin will have a maximum flow capacity of 1,700 gpm which equates to a hydraulic loading rate of 15.0 gpm/ft^2. Based on the historical raw water Cr(VI) concentrations and the estimated well capacities at each well site, the treatment system will be able to operate with one IX vessel and the calculated bypass percentage. As such when the resin in one vessel is being changed out, the well will operate for the relative short period of time with the other vessel in service. When 1 vessel is in operation the calculated Cr(VI) level in the blended water will remain near 6 ppb.

After the regenerated resin is reloaded into the vessel, a reduced flow of water will be run through the vessel in the reverse direction to normal flow for approximately 10 to 20 minutes. This re-leveling operation is conducted to ensure that the resin is evenly distributed and level to achieve even flow distribution and loading through the media when the vessel is returned to service. This water will be routed to the pump to waste reuse pond.

Table 5-13: Estimated Bypass Flow Percentage

Well No.	Cr6 Concentration µg/L	Bypass Flow, %
Well 12	21.0	21
Well 16	15.4	30
Well 17	21.2	21
Well 18	12.6	38
Well 19	19.4	23

5.1.8 Surge Analysis

Transient and surge analysis is critical for treatment plants, pump stations and transmission or force main designs for both water and wastewater prime mover and hydraulic conveyance systems. Transients can occur due the following causes:

- Pumps: trips due to power outage, startups and controlled shutdowns
- Valves: closure, opening of isolation valves, opening and closure of air release valves, and operation of check valves
- Rapid flow changes: transmission main and force main breaks

Dr. Don Wood, Professor of Emeritus of University of Kentucky and co-author of Pressure Wave Analysis Transient Flow in Pipe Distribution Systems, explains that there is a 52-60 psi pressure change for every foot per second velocity change. A decrease in velocity leads to a positive upstream pressure change and a negative downstream pressure change from the location (pump or valve action) which has

caused the velocity change to occur. High pressures can damage pumps and valves and can rapture pipes within the system. Low pressures may lead to cavitation in pipes (down surge from pump trip causes pressure to drop to vapor pressure) and water column separation, which can cause pipes and their joints to collapse, which could in turn cause water quality deterioration due to inflow through the damaged and collapsed pipe joints. In addition, when vapor cavities due to the downs surge collapse, a severe pressure increase over a relative short time is generated and can cause pipeline failure.

CWA's system was analyzed using the InfoSurge software under the following parameters:

- Peak hour demand with treatment under clean headloss conditions
- All existing wells on with the exception of Well 11
- Wells restart after power loss in two minutes
- Booster pumps restart after power loss in 30 seconds
- Assumed all pipes are ductile iron for wave speed calculation
- Pressure sensitive demand (demand decreases as system pressure decreases)
- Well pump discharge check valves opening/closing time of 60 seconds
- Treatment system downstream check valve opening/closing time of 1 second

The following outage scenarios were simulated where only the listed wells trip off during a power outage while the remaining wells stay active:

- Well 17 and 19 trip
- Well 12 trip
- Well 16 trip
- Well 18 trip

Preliminary results indicate that 1,500 gallon bladder surge tanks will be required at Well 12 and Well 18 to be located in between the well pump and the treatment system to prevent negative pressures from occurring. The remaining Wells 16, 17, and 19 do not require any surge mitigation measures. It was also observed that certain areas of the 150 Zone could experience negative pressures in a surge event although the 150 Zone distribution system will not be directly affected by treatment and is outside the scope of this analysis.

Surge mitigation recommendations will be verified during final design as the well pump improvements and yard piping layouts are finalized, and pertinent system information will be verified as feasible including:

- Existing bladder tank pre-charge pressure at the Well 18 Booster Stations.
- Future system improvements that could change distribution system dynamics (new wells, storage reservoirs, pressure reducing stations, etc.).

- Pipe materials (wave speed) and roughness coefficients.

5.2 Bag Filters

After the flow split, the water for SBA treatment is passed through bag filters to prevent sand and silt from settling in the resin bed. This minimizes the pressure drop in the resin bed and reduces the frequency of backwashing. A 5 micron (absolute) size bag was selected based on the resin vendor's recommendation. The units will be arranged in parallel with the number of units based on N+1, where N will provide treatment for the design treatment flows detailed in Section 5.1. Both bag filter units will run at all times as there are no minimum flow requirements. Change out of the bag on one unit can be accommodated with the other unit in operation and shall occur when the differential pressure reaches 10 psi. The bag filter units shall be equipped with analogue pressure indicators as well as differential pressure transmitter that will send a high differential pressure alarm if the bag manufacturers terminal high pressure is reached. The terminal high pressure for most bag filters is on average 3 times higher than 10 psi. Surplus bags for 2 to 3 change outs shall be stored on site. Change out requires access to the top of the vessel. A work platform will be provided to allow access. A summary of the bag filter design criteria is listed in **Table 5-14**.

Table 5-14: Bag Filter Design Criteria

Parameter	Unit	
Number of Units		2
Capacity	gpm	2000
Nominal Pore Size	µm	5
Number of Bags	-	18 - 22
Maximum Rated Pressure	psi	150
Maximum Allowable Headloss (Clean Filter)	psi	5
Maximum Vessel Diameter	in	48
Minimum Inlet Diameter	in	10
Vessel Weight (empty)	lbs	2,445
Materials of Construction	-	Stainless Steel (Bag Filter Vessel) Polypropylene (Bag Filter)

5.3 SBA Resin and Vessels

After bag filters, the water is fed to two parallel SBA resin vessels. Water flows into the units at the top through a distribution header, passes through the resin and the underdrain system, and exits from the bottom of the vessel.

SBA resin in each vessel removes Cr(VI) from the water. Cr(VI) concentrations in the treated water gradually increase over time as the resin capacity for Cr(VI) is used. When the treated Cr(VI)

concentration reaches the treatment target level, the resin must be regenerated. Regeneration will take place at the RRF. Resin will be transferred to and from the vessels to a specially configured tanker truck for conveyance to and from the RRF. A summary of the SBA resin design criteria is listed in **Table 5-15**.

Table 5-15: SBA Resin Design Criteria

Parameter	Unit	
Quantity (per vessel)	ft^3	600
Application	-	Cr(VI) removal
Polymer Structure	-	Gel Polystyrene crosslinked with divinylbenzene
Appearance	-	Spherical Beads
Functional Group	-	Type I Quaternary Ammonium
Ionic Form as Shipped	-	Cl^-
Mean Diameter	µm	570 +/- 50
< 425µm (max.)	µm	1 %
Uniformity Coefficient (max)	-	1.2
Specific Gravity	-	1.09
Shipping Weight	lb/ft^3	42.2 – 44.4
Temp Limit Cl^- Form	º F	212
Temp Limit OH^- Form	º F	140
Minimum Loading rate	gpm/ft^2	4
Maximum Loading rate	gpm/ft^2	15
Design Loading rate	gpm/ft^2	8.8
Design Flow rate	gpm	1,000
Anticipated Replacement Frequency	years	4

Table 5-16 summarizes the design criteria of the SBA resin treatment vessels.

Table 5-16: SBA Resin Vessel Design Criteria

Parameter	Unit	
Number of Units	-	2
Maximum Flow Capacity	gpm	2000
Vessel Diameter	ft	12
Nominal Resin Capacity	ft^3	600
Orientation	-	Vertical downflow
Resin Bed Depth	ft-in	5'4"
Manifold Configuration	-	4 Tier
Pressure Rating, psi	psi	150
Vessel Height	ft	16'6" to 20'1"
Vessel Weight (full), lbs	lbs	109,000
Relevel flowrate, gpm	gpm	150 - 250
Relevel Bed Expansion (max)	%	60
Tank material	-	Carbon Steel
Tank Internal Lining	-	TBD
Tank External Lining	-	TBD
Underdrain material	-	304 Stainless Steel
Access manways	-	Top and Side

5.4 Resin Releveling and Pump To Waste Ponds

A pump to waste pond will be required at each SBA well site to collect water during startup pump to waste and resin re-leveling events.

Sizing of the pump to waste ponds is based on the startup pump to waste requirement and resin re-leveling events. The storage capacity required is based on the typical resin re-leveling volume plus the pump to waste volume. The pump to waste volume is based on the maximum current pump volumetric flow rate operating at 3 minutes. Each SBA site has its own space constraints and the actual size and shape of the pump to waste reuse pond for each well will be based on the available space. Where feasible, ponds will be sized somewhat larger than the minimum requirement. Existing pump to waste ponds will be used, and expanded or relocated as necessary. A summary of the SBA pump to waste pond design criteria is provided in **Table 5-17**.

Table 5-17: SBA Pump to Waste Pond Design Criteria

Parameter	Unit	
Releveling Flow Rate	gpm	150 – 250
Releveling duration	min	10 - 20
Releveling Volume	gal	3000 - 5000
Pump to Waste Volume	gal	7000
Storage Capacity Required	gal	12,000
Side Slope	-	2:1

All existing well sites have automated pump to waste valves with the exception of Wells 12 and 18, which startup directly into their respective reservoirs. In order to prevent excessive sand accumulation in the bag filters and hence, excessive bag filter replacement, the addition of automatic pump to waste valves at Wells 12 and 18 is recommended. This addition will require some modification to the programming of the well startup and shutdown sequences.

5.5 Chemical Systems

The SBA treatment systems do not require any chemical dosing to condition the water upstream of the treatment vessels. Sodium hypochlorite will be dosed to the finished water to provide a disinfectant residual.

5.5.1 Sodium Hypochlorite

Sodium hypochlorite is CWA's preferred disinfection method. All the well sites currently have a sodium hypochlorite dosing system for disinfection. Because the capacity of the well sites is not expected to change significantly, the existing disinfection systems are planned to be reused.

5.6 Sampling and Analysis

5.6.1 Sampling Points

Manual sampling taps will be provided throughout each facility to allow water samples to be taken. Locations of sampling points are:

1. Raw water sampling point on manifold upstream of diversion to treatment;
2. Three intermediate sampling points on each resin vessel;
3. Treated water sampling point on discharge pipe from each resin vessel;
4. Blended water sampling point on manifold downstream of return of treated water.

6. CWA Resin Regeneration Facility Process Design

The two parallel pressure vessels, each with 600 cubic feet (cf) of resin, at each SBA treatment site will be commissioned in a staggered configuration to allow at least two weeks between exhaustion after the two 600 cf vessels are brought in parallel. This allows time to complete resin regeneration for one vessel at a time. Each vessel is hydraulically sized to take the full flow of the well and meet SBA treatment parameters, such as empty bed contact time and hydraulic loading rate.

A resin regeneration would be triggered based on vessel effluent monitoring via grab samples collected from vessel effluent sample taps. When a Cr(VI) grab sample from either of the vessels indicate Cr(VI) concentrations greater than the treated water target leaving the pressure vessel of 2 µg/L (so that blend with bypass shall never exceed 6 µg/L), resin is transferred to an offsite location for regeneration. CWA has options for accomplishing the resin regeneration, including using the CVWD CRRF or constructing a CWA RRF. This section presents the CWA RRF. A cost comparison of the CVWD CRRF and the CWA RRF are compared in **Section 12**. At the CWA RRF the resin would be regenerated with a salt (brine) solution. After the regeneration process is complete, the resin would be transferred into the tank truck and driven to the respective SBA treatment site where it would be placed back in the vessel for potable water service.

Each vessel has a magnetic flow meter that provides equal flow split through each of the two vessels and totalizes the flow through each vessel. The total flow will be used to monitor the volume of water treated by the resin between regenerations, typically referred to as BVs of treated flow. A BV is an industry term that refers to the equivalent volume occupied by the resin bed. Since 600 cubic feet, or 4,488 gallons, of resin will be regenerated at a time, all the corresponding process flows are correlated to 4,488 gallons. Based on water quality and historical performance, a BV target will be established. The targeted number of BVs will be used to notify CWA of the need for regeneration before Cr(VI) breakthrough occurs.

6.1 Design Capacity

The CWA RRF employs a batch treatment process operating based on the resin regeneration frequency at each of the SBA treatment sites. The CWA RRF is designed to regenerate 600 cf of resin in a less than a 6-hour shift once the tanker truck arrives at the facility (**Table 6-1)**.

Table 6-1: CWA RRF Batch Process Completion Time Frame (Regeneration only)

Unit Process	Flow (gpm)	Volume (gal)	Duration (min)
1. Spent Resin Slurry Make-up from BW Remnant Pump	300	2,000	7
2. Spent Resin Slurry Transfer to Regen Vessel	176	4,488	26
3. Backwash	283	4,488	16
4. Backwash Drain Down (Air-block)	176	4,488	26
5. Brine Regeneration	300	17,950	60
6. Slow Rinse	300	4,488	15
7. Fast Rinse	1350	11,220	9
8. Regenerated Resin Transfer[1]	176	4,488	26
Additional Process Transition Time per Step			10 x 8
		TOTAL	265 min (4.4 hrs)

[1]Remaining 4,488 gal of clean FR water left in regen vessel after 600 cf of regenerated resin is transferred stays in the regeneration vessel for next regen.

The spent brine generated from the regeneration process can be hauled as a hazardous waste or treated with EC. If treated, the spent brine treatment process will take an additional 6 hours. Refer to **Table 6-2** for the duration breakdown for the treatment of the 4,500 gallons of spent brine with EC.

Table 6-2: CWA RRF Batch Process Completion Time Frame (Spent Brine Treatment with EC)

Unit Process	Flow (gpm)	Volume (gal)	Duration (min)
1. 1st Stage EC Feed Pump	68	4,488	66
2. Settle			60
3. Filter Press in Closed Loop (1st Pass)	176	4,488	26
4. Filter Press in Closed Loop (2st Pass)	132	4,488	34
5. Filter Press in Closed Loop (3rd Pass)	88	4,488	51
6. 1st Stage EC Drain / 5um + 1 um Polish Filter	176	4,488	26
Additional Process Transition Time per Step			10 x 6
		TOTAL	323 min (5.4 hrs)

The regeneration frequency of the SBA well sites is based on the raw water Cr(VI) concentration, competing constituents (e.g. sulfate), and well utilization. **Table 6-3** summarizes the estimated regeneration frequency for CWA wells. As an upper bound, a scenario with CWA wells at 100% utilization representing a peak month was also included.

Table 6-3: CWA RRF Utilization (Regens Per Week)

Scenario	CWA
2013 Avg. Well Production[1]	1.4
Seasonal peak, 2.0 times 2013 Avg. Well Production	2.3
100% Utilization	3.0
Facility Capacity[2]	4.8

[1]For the five (5) CWA wells planned for SBA treatment (i.e. not including Well 11). Well utilization for the other wells ranged from 29 to 83 percent.
[2]Based on CWA RRF becoming a regional facility that operates at 1 regeneration per day, 5 days per week, 50 weeks per year (with 2 weeks downtime for facility maintenance).

Based on the current estimates for the CWA resin regeneration frequency, there is additional capacity available in the CWA RRF facility for future CWA wells or for other regional partners.

6.2 Redundancy

Redundancy was addressed in this design with shelf redundant pumps and a redundant regeneration vessel to provide ease of replacement or additional resin storage in the event a failure would occur. Additional strategies for addressing a failure event include:

- **Resin Storage**. If an SBA treatment site were to go down for unplanned maintenance (or go offline for longer than 30 minutes per 24 hours based on resin manufacturer recommendations), the resin can be transferred to the CWA RRF, regenerated, and stored in 12% NaCl brine in the 10,000 gallon emergency resin storage tank until the well is ready to go back in service.
- **Storage for hazardous brine**. If the or the hazardous brine hauler (Option B) were not available to haul or the spent brine treatment (Option C) is down, there is 40,000 gallons of spent brine storage capable of holding 8 regenerations worth of liquid hazardous waste on site at the CWA RRF.
- **Resin regeneration at the CVWD CRRF.** If the CWA RRF is not operational, emergency services could be negotiated with CVWD for regeneration of resin from CWA SBA treatment sites.

6.3 Treatment Process

The main unit processes incorporated in the CWA RRF, along with support unit processes, are briefly described in the following sections:

1. Production of Initial Make-up water consisting of softened, de-chlorinated (GAC treated), non-saline potable distribution system water
2. Spent Resin Transfer (SRT)
    - Spent resin slurry make-up with reclaimed, non-chlorinated backwash (BW) water supplied from the BW Remnant Tank
    - Transfer of spent resin with SRT peristaltic pump
3. Tanker Truck Disinfection (TTD)
    - 50-ppm sodium hypochlorite load

- 50-ppm sodium hypochlorite recycle to bulk tank
- Rinse of 50-ppm to Non-Saline Waste Reclaim Tank
- Touch-up dosing of bulk sodium hypochlorite as needed

4. Backwash (BW)
    - BW with flow controlled, softened, de-chlorinated (GAC treated), non-saline potable distribution system water
    - Backwash purge water to Non-Saline Waste Reclaim Tank
    - Air block install in regeneration vessel headspace
5. Brine Regeneration (BR)
    - Saturated brine (26%) make-up with rock salt and fast rinse water
    - 1 BV of neat brine (12% NaCl) make-up each regeneration comprised of approximately 50 percent saturated brine and 50 percent flow controlled, softened, de-chlorinated, non-saline potable distribution system water for dilution
    - Spent brine partitioning
    - Brine recycle to 12% Brine Recycle Tank
6. Slow Rinse (SR) / Recycle (SRR)
    - SR with flow controlled, softened, de-chlorinated (GAC treated), non-saline potable distribution system water to displace brine out of the vessel
    - SRR leaving the regeneration vessel consists of 12% brine and is recycled to the Brine Batch Tank
7. Fast Rinse (FR) / Recycle (FRR)
    - FR with flow controlled, softened, de-chlorinated (GAC treated), non-saline potable distribution system water displaces the last fraction of dilute brine out of vessel
    - Initial fraction of the FRR has between 3% to 1% NaCl so is used to provide make up water to the Saturated Brine tank
    - Latter fraction of FRR fills Non-Saline Waste Reclaim Tank, which is ultimately sent to the sewer as a W supplementation flow
8. Regenerated Resin Transfer (RRT)
    - Tanker truck already rinsed in Step 2
    - Regenerated resin is already in a slurry in regeneration vessel (no make-up water needed)
    - Transfer of regenerated resin with RRT peristaltic pump from regeneration vessel to tanker truck

Figure 6-1 below depicts the volumetric requirements of the regeneration process. The process is quantified on a “per regeneration basis” with respect to BVs of process fluids required, recycled, and augmented from potable water distribution system. As described previously, 1 BV is equivalent to 4,488 gallons. For example, if 4 BV of 12% NaCl brine is required for complete regeneration of the resin, that is equivalent to 4 x 4,488 gallons = 17,952 gallons of 12% NaCl brine.

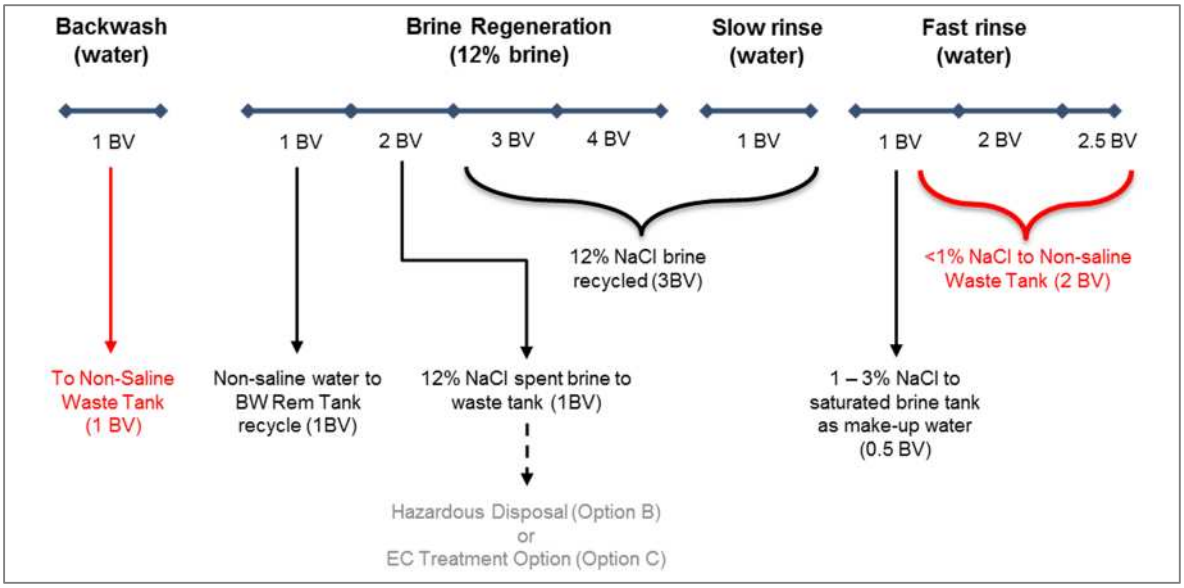


Figure 6-1. Regeneration Flow Partitioning Schematic

6.4 Process Design Criteria

The following sections outline the CWA RRF unit processes and present the design rationale for the process, major equipment sizing, material relating to pumps, mixers, filters, pressure vessels and tanks. Each of the following processes are presented in the sections below:

- Initial System Charge
- Spent Resin Transfer
- Resin Truck Disinfection
- Backwash
- Saturated Brine Make-up
- Saturated Brine Transfer
- Dilution Water Make-up
- 12% Brine Regeneration / 1st BV Backwash Remnant Water
- 12% Brine Regeneration / 2nd BV Spent Brine Disposal with Electrocoagulation
- 12% Brine Regeneration / 3rd + 4th BV Spent Brine Recycle
- Slow Rinse / Recycle
- Fast Rinse / Recycle
- Regenerated Resin Transfer
- Chemical Storage and Feed Facilities
- Air Mixing

6.4.1 Initial System Charge

There are two main process tanks that need to be filled with softened, de-chlorinated distribution system water prior to starting the first regeneration at the RRF: 1) Saturated Brine Tank; 2) Half the volume of

the Brine Recycle Tank. Approximately 8,260 gallons of softened, de-chlorinated distribution system water will be required to top off the 40 ton (9,800 gallon) Saturated Brine Tank once the rock salt is loaded. An additional 9,690 gallons of same water will be stored in the 20,000 gallon Brine Recycle Tank.

The 8,260 gallons of 26% brine will be pumped into the Brine Recycle Tank and mixed with 0.07% (non-saline) softened, de-chlorinated distribution system water to make the 12% neat brine needed for the regeneration. Air mixing through PulseAir diffusion plates will be used to ensure complete mixing of the 26% NaCl saturated brine at 1.2 specific gravity with the 0.07% NaCl dilution water with a specific gravity of 1.0 so the resulting 12% neat brine will be homogeneously mixed. The air mixing system is described in **Section 6.17** (Air Mixing System).

Three pressure vessels filled with 450 cf of GAC each will operate in parallel to dechlorinate the softened distribution system water prior filling tanks (at 200-300 gpm), performing SBA resin backwash (at 280-300 gpm), performing a SBA resin slow rinse (at 300 gpm) or the final SBA resin fast rinse flush (at 1350-1400 gpm). Since all of these regeneration unit processes are sequential batch type the maximum flow needed to be de-chlorinated through the GAC is the fast rinse flow rate of 1,400 gpm.

It is preferred that only de-chlorinated water contact the resin as chlorine degrades the resin and it can also lead to the formation of N-Nitrosodimethylamine (NDMA), a known toxic carcinogen regulated at the parts per trillion levels. The GAC system is described in **Section 6.7** (Saturated Brine Make-up) and **Section 6.9** (Dilution Water Make-up). On-line free chlorine and conductivity meters will monitor the quality of the water leaving the GAC system to ensure there is no chlorinated water contacts the SBA resin to avoid NDMA formation. Globe style solenoid operated flow control valves with magnetic flow meters will be placed on each process inlet to the regeneration vessel to ensure proper flow rates from the distribution system. These instruments, in addition to other tank instrumentation such as level transducers, will be described in further detail in **Section 10**.

Because the majority of the process water will come from the distribution system, a pressure reducing valve (PRV) will be used reduce the pressure in the main 12” fill line from the 80-100 psi range typical of the distribution system in the area to less than 60 psi in order to protect the regeneration vessels and Schedule 80 PVC process piping from excessive pressures.

The design criteria for the Initial System Charge is summarized in **Table 6-4** and **Table 6-5**.

Table 6-4: Design Criteria for Initial System Charge (Process Design)

Item	Value
Volume of Initial Charge Water, gal	18,000
Fluid Stored	Make-up water from CWA system
Fluid Salinity, % NaCl	< 0.07
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Free Chlorine Residual pre GAC, mg/L	1.0
Free Chlorine Residual post GAC, mg/L	0
Maximum Fill Rate, gpm	1,400
Minimum Fill Rate, gpm	200

Table 6-5: Design Criteria for Initial System Charge (Equipment)

Item	Value
Number of Saturated Brine Tanks	1
Number of Brine Recycle Tanks	1
Volume of Saturated Brine Tank, gal	9,800
Volume of Brine Recycle Tank, gal	20,000
PRV size / differential range,, psi	10” / 50-60
Fill Configuration	12” top
Drain Configuration	16” bottom w/ drain feature
Mixer Type	Pulsed air
Type of Tank	Fiberglass (black epoxy coated)
Fluid Pumped	Make-up water
Fluid Salinity, % NaCl	< 0.07
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Free Chlorine Range pre-GAC, mg/L	0.8-1.0
Free Chlorine Range post-GAC, mg/L	0

Below is a list of major equipment in this process listed in other sections:

- **Section 6.7** (Saturated Brine Make-up) – **Table 6-10** (GAC System)
- **Section 6.17** (Air Mixing System) – **Table 6-45** (Air mixing system)

6.4.2 Softened, de-chlorinated (GAC treated), non-saline potable distribution system water

Approximately 8.5 BV (38,150 gallons) of process water is required for each regeneration at the CWA RRF facility; however, roughly 52%, or 4.5 BV, of the process flows will be recycled as depicted in **Figure 6-1** above. The 4 BV (17,952 gallons) of waste flows that leave the facility will need to be made up for each regeneration. This make up water is provided by the CWA potable distribution system and must be dechlorinated and softened prior to use in the process. This water will enter the CWA RRF process after passing through a pressure reducing valve (PRV) that will regulate the downstream pressure not to exceed 60 psi so that operating pressures will be below the suggested operating pressure of the Schedule 80 PVC pipe and fittings and the regeneration vessels.

The automatic cation exchange water softeners will periodically require regeneration and generate cationic spent brine. It is estimated that the cation resin will be regenerated every 4.7 months (based on the estimated average CWA resin regeneration frequency) and would generate approximately 18,000 gallons (softener spent brine, backwash, and rinse water). The spent softener brine will be partitioned to the Water Softener Spent Brine Tank (ultimately bled to the local sewer line) or could be used as a feedstock for a future brine treatment option (second stage electro-coagulation discussed further in **Section 6.11.1**). The water quality of the combine spent water softener backwash, brine, and rinse water is estimated in **Table 6-6** below.

Table 6-6: Estimated Water Quality in the Softener Spent Brine Tank

Parameter	Units	Value[1]
Sodium	mg/L	560
Calcium	mg/L	777
Magnesium	mg/L	158
Chloride	mg/L	2,172
TDS	mg/L	5,317

[1] Raw water quality of captured spent cationic brine from Rayne Water Softener ZLD Project Pilot Tests on March 13, 2009.

Brine discharge to the sewer (whether treated SBA brine or spent cationic brine from the softeners) will have sulfate concentrations between 17,000 mg/L and 25,000 mg/L and be considered extremely corrosive to concrete sewage infrastructure. The CWA RRF is in close proximity to a 15” and 21” sewer line that can directly flow to the Avenue 54 WWTP. These sewer lines, associated manholes, and the Avenue 54 Headworks will be evaluated during detailed design for corrosion potential from these discharges. Potential mitigation options could include: (1) lining any concrete infrastructure, or (2) including additional brine treatment processes to allow for brine recycling (eliminating the brine discharge).

It is also important to note that the spent cationic brine from the softeners should never be discharged to the sewer at the same time or blended with the treated anionic brine from CWA RRF due to the potential for gypsum precipitation potential. This would likely cause plugging of collection system lines. To prevent mixing of both anionic and cationic brine sources in the sewer system, the discharge of Treated

Brine Tank will be interlocked with the Water Softener Spent Brine Tank discharge line to prevent both discharge valves being opened at the same time.

6.4.3 Spent Resin Transfer

The hopper bottom tank truck is sized to haul 600 cf of resin at a time. The resin is transported in the non-slurry form. To reduce the weight of the truck load, the resin is drained at the well site by keeping the drain valve open while the spent resin slurry is loaded into the tanker truck. A 60 mesh t-strainer keeps the resin in the truck while allowing the water to drain out of the tanker. Upon arrival at the RRF, resin slurry make-up water is required to fill the truck (**Figure 6-2)**, so the Spent Resin Transfer Pumps can move the slurry from the tank truck to the respective regeneration vessel (**Figure 6-3)**.

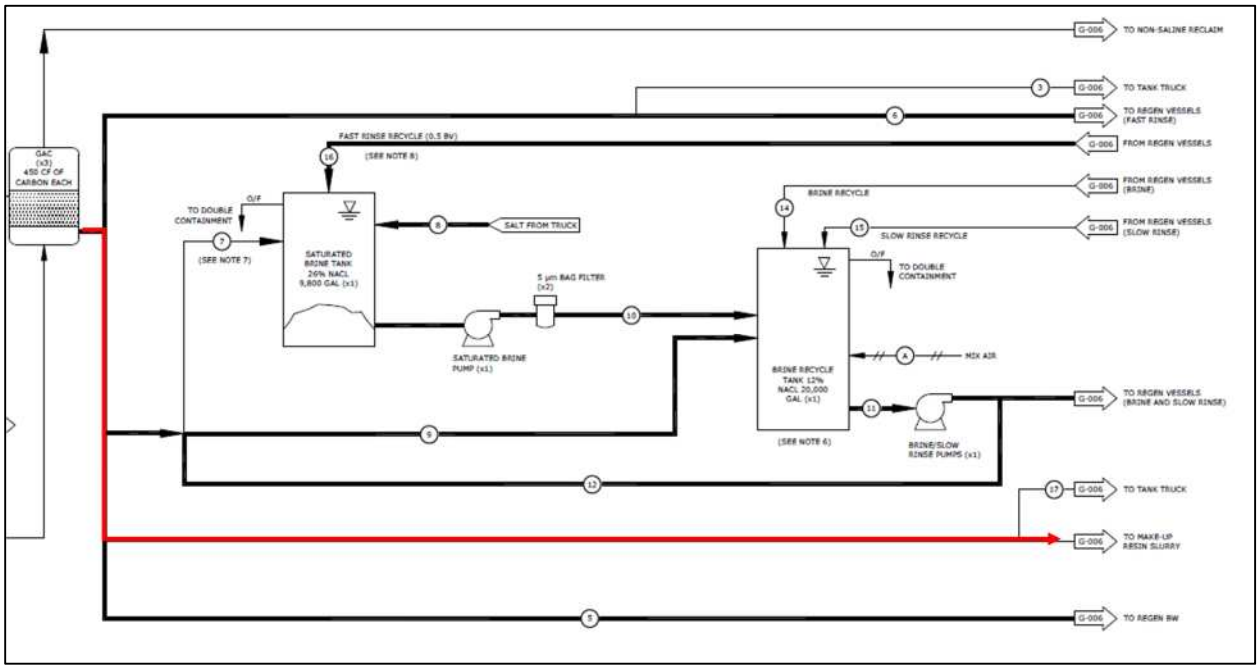


Figure 6-2: Resin Slurry Process Flow Diagram

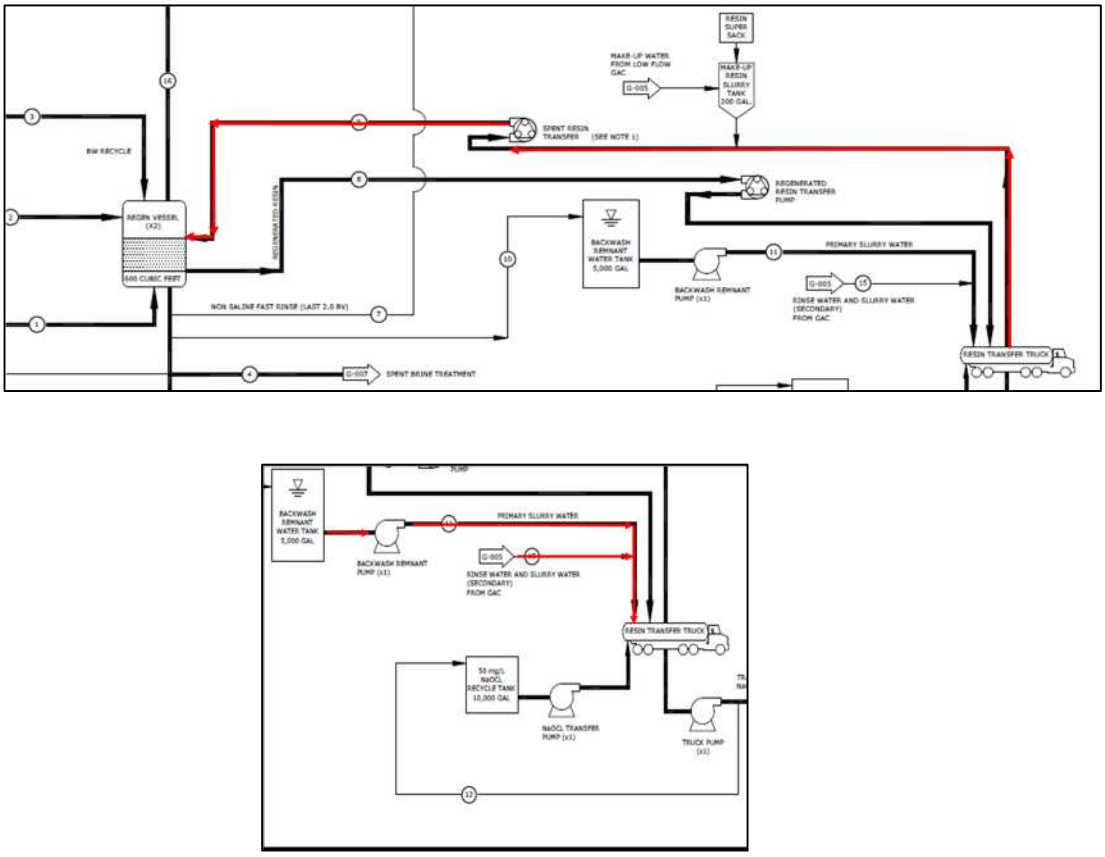


Figure 6-3. Resin Transfer Process Flow Diagram

6.4.4 Process Design Criteria

The spent resin beads, ranging in size from 425 µm – 620 µm, must be moved from the resin tank truck to the pressurized regeneration vessels in a quick, non-abrasive manner, without consuming excessive water and electricity. Attrition of the resin through abrasive transfer will degrade the resin bead and shorten the life of the resin. It will also cause fines that will ultimately be backwashed out of the resin bed, thereby requiring frequent replenishment with virgin resin. The design criteria for the Spent Resin Transfer process is summarized in **Table 6-7**.

Table 6-7: Design Criteria for Spent Resin Process (Per Regen)

Design Criteria	Amount
Volume of resin to be transferred from tanker truck to regen vessel, cf	600
Time to transfer resin, min	< 30 min
Fluid Pumped	Resin slurry
Fluid Salinity, % NaCl	<0.07
Fluid pH range	6-8
Transfer methods	Peristaltic pump
Bead size, um	425-620
Slurry Make-up Water Type	1st BV of Spent Brine Recovery (primary); De-chlorinated dist. sys. Water (secondary)
Volume required, gal	2,000
Time to fill tank truck, min	< 10

When spent resin arrives at the RRF, approximately 2,000 gallons of de-chlorinated, non-saline recycled water is pumped from the Backwash Remnant Tank to the tanker truck. This non-saline backwash water is pushed out of the bottom of the regeneration vessel by the incoming brine and stored in the Backwash Remnant Tank until this recycled water is needed for resin slurry make-up water. The Backwash Remnant Pumps are manually energized once all of the appropriate connections are made to the tank truck. A conductivity meter and flow totalizer on the system will be used to de-energize the pumps and ensure the proper volume of non-saline, non-contaminated water will be delivered to the tank to make the resin slurry. Since the contaminants being released from resin during the brine regeneration will be in the spent brine leaving the bottom of the regeneration vessel, the conductivity analyzer will be used to stop the Backwash Remnant pumps from delivering recycle water to the tank truck when the conductivity rises 5% from the beginning value indicating that contaminants may be present.

If additional water is needed to make up the spent resin slurry in the tank truck, or if the BW Remnant Recycle System is not available, softened, de-chlorinated distribution system water can be used to make the spent resin slurry in the tanker truck. The transfer of the resin make-up water is a manual process that requires operator communication to energize / de-energize the respective pump once the water has been filled to a level 2 to 4 inches above the resin bed in the truck.

Once the resin slurry make-up is complete, it can be transferred from the truck to the respective regeneration vessel using the Spent Resin Transfer Pumps. These pumps are peristaltic pumps, also known as hose pumps. They have been successfully (i.e., did not crush or damage resin after extensive testing) used before to transfer cationic resin of similar make-up in other industrial resin regeneration facilities in Arizona and California. They were evaluated through field testing, where testing showed that minimum surface attrition of the resin occurred, and that beads remained intact. The pumps are recommended for implementation at the RRF. The alternative is use of compressed air and pressurization for sluicing resin. This method is not recommended due to transfer inefficiency and noise.

Disinfection of the tank truck interior and resin backwashing in the regeneration vessel can begin simultaneously. This is detailed further in **Section 6.5** (Resin Truck Disinfection) and **Section 6.6** (Backwash / Resin Make-up).

6.4.5 Major Equipment

Table 6-8 through **Table 6-10** outline design criteria for major equipment.

Table 6-8: Design Criteria for Spent Resin Transfer Pumps

Design Criteria	Amount
Number of Pumps	2 total; 1 duty; 1 shelf
Type of Pump	Peristaltic Hose Pump
Shoes or Rollers	Roller
Fluid Pumped	Resin Slurry from Tank truck to Regen Vessel
Metering Capability, Y/N	Y
Fluid Salinity, % NaCl	0.07
Fluid pH range	6-8
Continuous Flow Rate, gpm	176
Maximum Discharge Pressure, psi	110
Time to Transfer 600 cf of resin from tanker truck to regen vessel, min	26
Hose Material	Natural Rubber
Motor Horsepower, HP	50
Pump Speed Control	VFD
Weight, lbs	5,400

Table 6-9: Design Criteria for Backwash Remnant Pumps

Design Criteria	Amount
Number of Pumps	2 total; 1 duty; 1 shelf
Type of Pump	Magnetic drive centrifugal
Fluid Pumped	Purged BW from BW Rem (primary) to Tank truck
Fluid Specific Gravity	1.0
Fluid Salinity, % NaCl	< 0.07
Fluid pH range	6-8
Continuous Flow Rate, gpm	300
Operating TDH, ft	46
Maximum Pump Speed, rpm	1800
Pump runtime per regen, min	<15
Minimum Pump Speed, rpm	1350
Inlet / Outlet Diameter, in	4 / 3
Impeller Type	EFTE Enclosed Impeller
Seals	Sealless, mag-drive
Motor Horsepower, HP	7.5
Pump Speed Control	VFD

Table 6-10: Design Criteria for GAC Contactors

Design Criteria	Amount
Number of GAC Contactors	Three (3)
De-chlor Range, mg/L from to mg/L to	1 to 0
Type/Material of Vessel	316SS
Vessel Diameter, ft	8
Bed Depth, ft	10
Flow Rate per Contactor, gpm	450
Empty Bed Contact Time at Max Flow, min	5
Hydraulic Loading Rate, gpm/sf	9
Backwash Expansion, %	40
Backwash Flow, gpm	450 regular / 600 initial fluff
Backwash Frequency, # per week	1
Media Life, years	2+

There will be a dedicated fill line connected to the truck that allows BW Remnant water to fill from the top. A manifold at the bottom of the hopper allows water to be drained with a truck mounted pump and suction y-strainer. Note: The same pump can be used to circulate flow from the bottom of the truck to the top for mixing of chemicals during disinfection. The piping and instrumentation will be described later in **Section 6.7 and 6.11**, respectively. Refer to the Tanker Truck PFD in **Figure 6-4** below.

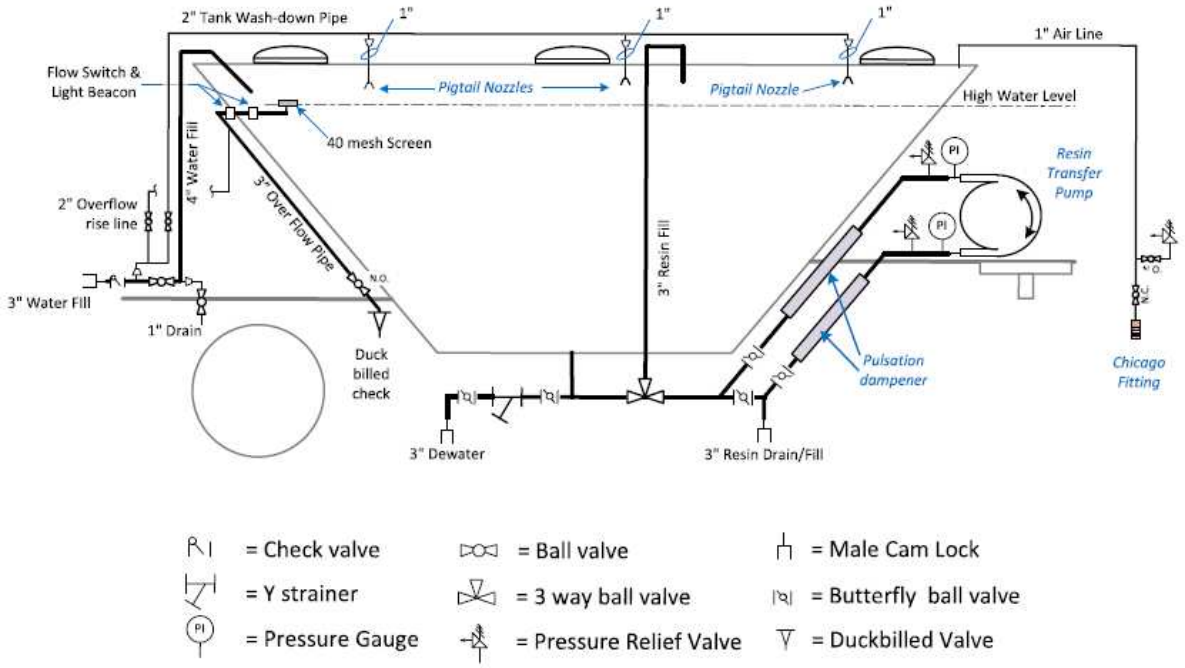


Figure 6-4. Process Flow Diagram for Tanker Truck

The major equipment details required in this section are presented in other sections of the report.

- **Section 6.8** (Saturated Brine Transfer) – **Table 6-24**: Design Criteria for Brine Recycle Tank (Brine Recycle Tank)
- **Section 6.17** (Air Mixing System) – **Table 6-45** (Air mixing system)

6.4.6 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-11**.

Table 6-11: Spent Resin Transfer Redundancy

Item	Function	Redundancy in Plant	Spares Required	Rationale
Peristaltic Pumps (VFD)	Spent Resin Transfer	1 total, 1 train, 1 swing pump	1 shelf + 2 spare hoses	Short term outage – use swing pump; Long term outage – install shelf pump; hoses will likely fail before pumps
Piping	Smooth, low resistance conduit with large radius, sweeping fittings to promote efficient resin slurry transfer	1 total, 1 train, 0 swing pump	none	Readily available
Instrumentation	Pressure gauges and transmitters on suction/discharge; peristaltic internal control for flow rate and totalization	1 total, 1 train, 0 swing pump	none	Readily available
Valves	Pinch valves will allow non-abrasive closure and longevity; all are manual	1 total, 1 train, 0 standby	1 shelf + 2 spare liners	May have a longer lead time for valve; liner will likely fail before valve
Tanks	Tank truck serves as suction supply	1 truck	1 common regen vessel	1 tanker truck can unload resin while 2 regen vessels available for loading

A dedicated spent resin transfer pump is required so as not to mix with regenerated resin transfer pumps. The same pump can also be used to pump from the Spent Resin Make-up Tank to add new resin to the regen vessel from the storage area in the event some was lost during the truck-vessel transfer, or backwashed out of the vessel as fines. The new resin added will be regenerated with the Spent Resin transferred from the SBA sites as discussed in **Section 6.4.3**. Since the main mechanical component of this train most likely to fail would be the pump, a shelf redundant pump can be used to replace the pump taken out of service for maintenance in either train. The rubber hose in the pump will fail before the pump itself so at least two hoses dedicated to spent transfer should be kept on the shelf at all times.

A swing resin transfer pump will be plumbed to the spent resin and regenerated resin transfer pump so it can fill the duty of resin pumping in the event either spent resin or regenerated resin pump is out of service for maintenance. The swing pump will also be used to draw down the water level in the regeneration vessel after the backwash to create the air bubble in the headspace of the vessel prior to the brine regeneration. This air bubble will significantly reduce the amount of neat 12% brine needed for the regeneration so it is not wasted in the headspace of the vessel. A vacuum breaker valve will passively open, while the combination air valves on the top of the vessels will also open to allow the water level to

drain. The combination air valves will be automatically closed to trap the bubble in the regen vessel during the brine and slow rinse, but open to release the air prior to the fast rinse.

6.5 Resin Tank Truck Disinfection

After the spent resin has been transferred from the tank truck to the regeneration vessel, as described above, the resin truck tank will require disinfection. A 12.5% strength 50-gallon drum will be used to batch the 10,000 gal 50-mg/L sodium hypochlorite tank. The truck will be filled with approximately 4,900 gallons of sodium hypochlorite to achieve a free chlorine residual of 50 mg/L. All interior surfaces of the truck tank will be wetted with the bulk sodium hypochlorite solution using the top spray nozzles. After two hours (or 30 minutes before regenerated resin is ready for transfer into the Tanker Truck), the chlorinated water will be drained down with the tanker truck pumps and sent back to the 50 mg/L Sodium Hypochlorite Bulk Storage Tank to be continually recycled. This solution will require routine monitoring to make sure the sodium hypochlorite does not loose strength. Occasionally, the solution will require fresh sodium hypochlorite. **Figure 6-5** provides an expanded view of the PFD below for a graphical depiction of this process.

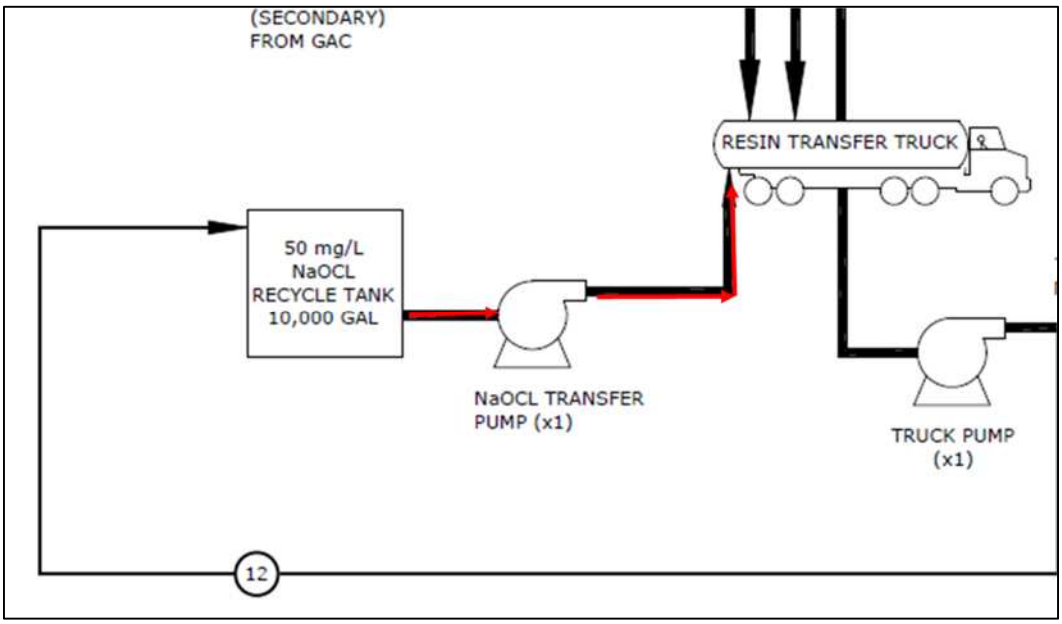


Figure 6-5. Resin Truck Disinfection Process Flow Diagram

6.5.1 Process Design Criteria

The 4,900 gallons of tank truck disinfection water comes from the 50-mg/L Sodium Hypochlorite Tank. The design criteria for the Tank Truck Disinfection process is summarized in **Table 6-12**. Sodium hypochlorite will be delivered to the facility in bulk 8% solution strength and pumped to the tank truck as needed. Assuming a concentration of 8%, the effective density of the hypochlorite will be 0.67 pound of

available chlorine per gallon of solution. Storage and feed requirements for sodium hypochlorite will be as shown in **Table 6-12**.

Table 6-12: Design Criteria for Tank Truck Disinfection

Design Criteria	Amount
Volume of Tanker Truck to be Disinfected, gal	4,900
Target Free Cl_2 Concentration, mg/L	50
Make-up Water Source	50 mg/L Bulk Storage Tank
Minimum Contact Time, hrs	2
Volume of Hypochlorite to Disinfect One Truck, gal	2
Avg. Number of Trucks Disinfected per Week	1-5
Volume Required for 15-Day Storage, gal	5 (due to recycle)
Volume of Carboy, gal	7
Type of Pumps for Transfer to Truck	Peristaltic Metering Pump
Number of Pumps	Two (2); one duty, one shelf
Flow Rate, gph	33
Maximum Pressure, psi	50
Motor Horsepower, HP	1/8
Transfer Time, minutes	9
Pump Speed Control	CS
Type of Pumps for Transfer From Truck to 50 mg/L Tank	Magnetic Drive Pump
Number of Pumps	Two (2); one duty, one shelf
Operating Flow Rate @ 100% speed, gph	345
Operating TDH@ 100% speed, ft	25
Motor Horsepower, HP	5
Transfer Time, minutes	15
Pump Speed Control	VFD

Note: Recommended storage volume of sodium hypochlorite is limited to 15 days because of degradation.

Monitoring of the volume of sodium hypochlorite fed to the truck will be achieved using a magnetic flowmeter installed on the pump discharge. Confirmation of chlorine residual can be obtained by grab sample and portable chlorine analyzer. After disinfection, the chlorinated water will be pumped back to the 50 mg/L Sodium Hypochlorite Storage Tank with the magnetic drive tanker truck transfer pumps. The truck will be rinsed with softened, de-chlorinated distribution system water through the same spray nozzles used to fill the tanker with sodium hypochlorite before transferring the regenerated resin back for transport.

6.5.2 Major Equipment

The major equipment details required in this section is presented in other sections of the report. Below is a list of major equipment in this process:

- **Section 6.4.2** (Spent Resin Transfer) – **Table 6-10** (GAC Contactors), **Table 6-9** (Backwash Remnant Pumps)
- **Section 6.10** (1st BV Backwash Remnant Recycle) – **Table 6-30** (Backwash Remnant Tank)
- **Section 6.17** (Air Mixing System) – **Table 6-45** (Air mixing system)

6.5.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-13**.

Table 6-13: Tank Truck Disinfection Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
Peristaltic Metering Pumps (VFD)	To accurately meter the 5% NaOCl to the truck at 5 gal in 9 min.	2 total, 1 trains;	1 shelf	Only 1 pump needed due to quick transfer rate; common redundant pump used if duty is down
Piping	Double contained Schedule 80 PVC	1 total, 1 trains; 0 standby	None	Readily available
Inst.	Pressure gauges and transmitters on suction/discharge; internal control for flow rate and totalization	1 total, 1 trains; 0 standby	2	Readily available, but low cost
Valves	Schedule 80 PVC ball valves will allow full pipe flow; all are manual	1 total, 1 trains; 0 standby	5 shelf (various sizes)	Readily available, but low cost
Tanks	5-gal carboy for 15-day supply for 4,900-gal truck disinfection as dosed into the 50 mg/L Sodium Hypo Storage Tank w/ peristaltic; later transferred from tank to truck with magnetic drive pump	1 total, 1 trains; 0 standby	None – drums replaced upon delivery	Can disinfect tanker truck at a time with ample time

Due to the low sodium hypochlorite volume requirement of only 2 gallons of 12.5% solution to disinfect the 4,900-gallon volume in the tanker truck to 50 mg/L concentration per AWWA C651, only one pump is needed. The low volumetric requirement of the sodium hypochlorite feed system will require less than two traditional 55-gallon drums feeding both processes for a 15-day storage.

6.6 Backwash / Resin Make-up

The purpose of this process is to introduce de-chlorinated, particle-free flow in a controlled manner into the bottom of the regeneration vessel to: 1.) Remove any accumulated solids on the resin bed, and; 2.) Expand the resin bed 60% to allow for a more effective co-current regeneration. Backwash recycle allows water to be continually reused in a closed loop after 0.1 µm filtration; monthly blowdown of backwash recycle water is recommended. Please refer to **Figure 6-6** for an expanded view of the PFD below for a graphical depiction of this process.

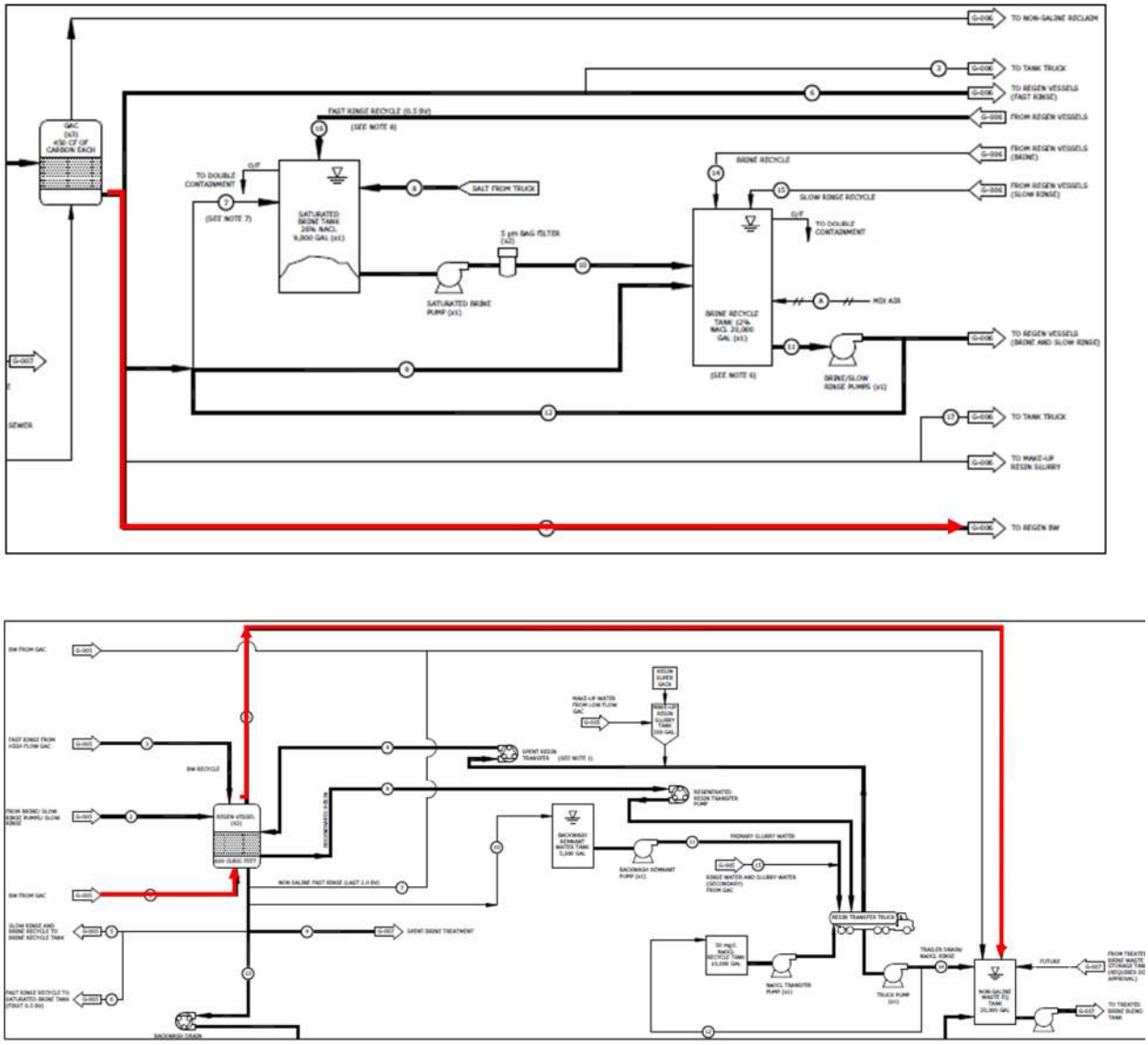


Figure 6-6. Backwash Process Flow Diagram

6.6.1 Process Design Criteria

The Backwashing consists of a 280-300 gpm counter current (upflow) of clean, non-saline water for a set duration of 1 BV (4,488 gallons). Minimal solids are anticipated in the backwash since the resin will come directly from pressurized vessels at the well site to the pressurized regeneration vessels at the RRF, with limited opportunity to accumulate dirt or dust during transport in the truck. The main purpose of the backwash is to break up any resin clumps and completely mix the resin bed.

Table 6-14 summarizes the general design criteria for the Backwash Process.

Table 6-14: General Design Criteria for Backwash Process (Per Regen)

Design Criteria	Amount
Backwash Hydraulic Loading Rate for 60% Expansion, gpm/ft^2	2.5
Backwash Bed Volumes	1
Backwash Flow, gpm	283
Backwash Duration, min	15
Backwash Volume Generated, gal	4,488 x 1 Train = 4,488
Fluid Source	From softened, de-chlorinated distribution system water (no pumping required)
Automated Flow Control	Yes
Fluid Salinity, % NaCl	<0.07
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Desired Free Cl_2 Residual, mg/L	0

All of the water entering the bottom of the regeneration vessel for the 1 BV Backwash, will be delivered with a solenoid operated flow control globe-style valve that has its own Process and Instrumentation Diagram (PID) loop control to throttle the valve based on a 4-20 Ma signal from a magnetic flow meter located at least two pipe diameters upstream of the valve. The solenoid operated pilots use distribution system pressure to open and close the cover and throttle to a desired flow setpoint. The BW magnetic flow meter will also totalize the amount of water used for the backwash and slowly close the flow control valve when reaching the 4,488 gallon requirement so as not to cause any pressure transients in the system.

The spent backwash water exiting the top of the regeneration vessel will be stored in the Non-Saline Waste Recovery tank if on site treatment is incorporated at the RRF; otherwise it will go directly to the sewer connection that ties into the Ave 54 WWTP headworks wet well. If stored for treatment it will be used to help dilute the sulfate, nitrate, selenium and Total Dissolved Solids (TDS) levels in the treated brine, prior to entering the WWTP.

When the backwash is complete, as indicated with a flow totalizer the process is slowly de-energized, and the process is stopped. If the settled bed falls within +/- 6 inches of the 600-cf mark on the sight glass than downstream unit processes do not need to be changed. If the level is greater than 4 inches below the line, the operator adds the appropriate volume of resin from the supersacks to the Make-up Resin Slurry Tank. De-chlorinated water is added to resin mixing tank to make a resin slurry that can be pumped with the Spent Resin Transfer pump under the correct valve configuration. An alternative to adding more resin would be to decrease the unit process requirements accordingly; however, the operation of the SBA sites are constrained around having 600 cf resin per treatment vessel. If the settled bed is above this line, additional regeneration time and spent waste will be generated to account for the increased resin.

After the resin level is verified to be within the 600-cf tolerance, the water level in the regeneration vessel is manually drained to approximately 1’ above the top of the settled bed with the swing peristaltic pump. The vacuum breaker valve at the top of the regeneration vessel will passively open (in addition to the automated combination air release valves) to allow air into the vessel so the water in the regeneration

vessel can be evacuated to a set level as seen through the regeneration vessel sight glass, without pulling a vacuum inside the vessel.

Once this is complete, a small motorized valve between the bottom of the combination valve and the top of the vessel or inlet pipe (whichever is higher in elevation) will close and the passive vacuum breaker valve will passively seat under positive pressure. This will allow a large air bubble to occupy the top of the regeneration vessel (above the brine dispersion laterals) so the extra 4,000 to 4,500 gallons of empty headspace does not need to be filled with brine. The air bubble in the headspace will reduce the amount of brine needed, and the time required to brine.

6.6.2 Major Equipment

Table 6-15 and **Table 6-16** outline design criteria for backwash and regeneration vessel units.

Table 6-15: Design Criteria for Backwash

Design Criteria	Amount
Number of Flow Control Valves	2 Total; 1 Duty; 1 Shelf
Is FCV Automated?	Yes
Type of Automation	solenoid
Support Instrumentation	Magnetic flow meter
Flow Range, gpm	200-400
Diameter, in	4
Pressure Rating, psi	150
Material of Construction	Ductile iron
Min Differential Pressure Requirement, psi	15
Pilot Water Quality	Softened and de-chlorinated
Fluid	Softened, de-chlorinated distribution system water
Fluid Salinity, % NaCl	< 0.07
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Desired Free Cl_2 Residual, mg/L	0

Table 6-16: Design Criteria for Regeneration Vessels

Design Criteria	Amount
Number of Regeneration Vessels	2 Total, one duty, one standby
Type/Material of Vessel	Steel, Epoxy-Coated Interior Compatible with 12% NaCl
Pressure Rating, psi	100
Internal Piping Material	PVC/PVDF
Resin Capacity of Vessel, ft^3	600
Resin Bead Diameter, µm	425 - 620
Required Expansion Volume, %	60
Max Expansion Volume, %	90
Bed Volume, gallons	4,488
Bed Depth, ft	5.3
Vessel Diameter, ft	12
Vessel Total Height, ft	10.2
Fluid Pumped	Backwash, brine and rinse water
Fluid Salinity, % NaCl	0.07 – 12
Fluid pH	6-8
Fluid Specific Gravity	1.0-1.1
Desired Free Cl_2 Residual, mg/L	0
Flow Range, gpm	280 – 1,400
Media Trap	10”, 250 µm y-strainer
Sight Glasses	Three 4”x12” windows in each quad

6.6.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-17**.

Table 6-17: Backwash Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
FCV	Used to flow pace desired flow rate and duration required for BW from softened, de-chlorinated and non-saline distribution system water	2 total; 1 train	1 shelf	Short term (ST) outage – use manual bypass; Long term (LT) – install shelf item
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Pressure on suction/discharge; mag flow meter, level transmitters, cond meters	2 total, 1 trains, 0 standby	1 shelf	ST outage – install shelf item; LT outage – replace shelf item
Valves	Butterfly (manual), check, ARV	1 total, 1 trains, 0 standby	None	Readily available
Tanks	20,000-gal Non-Saline Waste Reclaim Tank on effluent of regeneration vessel	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace

6.7 Saturated Brine Make-up

The purpose of this process is to use de-chlorinated, particle-free, recycled make-up water for the 40 ton briner to make the 26% NaCl saturated brine. The water will dissolve the salt to 26% NaCl concentration that will later be diluted to make up the 12% regeneration brine strength as described in Section 5.10 (Brine Regeneration). Another alternative for Saturated Brine Make-up water is the first BV of the Fast Rinse Recycle as described in detail in **Section 6.14** (Fast Rinse / Fast Rinse Recycle). Refer to **Figure 6-7** to the expanded view of the PFD below for a graphical depiction of this process.

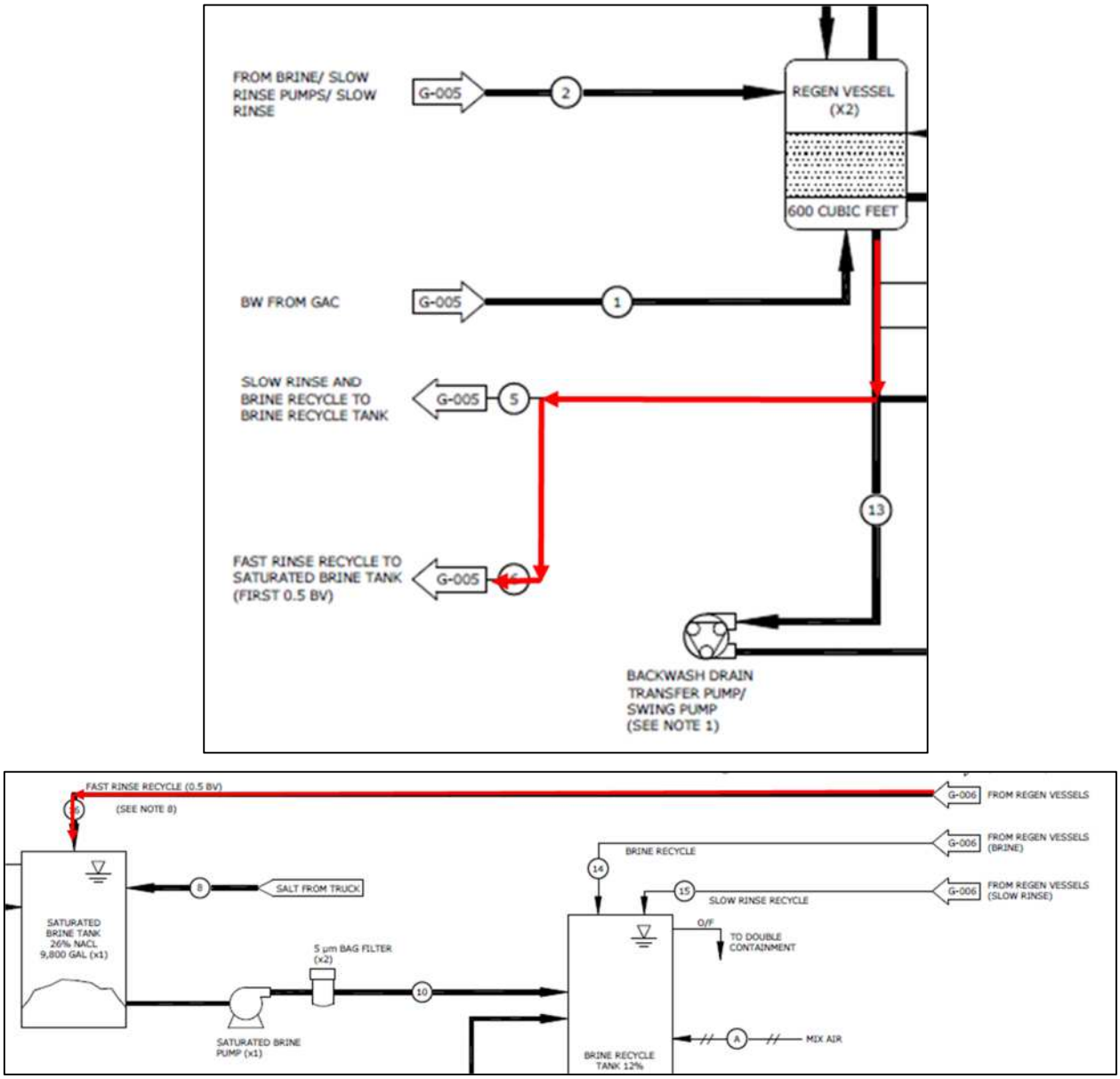


Figure 6-7. Saturated Brine Process Flow Diagram

6.7.1 Process Design Criteria

The Saturated Brine Tank was sized to store a minimum of 9,800 gallons of 26% saturated NaCl that is used as a feedstock for the regeneration process. The initial regeneration requires 4 BV (17,950 gallons) of 12% NaCl brine. Only 1 BV (4,488 gallons) of 12% NaCl is required thereafter once the recycle process is initiated. To support the initial regeneration and provide the residence time for the salt to be

diluted in the recycle mode, the larger 40 ton Briner was used. The briner utilizes 2.6 pounds of salt for every gallon of 26% NaCl (2,065 gallons required for 1 BV). Salt is transported in 25 ton tank truckers and deliveries are required every 50 days assuming 6 regenerations per month. A minimum of 10 tons of salt should be maintained in the briner between deliveries.

The size of the briner was based on the mass balance calculation below to supply the initial volume of 12% NaCl per train, working backwards from the endpoint volume and salt concentration of 17,950 gallons of 12% NaCl knowing that the maximum saturated brine concentration is 26%:

$$8260\ \text{gal} \times 26\% + 9692\ \text{gal} \times \text{NaCl}\% = 17952\ \text{gal} \times 12\%$$
$$\text{NaCl}\% = 0.07\%$$

Therefore, to make up the initial 17,952 gallons of 12% NaCl concentration for the regeneration, 8,260 gallons of 26% NaCl must be mixed with 9,692 gallons of less than 0.07% NaCl. For the purposes of this design, source water with a NaCl concentration less than 0.07% is considered non-saline as supplied from the softened, de-chlorinated distribution system. A 40 ton briner is the next nominal size larger that will hold 9,800 gallons of 26% NaCl.

For subsequent recycle water operation where only 1 BV (4,488 gallons) of 12% NaCl will need to be added per regeneration, only 2,065 gallons of 26% NaCl must be mixed with 2,423 gallons of 0.07% NaCl per calculation below:

$$2065\ \text{gal} \times 26\% + 2423\ \text{gal} \times \text{NaCl}\% = 4488\ \text{gal} \times 12\%$$
$$\text{NaCl}\% = 0.07\%$$

The design criteria for the saturated brine make-up process is noted in **Table 6-18**.

Table 6-18: General Design Criteria for Saturated Brine Make-up Process (Per Regen)

Design Criteria	Amount
Saturated NaCl Brine Concentration, %	26
Maximum NaCl Concentration Softened, De-chlorinated Dist. Sys Water, %	0.07
Saturated Brine Specific Gravity	1.2
Initial Saturated Brine Volume, gal	8,260
Recycle Mode Saturated Brine Volume, gal	2,065
NaCl Phase NSF approved	Solid
Fluid pH range	6-8
Required Free Cl_2 Residual, mg/L	0

6.7.2 Major Equipment

Table 6-19: Design Criteria for Saturated Brine Tank (Initial Charge)

Design Criteria	Amount
Number of Saturated Brine Tanks	1 Total; 1 duty
Type/Material of Tank	Fiberglass-Reinforced Plastic
Material Stored in Tank	Saturated NaCl brine
Capacity of Tank, gal / ton	9,800 / 40
Tank Diameter, ft	10
Tank Straight Shell Height, ft	16'-9"
Fill Configuration	6" top
Mixer Type	-
Fluid Salinity, % NaCl	26
Fluid pH range	6-8
Fluid Specific Gravity	1.2
Free Chlorine Range, mg/L	0

Table 6-20: Design Criteria for Saturated Brine Make-up (Initial Charge)

Design Criteria	Amount
Number of Flow Control Valves	2 Total; 1 Duty; 1 Shelf
Is FCV Automated?	Yes
Type of Automation	solenoid
Support Instrumentation	Magnetic flow meter
Flow Range, gpm	200-400
Diameter, in	4
Pressure Rating, psi	150
Material of Construction	Ductile iron
Min Differential Pressure Requirement, psi	15
Pilot Water Quality	softened and de-chlorinated
Fluid	1st BV of Fast Rinse having 1-3% NaCl
Fluid Salinity, % NaCl	1-3
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Required Free Cl_2 Residual, mg/L	0
Fill time per regen, min	<15

Below is a list of major equipment in this process listed in other sections:

- **Section 6.4.2** (Spent Resin Transfer) –**Table 6-10** (GAC Contactors)

6.7.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-21**.

Table 6-21: Saturated Brine Make-up Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
Mag Drive Cent. Pumps	To transfer the 26% NaCl saturated brine to the Brine Recycle Tank; de-chlor, make-up water from Low Flow GAC system	2 total, 1 trains, 0 standby	1 shelf	Short term (ST) outage – use remaining 7,500 gal of brine in Sat Brine Tank; Long term (LT) – install shelf pump
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Pressure gauges and transmitters on suction/discharge; mag flow meter, level transmitters	1 total, 1 trains, 0 standby	1 shelf	ST outage – use remaining 7,500 gal of brine in Sat Brine Tank; LT outage – install shelf item
Valves	Ball (manual), check, ARV	1 total, 1 trains, 0 standby	None	Readily available
Filter (air)	Bag filter on briner vent to capture airborne salt from load	1 total, 1 trains, 0 standby	None	Readily available
Tanks	40 ton (9,800 gal) fiberglass briner on supply; 20,000-gal fiberglass Brine Recycle Tank on discharge	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace tank

6.8 Saturated Brine Transfer

The purpose of this process is to transfer the 26% NaCl to the Brine Recycle Tank where it gets diluted with softened, de-chlorinated, non-saline water from the distribution system to make the 12% NaCl brine solution required for regeneration. Please refer to the expanded view of the PFD below for a graphical depiction of this process.

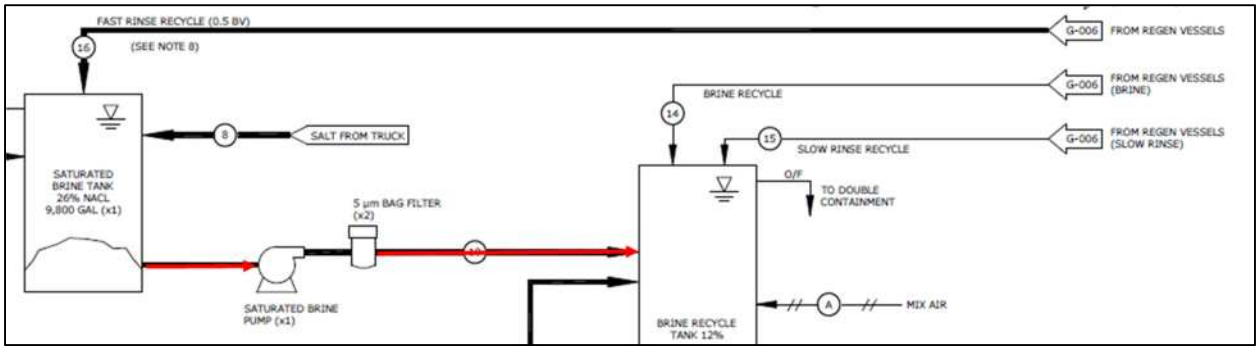


Figure 6-8.Saturated Brine Transfer Process Flow Diagram

6.8.1 Process Design Criteria

After adding the rock salt to the 40-ton Briner, it will dissolve at approximately 20 gallons per minute (gpm) at standard temperature and pressure once the reclaimed 3% NaCl Fast Rinse water is introduced in the tank. Once the brine solution is prepared, the 26% NaCl will be transferred to the Brine Recycle Tank using a magnetic drive centrifugal pump, due to the corrosiveness of the brine, through a 5-micron bag filter to remove any solids accumulated on the rock salt in transit to the RRF as well as any undissolved salt. Since the Brine Recycle Make-up is a batch process, the rate at which the 26% NaCl is transferred to the Brine Recycle Tank is controlled by flow totalization as indicated with a magnetic flow meter. The salinity of the brine leaving the Saturated Brine Tanks will be consistently between 25% and 26% NaCl. As noted in Section 5.7.1, 2,065 of 26% NaCl brine will be mixed with 2,423 gallons of dilution water from the distribution system with a flow control valve and totalizer to make the 12% NaCl required for the regeneration. Conductivity meters on the discharge of the Saturated Brine Pump and on the softened, de-chlorinated, non-saline distribution system water will confirm the percent salinity of either stream. If either process stream is outside of the percent salinity required to make the 12% NaCl brine for regeneration, the totalized flow will be adjusted with the salt mass balance equations presented in Section 5.7.1. To ensure that complete mixing occurs in the tank, an air mixing system will be used as described in detail in **Section 6.17** (Air Mixing System).

Table 6-22: Design Criteria for Saturated Brine Transfer Process (Per Regen)

Design Criteria	Amount
Saturated NaCl Brine Concentration, %	26
Maximum NaCl Concentration in Supply Water, %	0.07
Saturated Brine Specific Gravity	1.2
Initial Saturated Brine Volume, gal	8,260
Normal Operating Mode Saturated Brine Volume, gal	2,065
Fluid pH range	6-8
Desired Free Cl_2 Residual, mg/L	0

6.8.2 Major Equipment

Table 6-23: Design Criteria for Saturated Brine Transfer Pumps

Design Criteria	Amount
Number of Pumps	2 Total; 1 Duty; 1 shelf
Type of Pump	Mag drive centrifugal
Fluid Pumped	26% NaCl from Saturated Brine Tank to Brine Recycle Tank
Fluid Specific Gravity	1.2
Fluid Salinity, % NaCl	26
Fluid pH range	6-8
Continuous Flow Rate, gpm	400
Maximum TDH, ft	46
Maximum Pump Speed, rpm	1800
Pump runtime per regen, min	<15
Minimum Pump Speed, rpm	1350
Inlet / Outlet Diameter, in	6 / 6
Impeller Type	EFTE Enclosed Impeller
Seals	Sealless, mag-drive
Motor Horsepower, HP	7.5
Pump Speed Control	CS

Table 6-24: Design Criteria for Brine Recycle Tank

Design Criteria	Amount
Number of Brine Recycle Tanks	1 Total; 1 duty; 0 standby
Type/Material of Tank	Fiberglass-Reinforced Plastic
Material Stored in Tank	12% NaCl from Brine Recycle Tank to Regen Vessels
Capacity of Tank, gal	20,000
Tank Straight Shell Height, ft	16’-9”
Fill Configuration	6” top
Drain Configuration	6” bottom w/ drain feature
Mixer Type	Air
Fluid Salinity, % NaCl	12
Fluid pH range	6-8
Fluid Specific Gravity	1.1

Below is a list of major equipment in this process listed in other sections:

- **Section 6.17** (Air Mixing System) – **Table 6-45** (Air mixing system)

6.8.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-25**.

Table 6-25: Saturated Brine Transfer Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
Mag Drive Cent. Pumps	To transfer the 26% NaCl saturated brine to the Brine Recycle Tank to mix with dilution water to make 12% NaCl	2 total, 1 trains, 0 standby	1 shelf	Short term (ST) outage – install shelf pump; Long term (LT) – procure another replacement pump
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Psi gauges and transmitters on suction/discharge; mag flow meter, level transmitters	2 total, 1 trains, 0 standby	1 shelf	ST outage – install shelf item; LT outage – procure another replacement
Valves	Ball (manual), check, ARV	1 total, 1 trains, 0 standby	None	Readily available
Filter (air)	Bag filter on briner vent to capture airborne salt from load	2 total, 1 trains, 0 standby	1 shelf	Standard practice and low cost item to have in stock
Tanks	40 ton (9,800 gal) fiberglass briner on supply; 20,000-gal fiberglass Brine Recycle Tank on discharge	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace tank mobilize spare HDPE tank and plumb into main system for emergency

6.9 Dilution Water Make-up

The purpose of this process is to introduce the softened, de-chlorinated, solids free, non-saline distribution system water to the Brine Recycle Tank to dilute the 26% NaCl saturated brine to the desired 12% NaCl concentration required for regeneration. For the purpose of the RRF, water with a NaCl concentration less than 0.07% is classified as non-saline, which is a conservative number given the historical distribution system water has TDS levels below 300 mg/L. Please refer to the expanded view of the process flow in **Figure 6-9** for a graphical depiction of this process.

6.9.1 Process Design Criteria

The softened, de-chlorinated, non-saline distribution system dilution water will be metered to the Brine Recycle Tank through an automated flow control valve located in the Brine Recycle Tank fill line. Since regeneration is a sequential batch process, the water softeners and GAC systems will treat the distribution system water on an as needed basis when the Brine Recycle Dilution Water Fill Flow Control Valve opens and begins to fill the Brine Recycle Tank with the proper volume to cut the 26% NaCl Saturated brine to the desired 12% concentration. The conductivity meter on the discharge of the GAC manifold will be used verify the percent NaCl used for the brine dilution, which is estimated to be less than 0.07% NaCl solution. To ensure that complete mixing occurs in the tank, an air mixing system will be used as described in detail in **Section 6.17** (Air Mixing System).

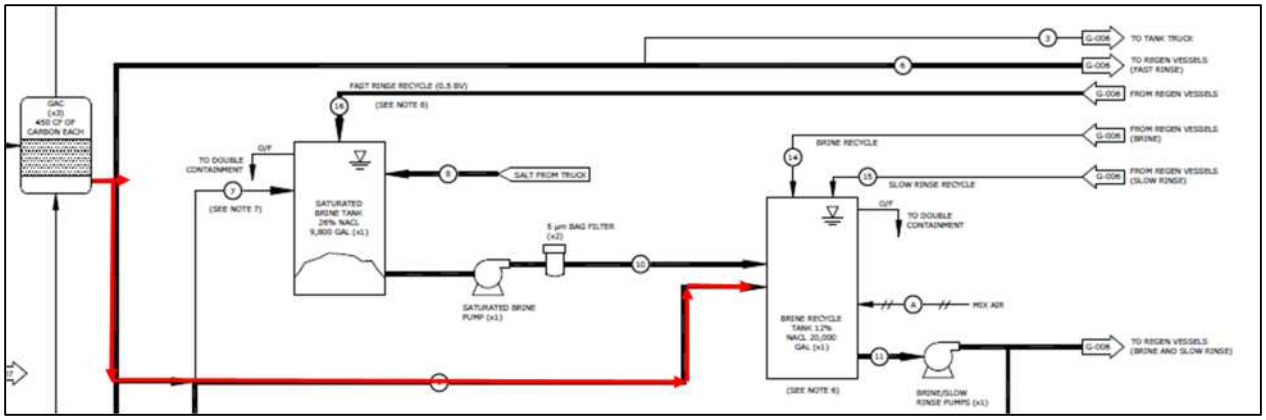


Figure 6-9. 12% Dilution Water Make-Up Process Flow Diagram

Table 6-26: General Design Criteria for Dilution Water Make-up (Per Regen)

Design Criteria	Amount
Maximum NaCl Concentration in distribution system dilution water, %	0.07
Fluid Specific Gravity	1.0
Initial Make-up Volume, gal	9,697
Recycle Mode Saturated Brine Volume, gal	2,423
Fluid pH range	6-8
Desired Free Cl_2 Residual, mg/L	0
Time to transfer dilution water, min	< 15

6.9.2 Major Equipment

Below is a list of major equipment in this process listed in other sections:

- **Section 6.6** (Backwash/Resin Make-up) – **Table 6-16** (Regen Vessel)
- **Section 6.8** (Saturated Brine Transfer) – **Table 6-24** (Brine Recycle Tank)
- **Section 6.10** (1st BV Backwash Remnant Recycle) – **Table 6-30** (Backwash Remnant Tank)

6.9.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-27**.

Table 6-27: Design Criteria for Dilution Water Make-up

Design Criteria	Amount
Number of Flow Control Valves	2 Total; 1 Duty; 1 Shelf
Is FCV Automated?	Yes
Type of Automation	solenoid
Support Instrumentation	Magnetic flow meter
Flow Range, gpm	200-400
Diameter, in	4
Pressure Rating, psi	150
Material of Construction	Ductile iron
Min Differential Pressure Requirement, psi	15
Pilot Water Quality	softened and de-chlorinated
Fluid	Distribution system water
Fluid Salinity, % NaCl	<0.07
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Required Free Cl_2 Residual, mg/L	0
Fill time per regen, min	<15

The brine dilution water is delivered under pressure from the distribution system through the water softeners and GAC system once the respective process flow control valve opens. A conductivity meter verifies the % NaCl is < 0.07% and a magnetic flow meter is used to record instantaneous flow and totalized flow. The FCV utilizes the 4-20mA magnetic flow meter output to modulate flow with its internal PID loop controller and slowly closes the valve after the desired volume of water has entered the tank.

According to the GAC manufacturer Calgon, the media will last 5 years if just de-chlorinating the distribution system water at an assumed concentration of 1 mg/L free chlorine to 0 mg/L free chlorine assuming:

- No organics in the water
- 17,950 gallons per regeneration and six regenerations per month regenerations per month

6.10 Brine Regeneration / 1st BV Backwash Remnant Water

A 12% NaCl brine is used in the regeneration of the resin to exchange the anions accumulated on the spent resin with the chlorides in the salt. As previously discussed in Section 5.6 Backwash/Resin Make-up, the brine regeneration process occurs after the air block is installed in the headspace of the regeneration. Note that the air block is kept in the regeneration vessel headspace for the brine regeneration and the slow rinse, but is released before the fast rinse so the entire pressure vessel internals are rinsed. A magnetic drive pump will be used to deliver 4 BV of the 12% NaCl brine flow in a co-current configuration into the brine diffusion lateral located at top of the resin vessel. This diffusion lateral is about 6 inches to 1 foot above the 600 cf resin level. As the brine moves downward through the resin bed, it pushes the “remaining” backwash water out the bottom of the vessel. This “leftover”

backwash water is approximately 1 BV of non-saline, de-chlorinated water that is the exact volume needed to make-up a slurry when the spent resin truck arrives at the RRF. This flow is diverted to the BW Remnant Tank where it later will be pumped to the tanker truck to make up the slurry when the truck arrives at the RRF.

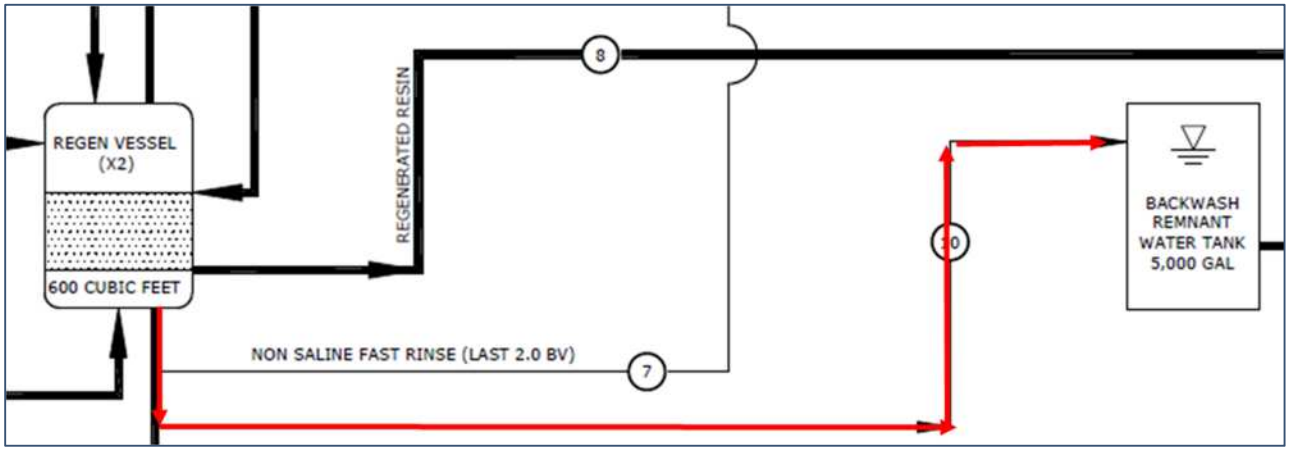


Figure 6-10. 1st BV Backwash Remnant Process Flow Diagram

6.10.1 Process Design Criteria

As previously mentioned, the brine regeneration step consists of introducing 4 BVs (17,950 gallons) of 12% NaCl over the resin in a co-current, or down flow, at a rate of 300 gpm. The regeneration rate is a ratio of the resin volume to the flow rate through the pressure vessel; otherwise known as empty bed contact time (gal of resin ÷ gpm of flow = min of contact time). A critical factor in the design of the regeneration vessel internals is to maintain an equal velocity profile across the resin bed surface area to ensure equal contact time. Non-plug flow will result in short-circuiting and lower the empty bed contact time for portions of the resin bed that experienced higher velocities, resulting in incomplete regenerations. Stringent requirements such as computational fluid dynamics, will be placed on the vessel manufacturer to develop a dispersion lateral and underdrain configuration that results in plug flow for the desired flow range.

The regeneration vessel configuration incorporates the components below to optimize regeneration efficiency with respect to time, salt consumption and waste generation. They are as follows:

1. Vessel Air Locking during the Regeneration - The regeneration vessel is sized to allow 60% to 80% bed expansion during backwash, the sideshell height will vary based on manufacturer but will range from 10-12 feet. There is significant headspace above the settled resin bed that would need to be filled with 12% NaCl brine solution. The vessel will be designed to allow a backwash water drain down prior to the 12% NaCl regeneration as discussed in Section 5.6.1 (Backwash / Resin Make-up). The draindown is performed with the swing peristaltic pump. During the draindown, the air-vacuum valve allows air to enter the regeneration vessel and the water level is decreased to 6’’- 12” above the resin bed. Water level can be monitored though the sight glass.

This water will go back to the Non-Saline Waste Reclaim Tank for beneficial reuse. Before the brine regeneration, the isolation valve for the combination valve will automatically close to prevent air from leaving the headspace, thereby trapping the air bubble in the top of the vessel and occupy the 3,000 to 4,000 gallons of headspace the brine would need otherwise need to fill before ever touching the resin. Note: All of the downstream process tanks are top fill and higher than the regeneration vessels so the bubble can only be evacuated out of the combination air valve when it automatically opens after the slow rinse is complete. This configuration saves approximately 10-15 mins in the regeneration process and minimizes brine use.

2. Recycle – Since the water left in the regen vessel after the backwash drain down is solids-free, non-saline, de-chlorinated water, it can be recovered to the Backwash Remnant Water Tank until the conductivity meter on the regen vessel outlet line indicates an increase in conductivity. It is anticipated that 2,000 to 3,000 gallons of water will be recovered from this process for beneficial reuse.

Table 6-28: General Design Criteria for Resin Regeneration Process

Design Criteria	Amount
Regeneration Rate, gpm/ft^3	0.5
Regeneration Bed Volumes	4
Brine Concentration for Regeneration, % NaCl	10-12
Resin Volume in Vessel, cf	600
Brine Flow, gpm	300
Regeneration Duration, min	60
Brine Volume per Regeneration, gal	17,950
Brine Recycle Rate	75%

6.10.2 Major Equipment

Table 6-29: Design Criteria for Brine Transfer Pumps

Design Criteria	Amount
Number of Pumps	2 Total; 1 Trains; 1 shelf
Type of Pump	Mag drive centrifugal
Fluid Pumped	12% NaCl from Brine Recycle Tank to Regen Vessel
Fluid Specific Gravity	1.1
Fluid Salinity, % NaCl	12
Fluid pH range	6-8
Continuous Flow Rate @ 60 Hz, gpm	360
Operating TDH @ 60 Hz, ft	40
Maximum Pump Speed, rpm	1800
Pump runtime per regen, min	60
Minimum Pump Speed, rpm	1350
Inlet / Outlet Diameter, in	4 / 3
Impeller Type	EFTE Enclosed Impeller
Seals	Sealless, mag-drive
Motor Horsepower, HP	7.5
Pump Speed Control	VFD

Table 6-30: Design Criteria for Backwash Remnant Tank

Design Criteria	Amount
Number of Pumps	1 Total; 0 standby
Type/Material of Tank	Fiberglass-Reinforced Plastic
Material Stored in Tank	Recycled Non-Saline, Non-chlorinated Regen Water (0-1 BV)
Capacity of Tank, gal	5,000
Tank Diameter, ft	7
Tank Straight Shell Height, ft	18
Fill Configuration	6” top
Drain Configuration	6” bottom w/ drain feature
Fluid Salinity, % NaCl	<0.07%
Fluid Specific Gravity	1.0

Below is a list of major equipment in this process listed in other sections:

- **Section 6.6** (Backwash / Resin Make-up) – **Table 6-16** (Regen Vessel)
- **Section 6.8** (Saturated Brine Transfer) – **Table 6-24** (Brine Recycle Tank)
- **Section 6.17** (Air Mixing System) – **Table 6-45** (Air mixing system)

6.10.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-31**.

Table 6-31: Spent Brine Regeneration Redundancy

Item	Function	Redundancy in Plant	Spares Required	Rationale
Mag Drive Cent. Pumps	To transfer the 12% NaCl brine to regen vessel for regeneration and Spent Brine Recycle Tank	2 total, 1 duty, 0 standby	1 shelf	Short term (ST) – repair pump; Long term (LT) – install shelf pump
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Pressure on suction/discharge; mag flow meter, level transmitters, cond meters	2 total, 1 train, 0 standby	1 shelf	ST outage – install shelf item; LT outage – replace shelf item
Valves	Butterfly (manual), check, ARV	1 total,1 trains, 0 standby	ARV-Shelf	Butterfly and check valves readily available; ARV is critical to the process
Tanks	20,000-gal dedicated fiberglass Brine Recycle Tank on supply; same tank on discharge	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace tank

6.11 Brine Regeneration / 2nd BV Spent Brine Disposal

The purpose of the spent brine disposal process is to transfer the hazardous waste fraction of the spent brine to the spent brine treatment system where Cr(VI) and other anions are removed from the brine waste stream. Of the 4 bed volumes of 12% brine used to regenerate a 600 cf batch of resin, 3 bed volumes will be recycled without treatment as discussed in Section 5.10 (12% Brine Regeneration / 1st BV Spent Brine Recycle) and Section 5.12 (12% Brine Regeneration / 3rd – 4th BV Spent Brine Recycle); **1** BV will be wasted due to the high concentration of eluted anions. The 1 BV wasted contains elevated concentrations of chromium, selenium, uranium, vanadium, nitrate and sulfate (called "spent brine" in this report) as shown in Figure 6-14. The concentrations of the eluted anions in this 1 BV of spent brine likely will exceed the following regulatory limits and need to be disposed of or treated accordingly:

- California hazardous waste limits measured by soluble threshold limit concentration (STLC) and total threshold limit concentration (TTLC)
- Federal Resource Conservation and Recovery Act (RCRA) hazardous waste limits measured by toxicity characteristic leaching procedure (TCLP)
- Radioactivity measured by uranium and thorium concentrations, categorized as LLRW or TENORM

The 1 BV of spent brine per regeneration will be treated with the use of EC. In addition to traditional Chemical Coagulation (CC), EC was identified (and extensively tested by Hazen on similar spent brine) as a brine treatment technology that offers advantages over CC with fewer chemical deliveries, lower operational requirements, and potentially improved brine quality. In the absence of field testing the

efficacy of EC in treating CWA spent anionic brine, the basis of the EC design parameters used for the RRF are taken from local SBA Cr(VI) Treatment Regeneration Facilities for other Hazen clients.

EC is an alternative to the use of a ferrous chemical.EC uses direct current electricity, sacrificial metal blades and conductive water to drive oxidation reduction reactions. During EC, chemical coagulation reactions occur (without adding metal salts like ferric chloride) by dissolution of the metal blades. Additionally, negative-charged contaminates are magnetically attracted to anode and positive-charged contaminates are magnetically attracted to cathode. EC does not remove NaCl, therefore the NaCl stays in solution. Please refer to **Figure 6-11** below regarding parameters that influence the efficacy of EC in removing contaminates.

Figure 6-11. Removal Efficacy of EC

Photos of a benchtop EC unit are provided in **Figure 6-12**. A full scale EC unit is shown in **Figure 6-13**. Below is a description of the various unit processes that occur during EC that pertain to spent brine treatment at the RRF.

Figure 6-12. Benchtop EC unit with Iron Blades

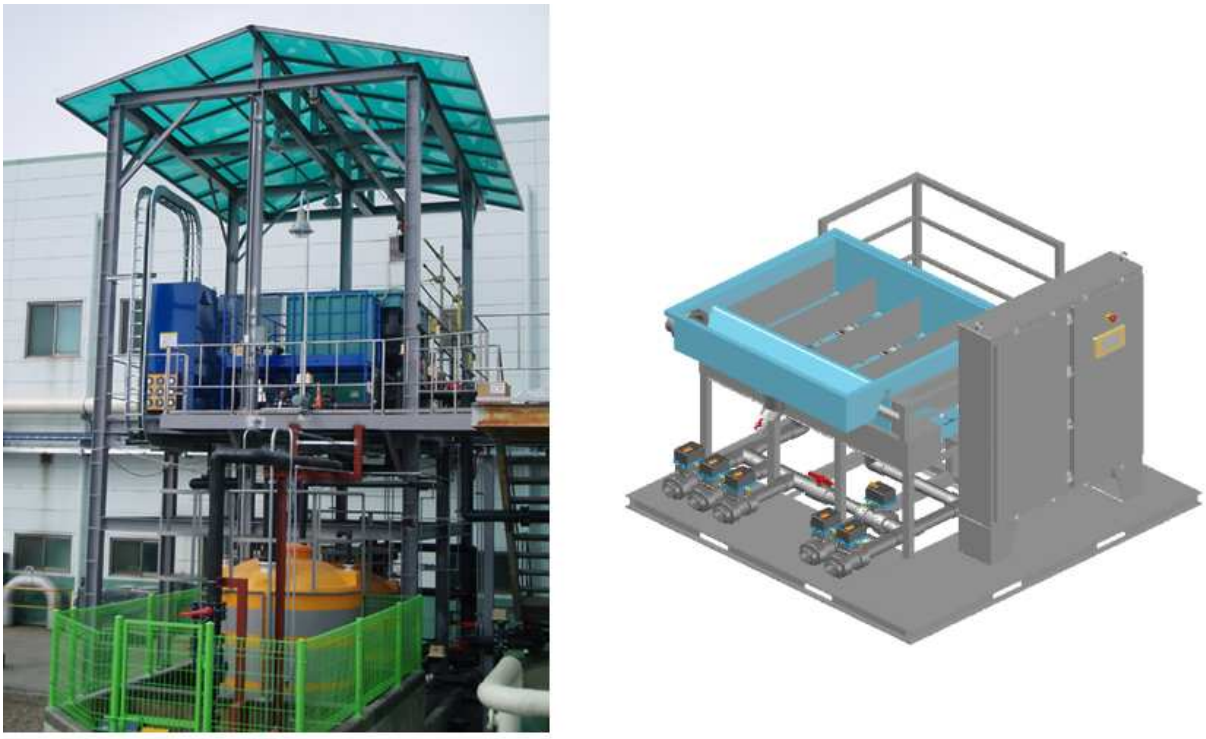


Figure 6-13. Full Scale EC Units

Oxidation reduction reactions occur in the EC process, as in the CC process. For EC, anode oxidation results in release of ferrous ions into the solution and cathode reduction of water forms hydroxide (OH-) ions, which together form complex metal oxides that precipitate. Typically iron blades are used, however

a variety of blade materials are available to target various constituents. Once a direct current is applied to the circuit, the iron anode releases the ferrous ion and oxygen while several simultaneous reactions occur. The oxygen oxidizes the ferrous to ferric ion. The ferric ion then combines with the OH released from the cathode to form a hydrophobic ferric hydroxide floc. Additionally, the ferrous iron is a reductant and converts Cr(VI) to Cr(III). The surface of the cathode can also reduce Cr(VI) to Cr(III), transform water into hydrogen gas and hydroxide, and reduce oxygen to water. Refer to **Figure 6-14** and **Figure 6-15** for a depiction of the EC reactions.

Figure 6-14. Spent Brine Waste

As observed below, hydrogen and chlorine gas can be produced in the EC process under some conditions. In order to prevent this phenomenon from occurring the polarity of the electrodes are reversed at one minute frequencies.

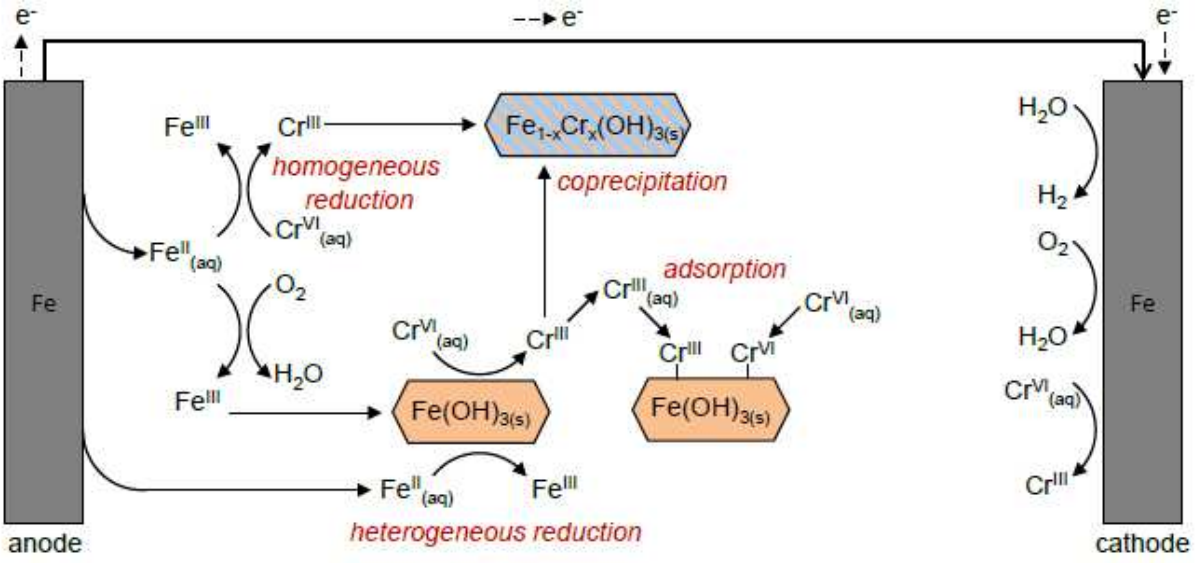


Figure 6-15. EC Reaction Process

(Source: 1.) Washington University Presentation "Contaminant Removal from Water through Oxidation-Reduction and Adsorption of Iron Oxides Generated during Electrocoagulation" March 25, 2015, 249th Annual American Chemistry Society Meeting, Denver CO; 2.) Powell Water Solutions, Inc.)

Iron dissolved by the plates provides coagulant to precipitate chromium 3. The advantage of EC is that no other chemical addition is needed for the brine treatment process, other than the use of 15% Hydrochloric acid to periodically clean the blades. This acid is continually reused in the process until the strength of the acid is diminished as noted by greater than 30 minute soak times to effectively clean the blade down to bare metal as seen by a shiny metal surface once the reaction chamber is drained. The floc can be settled or filtered with traditional equipment. Selenium can be reduced with EC under certain conditions although this testing found it to be more difficult to remove with higher energy intensity and time. The selenium removal mechanism is described in **Figure 6-16**.

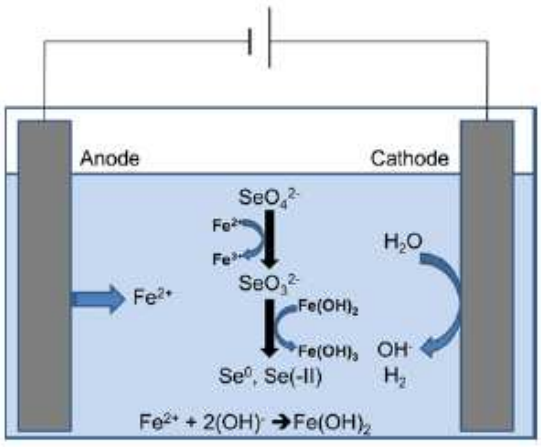


Figure 6-16. Selenium Removal Mechanism

(Source: Chemical Engineering Journal "Electrochemical Removal of Selenate from Aqueous Solutions" May 2, 2012)

In addition, to effectively removing greater than 99% of the Chromium, Uranium and Vanadium in the spent brine, EC also achieved 40% to 70% of the Selenium under extensive iron doses from the anode and longer run times resulting in higher energy intensities (kWh/kgal) and solids content. The only other tangible contaminates left in the treated brine is elevated sulfate and nitrate, at concentrations ranging between 17,000 mg/L – 23,000 mg/L and 400 mg/L – 600 mg/L respectively. These elevated levels of sulfate and nitrate prevent the treated brine from being recycled for subsequent brine regenerations. Per the American Concrete Institute, if the sulfate is not removed to below 150 mg/L prior to sewer discharge, moderate to very severe corrosion will occur in the concrete sewer infrastructure including pipes and manholes. Please refer to **Table 6-32** below for corrosion potential to sulfate concentration.

Table 6-32. Corrosion and Sulfate Concentration

Corrosion Level	Concrete Corrosion Potential
SO_4^{2-} < 150 mg/L	Negligible corrosion
150 mg/L < SO_4^{2-} < 1,500 mg/L	Moderate corrosion
1,500 mg/L < SO_4^{2-} < 10,000 mg/L	Severe corrosion
SO_4^{2-} > 10,000 mg/L	Very severe corrosion

Hazen's previous field testing of EC consisted of evaluating the efficacy of adding calcium chloride to the EC treated brine after the chromium, uranium and vanadium was removed through filtration. Adding calcium chloride to sodium sulfate in a brine solution precipitates calcium sulfate (otherwise known as gypsum – a marketable fertilizer additive for soils with high sodium adsorption ratios) while generating two moles of sodium chloride. This reaction coupled with the EC unit operating at 2 min/L adding iron at 8g/L resulted in 37% nitrate removal, 50% sulfate removal and 63% selenium removal; however, the calcium concentration in the brine increased from less than 100 mg/L to 870 mg/L which would likely foul the resin at such concentrations. There are several more operating parameters that can be optimized with further field testing to address the excess calcium concentrations and achieve further nitrate, sulfate and selenium removal.

Another phenomenon noticed with previous EC testing is the reduction of nitrate to ammonia with longer process times and activation energy. If the nitrate can be reduced to ammonia there may be a potential to generate struvite from the waste brine with the proper molar addition of magnesium and phosphorus to balance the ammonia concentration. Struvite is a white to light tan colored, crystalline substance, consisting of magnesium, ammonium and phosphate in equal molar concentrations (1:1:1), having the chemical formula, $MgNH_4PO_4 \bullet 6H_2O$. The market rate for struvite is between $1,400 - $1,600 per ton; however further field testing would be required to confirm the efficacy of struvite generation with respect to quantity and quality, the amount of magnesium chloride and phosphoric acid required, the amount of electricity required and iron blade consumption.

At the RRF, spent anionic brine disposal options that are being considered include:

1. No treatment of brine, with off-site disposal as a liquid hazardous waste
2. Treatment of brine by 1st Stage EC with LLRW solids disposal likely; liquid disposal of non-hazardous brine off-site or bled to local sewer system after blending with contents of Non-Saline Waste Reclaim Tank.

3. Treatment of brine by 1st Stage EC followed by future 2nd Stage EC with 1) addition of calcium chloride to precipitate gypsum while removing sulfate and selenium 2) addition of magnesium chloride and phosphoric acid to remove ammonia and generate struvite as solids by-product; potential reuse of 2nd stage EC treated brine for subsequent brine regenerations.

Figure 6-17 provides an illustration of the spent brine system. Note: The red return brine line in the Spent Brine Treatment PFD in **Figure 6-17** is for 2nd stage treatment after the concept is extensively tested and approved by DDW, or for re-treating the electro-coagulated spent brine if the treated total chromium is greater than 5 mg/L.

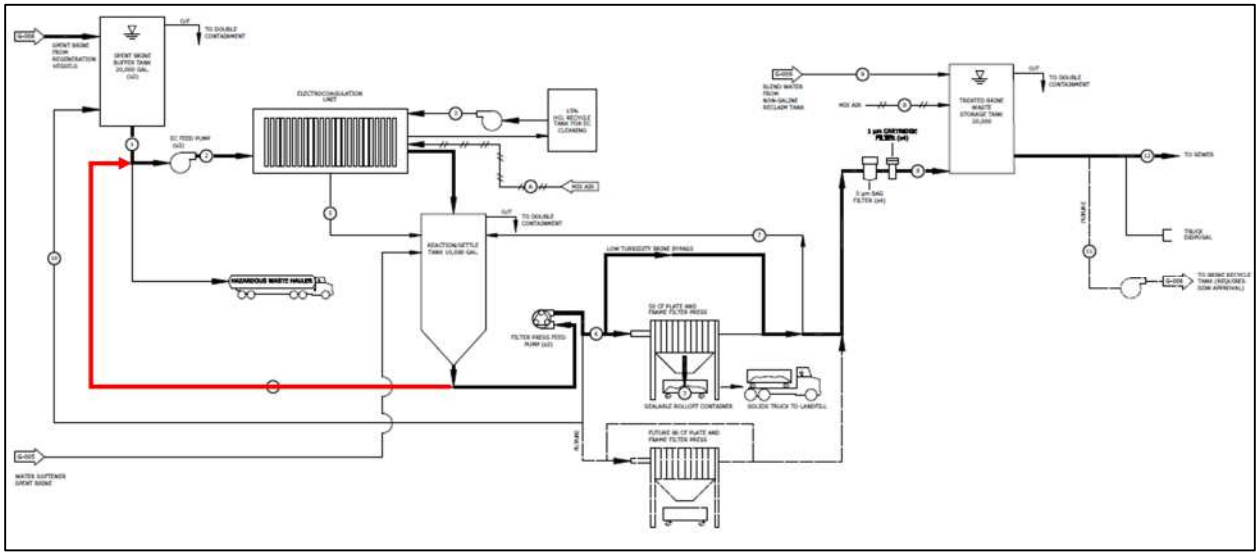


Figure 6-17. Spent Brine Waste Treatment PFD – Electro-coagulation (red lines indicate 2nd Stage EC Treatment)

6.11.1 Process Design Criteria

This section will elaborate on the treatment of the spent brine with 1st Stage EC and the option to perform 2nd Stage EC in the future. The only extra capital required to accommodate the 2nd Stage EC Treatment is the foot print required for the 2nd Stage EC Filter Press, which is approximately 8' x 24'.

The 1st Stage EC Treated Brine Process pumps 4,500 gallons of untreated spent brine at a time from the 20,000 gallon Spent Brine EQ Tank . The EC feed pump is equipped with VFDs and magnetic flow meters so the flow can be paced through the EC chamber to maintain a desired hydraulic retention time, while maintaining a desired current density across the electrodes. The EC chamber resembles a polypropylene tank (open to the atmosphere) with several hundred iron blades submerged below the water surface. The untreated brine enters the bottom of the EC reaction chamber and travels upward in a plug flow pattern in the directions of the air bubbles generated from the anode, while direct current is passed through the chamber. The water overflows the effluent weir and flows by gravity to the Reaction Tank, where floc formation and subsequent settling occurs.

A peristaltic filter press feed pump delivers the electro-coagulated contents of the Reaction Tank to the 1st Stage through the filter press in a closed loop (back into the Reaction Tank) until the press fills with the

chromium and uranium laden iron oxide solids as indicated by an increase in discharge pressure. The contents of the reaction tank will turn from dark brown to clear as the suspended solids are filtered through the press; however, the brine, sulfate, nitrate and selenium will remain in the clear, 1st Stage EC treated brine. This closed loop filtration concept was practiced in the field (**Figure 6-18**) with a 5 micron cartridge filter and a peristaltic filter pump. The electro-coagulated contents went from black to 0.45 NTU turbidity in less than 3 minutes per graphic below at less than 30 psig.

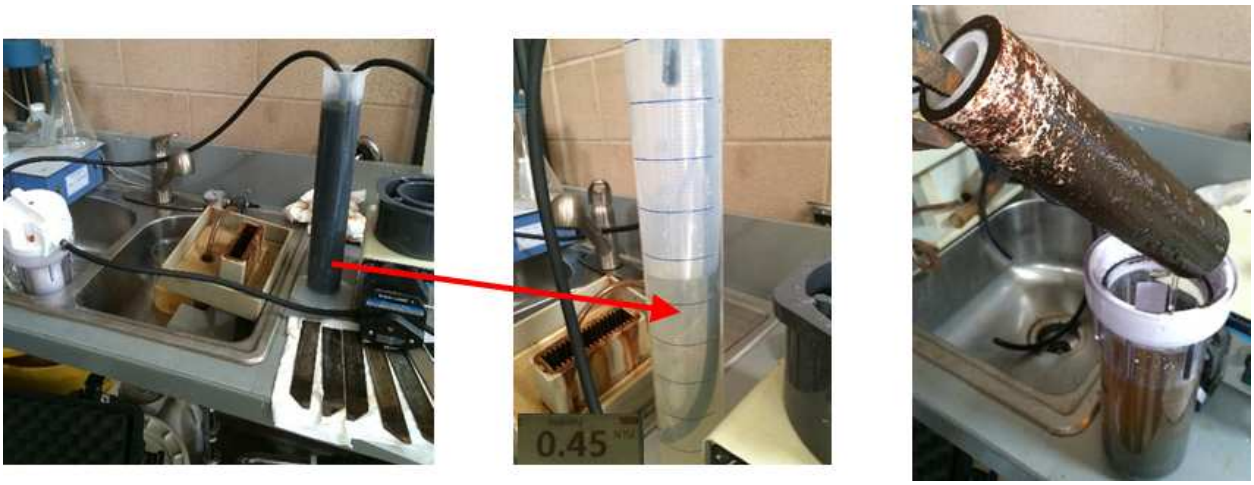


Figure 6-18. Closed Loop Filtration

After the majority of the LLRW solids are removed in the 1st Stage Filter Press (as was experienced in rightmost graphic above), the filter press feed pump drains down the Reaction Tank and bypasses filter press. While emptying the Reaction Tank of the filter pressed, electro-coagulated contents, the solids blow down and removal process can begin. Any pinfloc left in the Reaction Tank will be further removed through the 5 micron, followed by the 1 micron polishing filters before the treated brine enters the Treated Brine Storage Tank. Once the 20,000 gallon Treated Brine Tank is filled with 4,500 gallons of 1st Stage EC Treated Brine, 14,000 gallons of the Non-saline Process Reclaim Water is pumped into the tank to dilute the salinity, sulfate, nitrate and selenium to within acceptable concentrations. The air mixing system is used to homogeneously mix the contents of the Treated Brine Tank prior to being bled to the local sewer collection system for ultimate disposal.

The 1st Stage EC design parameters (**Table 6-33**) shall be maintained in the RRF Spent Brine Treatment Process.

Table 6-33. General Design Criteria for Resin Regeneration Process

Design Criteria	Amount
Batch Treatment Volume, gal/regen	4,500
Required Time to Treat for 1st Stage, hrs	1.11
Process Flow Rate, gpm	68
Current Density, amps/ft2	0.75
Volts per gap between blades, V/gap	0.5
Blade Spacing, in	1/8
Blade Surface Area : Flow Ratio, in2/gpm	5.720
Design Blade Surface Area, in2	386,680
3 Phase Power, V DC	324
Correlating Fe Dose, g/L	8
Process Air Requirement, cfm	3
Current : Flow Rate Ratio, amps/gpm	4,820
Energy Intensity, kWh/kgal	25
Blade Consumption, #/kgal	70
Chromium Removal Efficacy @ Raw Conc, % @ mg/L	99% @ 210
Selenium Removal Efficacy @ Raw Conc, % @ mg/L	30% @ 1.8
Uranium Removal Efficacy @ Raw Conc, % @ mg/L	99% @ 150
TDS Removal Efficacy @ Raw Conc, % @ mg/L	0% @ 140
Salinity Removal Efficacy @ Raw Conc, % @ mg/L	0% @ 10-12%
pH	7-12

6.11.2 Major Equipment

The redundancy for the major process equipment is summarized in **Table 6-34**.

Table 6-34. Spent Brine Treatment - Electrocoagulation

Item	Function	Redund. In Plant	Spares Required	Rationale
Pumps	Used to flow pace spent brine at a desired flow rate to EC Reaction Tank	2 total; 1 duty	1 shelf	ST outage – use manual bypass; LT – install shelf item
EC Equipment	Spent brine treatment	1 total, 1 duty, 0 standby	None	Store spent brine in Spent Brine EQ Tanks
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Psi on suction/discharge; mag flow meter, level transmitters, cond meters	2 total, 1 trains, 0 standby	1 shelf	ST outage – install shelf item; LT outage – replace shelf item
Valves	Butterfly (manual), pinch (auto) check, ARV	1 total, 1 trains, 0 standby	None	Readily available
Tanks	10,000 gal Reaction Tank; 20,000-gal Spent Brine EQ	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace

6.12 Brine Regeneration / 3rd – 4th BV Spent Regeneration Recycle

This section focuses on how the 3rd and 4th BV (8,980 gallons) of 12% NaCl brine leaving the bottom of the regeneration vessel is recycled within the RRF without treatment. **Figure 6-19** provides an overview of the process.

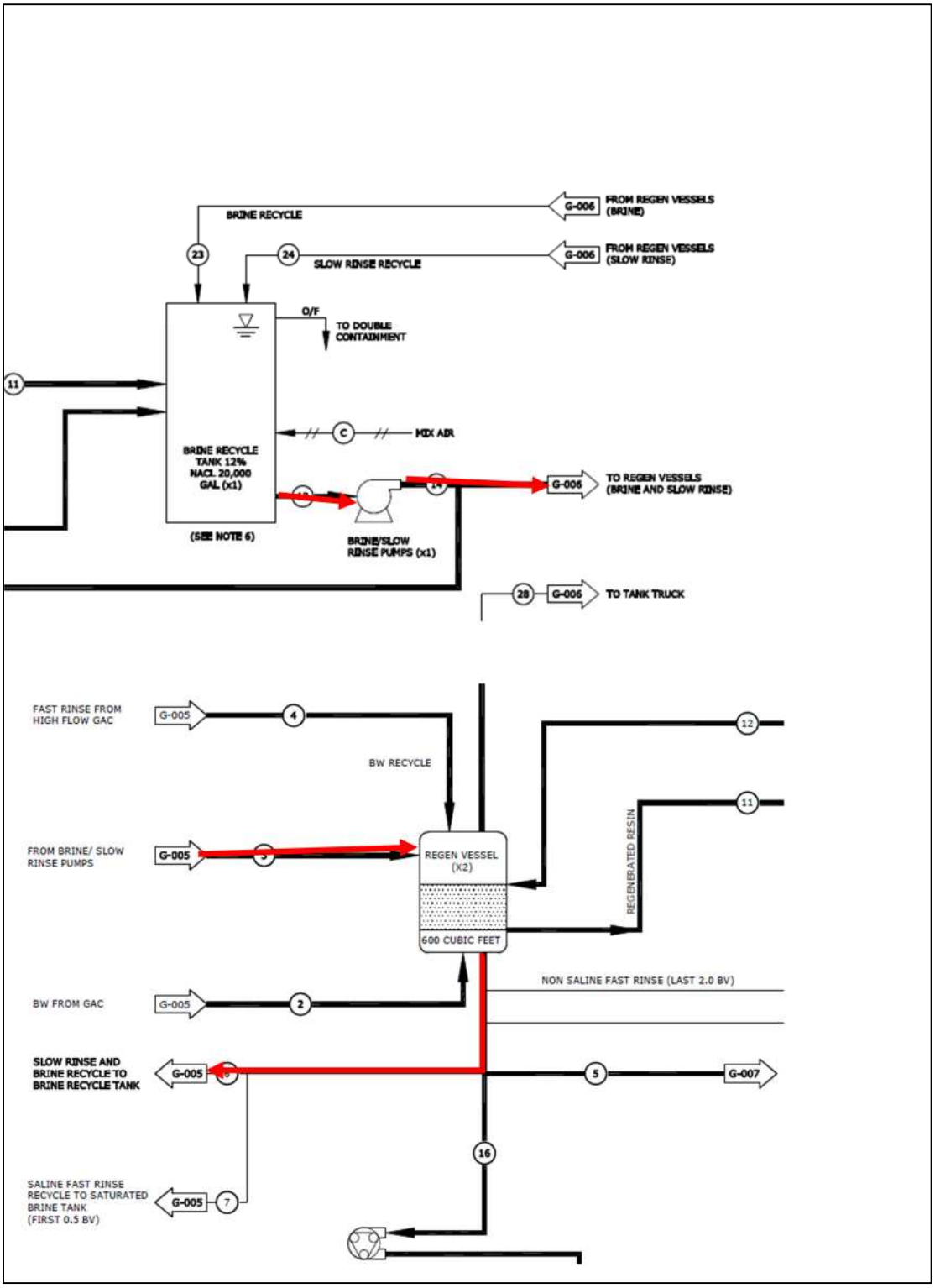


Figure 6-19. Brine Regeneration, 3rd and 4th BV PFD

6.12.1 Process Design Criteria

The 12% NaCl regeneration continues past the 2nd BV where the Cr(VI) and other constituents of concern are eluted off the resin for an effective regeneration. Constituents of concern may be elevated in this remaining portion of brine; however extensive pilot testing on similar water quality with the same Purolite A600 SBA resin have shown an insignificant impact in the overall recycle and regeneration process. The use of magnetic flow meters and conductivity meters on the outlet side of regeneration vessels will be used to determine when the waste peak (2nd BV) has passed through the regeneration vessel, so the spent brine (containing 12% NaCl) can be recycled directly back to the Brine Recycle Tank for subsequent reuse. No treatment is required for this 3rd and 4th BV of recycled brine.

There are several items designed into the regeneration vessel configuration that allow for improved regeneration efficiency with respect to time, salt consumption and waste generation. They are as follows:

1. Recycle – The conductivity meter and the flow totalizer on the outlet of the regeneration vessels will trigger the end of the waste peak (to spent brine). For example, once the 4,488 gallons of spent brine passes the effluent flow meter while conductivity meter indicates 12% NaCl concentration, the process will then open the Brine Recycle Tank valves on the regeneration vessel outlet manifold while closing the Spent Brine Treatment EQ valves. It is anticipated that 8,980 gallons of 12% NaCl will be recycled back to the Brine Recycle Tank under this mode of operation. No treatment is required for this volume of recycled brine. Refer to the graphs below depicting the flow partitioning volumes for the regeneration process; the volume in the red box is the spent brine to treatment and the volume in the green box is the volume that will be directly recycled back to the Brine Recycle Tank.

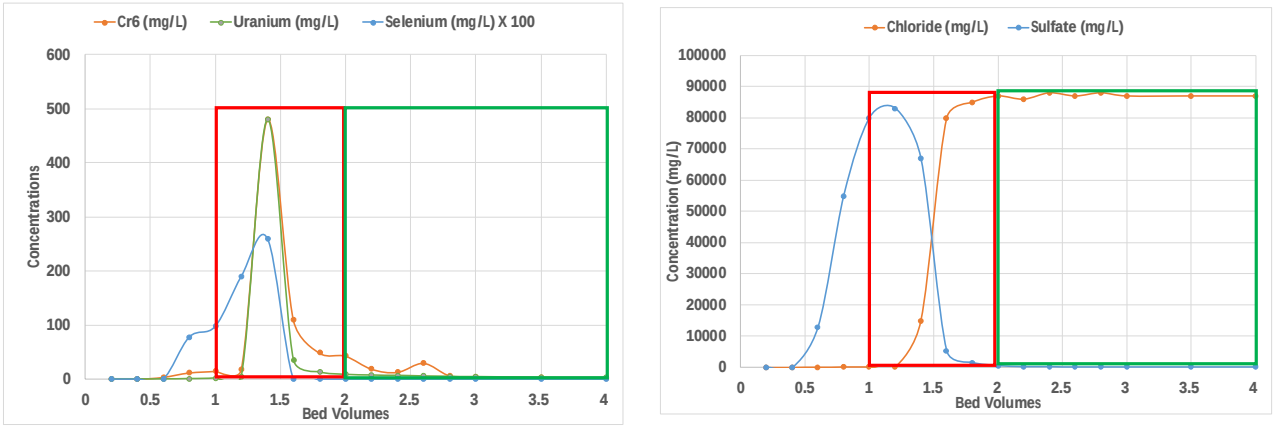


Figure 6-20. Flow Partitioning Volumes for Regeneration

Table 6-35: General Design Criteria for Resin Regeneration Process

Design Criteria	Amount
Regeneration Rate, gpm/ft^3	0.5
Regeneration Bed Volumes	4
Brine Concentration for Regeneration, % NaCl	10-12
Resin Volume in Vessel, cf	600
Brine Flow, gpm	300
Regeneration Duration, min	60
Brine Volume per Regeneration, gal	17,950
Brine Recycle Rate	75%

6.12.2 Major Equipment

Below is a list of major equipment in this process listed in other sections:

- **Section 6.6** (Backwash/Resin Make-up) –**Table 6-16** (Regen Vessel)
- **Section 6.8** (Saturated Brine Transfer) – **Table 6-24** (Brine Recycle Tank)
- **Section 6.10** (1st BV Backwash Remnant Recycle) – **Table 6-30** (Backwash Remnant Tank)
- **Section 6.17** (Air Mixing System) – **Table 6-45** (Air mixing system)

6.12.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-31** in **Section 6.8** (Saturated Brine Transfer).

6.13 Slow Rinse / Slow Rinse Recycle

The purpose of the slow rinse is to provide the initial flush of the remaining salt from the regeneration vessel from 12% NaCl to approximately 3% NaCl concentration, so that it can eventually go back into service without adding highly saline water to the distribution system. A schematic of the process is included in **Figure 6-21**.

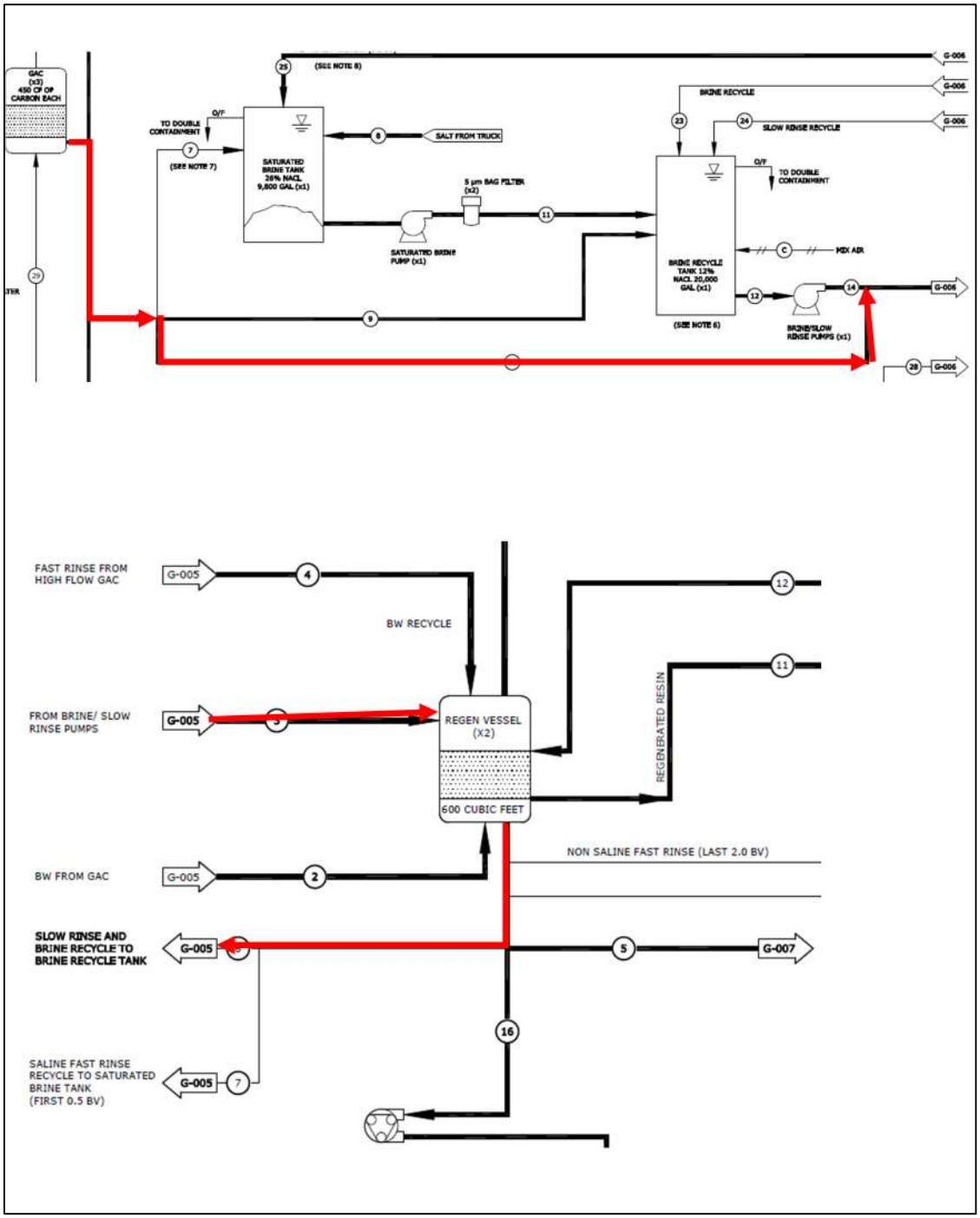


Figure 6-21.Slow Rinse / Slow Rinse Recycle Process Flow Diagram

6.13.1 Process Design Criteria

The slow rinse will utilize the same brine pump discharge line and flow dispersion laterals (in the regeneration vessel) to slowly introduce non-saline, de-chlorinated distribution system water co-currently over the resin bed for 1 BV (4,488 gallons). The 1 BV of spent brine displaced by the slow rinse contains the 12% NaCl, but insignificant concentrations of chromium, uranium, selenium, etc., so it can be recycled directly back to the Brine Recycle Tank without any additional treatment. Utilizing the brine pump discharge line for the slow rinse from the distribution system will provide savings in capital and allow a regular flush of the brine pump discharge line. **Table 6-36** summarizes the design criteria of the slow rinse process.

Table 6-36: Slow Rinse Design Criteria

Design Criteria	Amount
Slow Rinse, gpm/ft^3	0.5
Slow Rinse Flow, gpm	300
Slow Rinse Bed Volumes	1
Duration, min	15
Slow Rinse Waste Volume per regen, gal	4,488

A conductivity meter will be used to monitor the salt concentration, or conductivity, leaving the bottom drain of the regeneration vessel. The online meter can be used to indicate when the salt concentration leaving the bottom drain has dropped to a level between 2-3% NaCl. At this point the Slow Rinse process can stop and the Fast Rinse process can begin. Continuing the slow rinse past the 2-3% NaCl concentration would dilute the strength of the brine in the Brine Recycle Tank and possibly result in less effective regenerations of other process variables were not adjusted.

6.13.2 Major Equipment

Major equipment associated with the Slow Rinse process includes the Brine Recycle Tank and the Flow Control Valves. Softened, de-chlorinated water is provided from the water softeners and GAC units directly to the regeneration vessels via the flow control valves. **Table 6-37** describes the design criteria for slow rinse recycle.

Table 6-37: Design Criteria for Slow Rinse Recycle

Design Criteria	Amount
Number of Flow Control Valves	2 Total; 1 Duty; 1 Shelf
Is FCV Automated?	Yes
Type of Automation	solenoid
Support Instrumentation	Magnetic flow meter
Flow Range, gpm	200-400
Diameter, in	4
Pressure Rating, psi	150
Material of Construction	Ductile iron
Min Differential Pressure Requirement, psi	15
Pilot Water Quality	Non-saline, softened and de-chlorinated
Fluid	Distribution system water
Fluid Salinity, % NaCl	Non-saline, softened and de-chlorinated entering regen vessel; saline @12% to 3% exiting vessel
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Desired Free Cl_2 Residual, mg/L	0
Fill time per regen, min	<15

Note: FCV does not need to be rated for high saline application here because it will be placed on the inlet of the regen vessel prior to being exposed to high saline slow rinse effluent exiting regeneration vessel

6.13.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-38**.

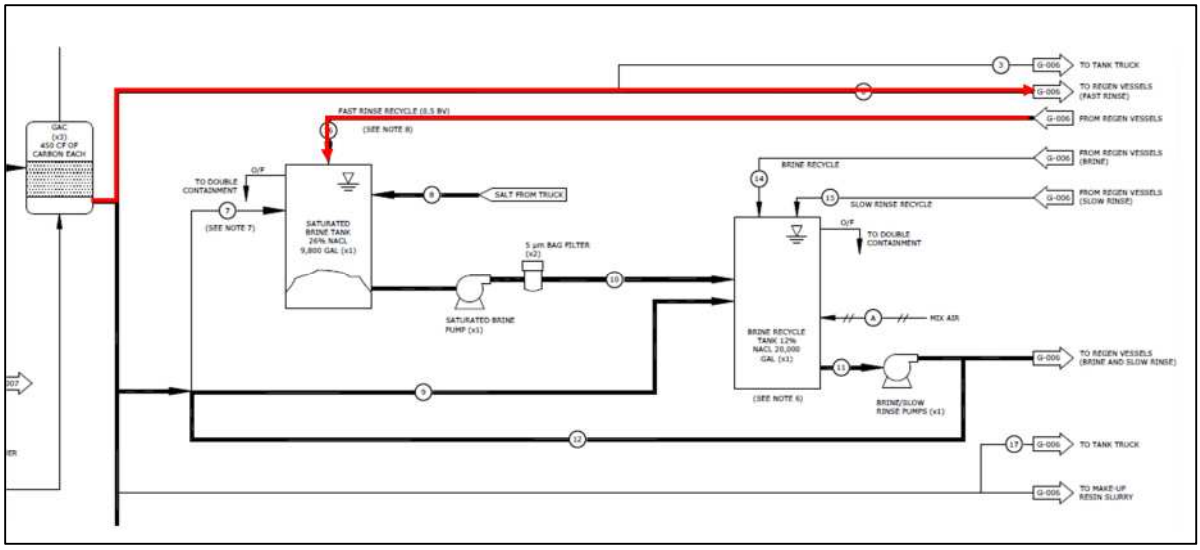
Table 6-38: Slow Rinse / Slow Rinse Recycle Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
FCV	Used to flow pace desired flow rate and duration required for SR / SRR from softened, de-chlorinated and non-saline distribution system water	2 total; 1 duty	1 shelf	Short term (ST) outage – use manual bypass; Long term (LT) – install shelf item
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Psi on suction/discharge; mag flow meter, level transmitters, cond meters	2 total, 1 trains, 0 standby	1 shelf	ST outage – install shelf item; LT outage – replace shelf item
Valves	Butterfly (manual), check, ARV	1 total, 1 trains, 0 standby	None	Readily available
Tanks	20,000-gal Brine Recycle Tank on effluent of regeneration vessel	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace

6.14 Fast Rinse / Fast Rinse Recycle

The Fast Rinse process utilizes 2.5 BV of water to rinse the 600 cubic foot of resin and reduce the salinity from 3% NaCl to less than 1% NaCl. The process will recover and re-purpose the rinse water. The first 0.5 BV of spent fast rinse water will not have any contaminants (or chlorine) other than the 3% - 1% NaCl and it can be sent to Saturated Brine Tank for make-up water. Utilizing this clean, saline water as saturated brine make-up will help improve the salt and water efficiency of the RRF.

The remaining 2.0 BV of fast rinse water will have minimal salt and can be sent to the Non-Saline Waste Reclaim Tank for beneficial reuse if spent brine treatment is incorporated or slowly bled to the local sewer system if the spent brine treatment is not incorporated in the design. Schematics of the Fast Rinse / Fast Rinse Recycle are shown in **Figure 6-22** and **Figure 6-23.**



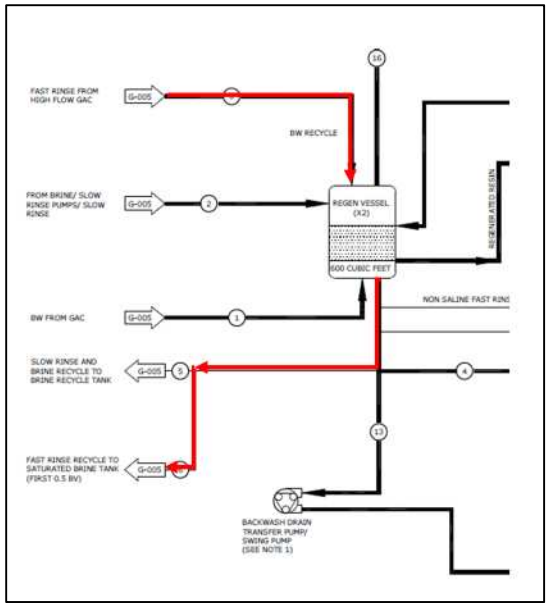


Figure 6-22. Fast Rinse PFD, 1st 0.5 BV Recycle to Saturated Brine Tank Make-up Water

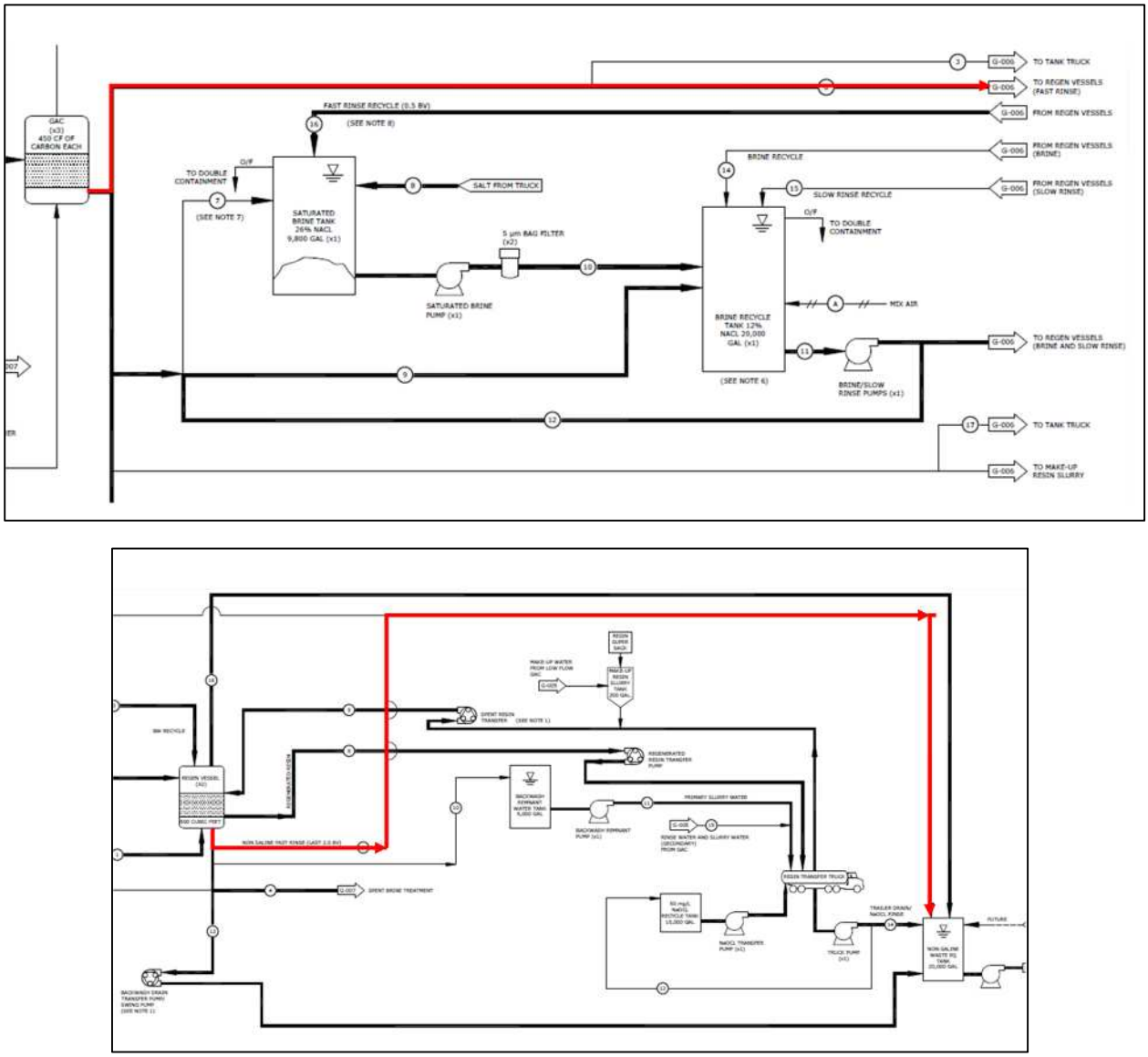


Figure 6-23. Fast Rinse PFD, 2nd 2 BV Recycle to Non-Saline Process Water Reclaim Tank

6.14.1 Process Design Criteria

Prior to the Fast Rinse, the air bubble utilized in the 300 gpm regeneration and slow rinse will be purged by opening the combination air valve isolation valve. The combination air valve will automatically seat under positive pressure in the regeneration vessel and the automated isolation valve just upstream of this valve will remain open for the duration of the regeneration process until a subsequent backwash is initiated on another 600 cf of spent resin. The Fast Rinse will utilize softened, de-chlorinated, non-saline distribution system water co-currently over the resin bed for 2.5 BV (11,220 gallons) with the use of the same type of automated flow control valve used for the backwash, slow rinse and other support processes

requiring flow paced distribution system water. Fast rinse water will be introduced into the top dispersion lateral as opposed to the brine/slow rinse dispersion lateral located just above the settled resin bed.

A separate set of flow dispersion laterals are designed to evenly disperse the higher flow rate for the fast rinse process and still maintain plug flow, while ensuring the entire contents of the vessel is rinsed of brine. The flow dispersion laterals entering the side of the vessel for the regeneration and slow rinse flow would not be able to accommodate the higher velocity associated with the fast rinse, which would result in excessive headloss and short-circuiting. The design criteria for the process is presented in **Table 6-39**.

Table 6-39: Fast Rinse Design Criteria

Design Criteria	Amount
Fast Rinse Flow, gpm/cf	2.2
Fast Rinse Flow, gpm	1357
Hydraulic Loading, gpm/sf	12
Fast Rinse BV	2.5
Duration, min	10
Fast Rinse Recycle Volume	11,220
Number of Flow Control Valves	2 Total; 1 Trains; 1 Shelf
Is FCV Automated?	Yes
Type of Automation	solenoid
Support Instrumentation	Magnetic flow meter
Flow Range, gpm	1,300-1,500
Diameter, in	8
Pressure Rating, psi	150
Material of Construction	Ductile iron
Min Differential Pressure Requirement, psi	15
Pilot Water Quality	Non-saline, softened and de-chlorinated
Fluid	Distribution system water
Fluid Salinity, % NaCl	Non-saline, softened and de-chlorinated entering regen vessel; 3% - 0.7% NaCl exiting vessel
Fluid pH range	6-8
Fluid Specific Gravity	1.0
Desired Free Cl_2 Residual, mg/L	0
Fill time per regen, min	<15

Note: FCV does not need to be rated for high saline application here because it will be placed on the inlet of the regen vessel prior to being exposed to high saline fast rinse effluent exiting regeneration vessel

An online conductivity meter will be used to track the salt concentration, or conductivity, leaving the bottom drain of the regeneration vessel. At a concentration of 1-3% (first BV of fast rinse), flow will be diverted to the saturated brine tank for make-up water. At less than 0.7% NaCl, flow is sent to the Non-Saline Waste Reclaim Tank for beneficial reuse as blending water if spent brine treatment is incorporated Note: A 60 mesh (250 micron) strainer is included on the common line existing the regeneration vessel

bottom to ensure no media loss is occurring through the underdrain in the regen vessels. An increase in pressure differential across this strainer indicates that an underdrain lateral has failed and requires maintenance. The other regeneration vessel can be used in this event.

6.14.2 Major Equipment

Below is a list of major equipment in this process listed in other sections of the memorandum:

- **Section 6.4.1** (Initial System Charge)

6.14.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-40**.

Table 6-40: Fast Rinse / Fast Rinse Recycle Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
FCV	Used to flow pace desired flow rate and duration required for FR / FRR from softened, de-chlorinated and non-saline distribution system water	2 total; 1 duty	1 shelf	Short term (ST) outage – use manual bypass; Long term (LT) – install shelf item
Piping	PVC	1 total, 1 trains, 0 standby	None	Readily available
Inst.	Psi on suction/discharge; mag flow meter, level transmitters, cond meters	2 total, 1 trains, 0 standby	1 shelf	ST outage – install shelf item; LT outage – replace shelf item
Valves	Butterfly (manual), check, ARV	1 total, 1 trains, 0 standby	None	Readily available
Tanks	20,000-gal Non-Saline Waste Reclaim Tank on effluent of regeneration vessel	1 total, 1 trains, 0 standby	None	ST outage – repair tank; LT outage – replace

6.15 Regenerated Resin Transfer

The regenerated resin will be returned to the transfer truck from the regeneration vessel in a non-abrasive manner, to minimize attrition of the resin and fines in the 600 cubic foot bed. Fines in the resin bed will result in excessive headloss through the treatment vessels at the well site. An overview of this process is shown in **Figure 6-24**.

6.15.1 Process Design Criteria

When regenerated resin is ready for transfer, the contents of the regeneration vessel (resin slurry and water in the headspace) will be drained out with the regenerated resin peristaltic pump to the tanker truck. Since there will be approximately 2,000 gallons of remaining fast rinse water in the regen vessel the tanker truck transfer pumps will pump the water out of the bottom of the truck at the same flow rate of the regenerated resin transfer pump is delivering the resin slurry (176 gpm), because the truck is designed to

transport dry resin only. This water will be stored in the Non-Saline Waste Reclaim Tank if spent brine treatment is implemented or sent directly to the sewer if treatment is not implemented. A t-strainer at the bottom of the truck load port will keep the media in place and prevent resin loss while the water drains. The transfer and recycle process will take approximately 30 minutes.

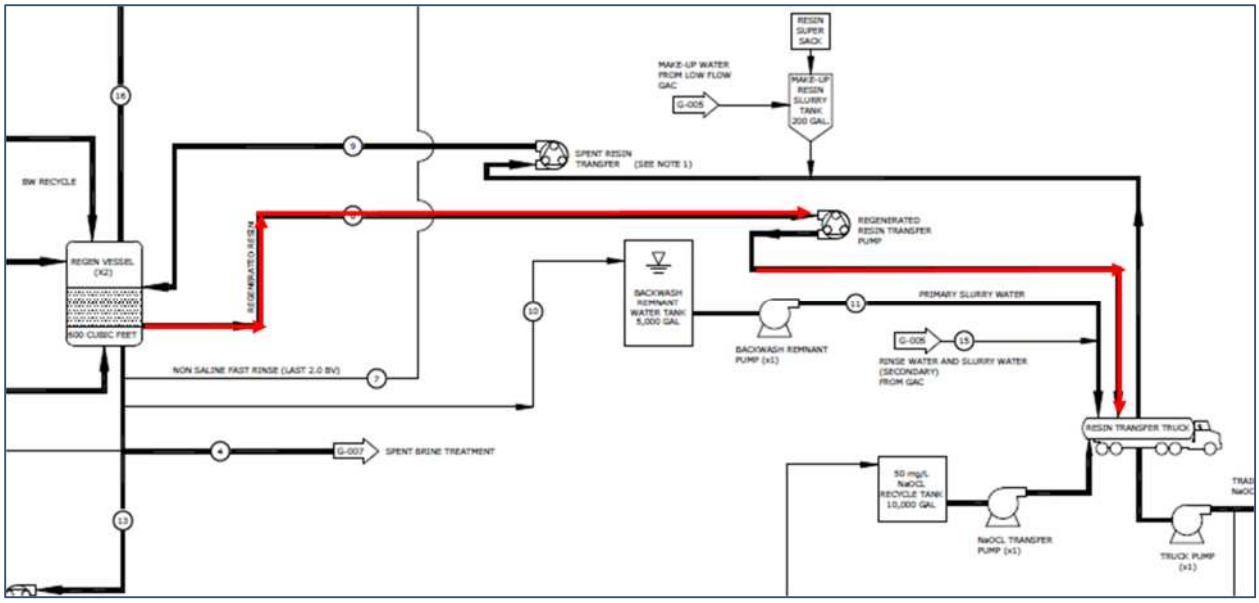


Figure 6-24. Regenerated Resin Transfer PFD

Table 6-41 summarizes the design criteria of the regenerated resin transfer process components.

Table 6-41: Design Criteria for Regenerated Resin Transfer

Design Criteria	Amount
Volume of resin to be transferred, cf	600
Time to transfer resin, min	< 30 min
Fluid Pumped	Resin slurry
Flow Rate, gpm	176
Fluid Salinity, % NaCl	0
Fluid pH range	6-8
Non-abrasive transfer methods	Peristaltic pump
Bead size, µm	425-620
Volume slurry water, gal	2000
Continuous Flow Rate @ 60 Hz, gpm	200
Operating TDH @ 60 Hz, ft	40
Maximum Pump Speed, rpm	1800
Pump runtime per regen, min	30
Minimum Pump Speed, rpm	1350
Inlet / Outlet Diameter, in	4 / 3
Impeller Type	EFTE Enclosed Impeller
Seals	Sealless, mag-drive
Motor Horsepower, HP	5
Pump Speed Control	VFD
Transfer Time, min	5
Media Retention	“T” Strainer 100 um

6.15.2 Major Equipment

Table 6-42 summarizes design criteria for the regenerated resin transfer pumps.

Table 6-42: Design Criteria for Regenerated Resin Transfer Pumps

Design Criteria	Amount
Type of Pump	Peristaltic Hose Pump
Shoes or Rollers	Roller
Fluid Pumped	Resin Slurry
Continuous Flow Rate, gpm	176
Maximum Discharge Pressure, psi	110
Maximum Pump Speed, rpm	57
Hose Inner Diameter, in	3.0
Hose Material	Natural Rubber
Motor Horsepower, HP	30
Pump Speed Control	VFD

Below is a list of major equipment in this process listed in other sections:

- **Section 6.4.2** (Spent Resin Transfer) – **Table 6-8** through **Table 6-10** outline design criteria for major equipment.

6.15.3 Major Equipment Redundancy

The redundancy for the major process equipment is summarized in **Table 6-43**. Key equipment is provided with N+1 redundancy.

Table 6-43: Regenerated Resin Transfer Redundancy

Item	Function	Redund. In Plant	Spares Required	Rationale
Peristaltic Pumps (VFD) + Truck Mounted Cent. Pump	Regenerated resin transfer (peristaltic pumps, PP); resin slurry water drain to recycle (centrifugal pumps)	2 total, 1 trains, 0 standby	1 shelf + 2 spare hoses (PP); 1 shelf cent. pump	Short term (ST) outage – use swing pump; Long term (LT) – install shelf pump; hoses will fail before pumps
Piping	Smooth, low resistance conduit with sweeping fittings to promote efficient resin slurry transfer	2 total, 1 trains, 0 standby	none	Readily available
Tubing	Smooth, low resistance, low psi hose with non-pinching characteristic to promote efficient resin slurry transfer	2 total, 1 trains, 0 standby	none	Readily available
Inst.	Pressure gauges and transmitters on suction/discharge; peristaltic internal control for flow rate and totalization	2 total, 1 trains, 0 standby	none	Readily available
Filter/Y-strainer	250 µm y strainer placed on drain pump suction to keep regen resin in truck and not in Feedwater Tank	2 total, 1 trains, 0 standby	1 shelf	ST outage – use other train; LT – install shelf pump
Valves	Pinch valves will allow non-abrasive closure and longevity; all are manual	2 total, 1 trains, 0 standby	1 shelf + 2 spare liners	May have a longer lead time for valve; liner will fail before valve
Tanks	Tank truck serves as suction supply; Non-Saline Discharge Tank on discharge	-	1 common regen vessel	1 tanker truck can be loaded at a time

A dedicated regenerated resin transfer pump is needed so the spent resin could never be mixed with the regenerated resin pumps. Since the main mechanical component of this train most likely to fail would be the pumps, a shelf redundant pump can be used to replace the pump taken out of service for maintenance in either train. At least two hoses dedicated to regenerated transfer should be kept on the shelf at all times.

6.16 Chemical Storage and Feed Facilities

Chemical storage and feed facilities will be provided for the RRF for disinfection of resin transfer tank trucks.

6.16.1 Disinfection of Resin Tank Trucks

After resin is delivered to the RRF, the resin tank on the truck will require disinfection as described in **Section 6.5** (Resin Tank Truck Disinfection). Sodium hypochlorite storage and feed requirements are identified in **Table 6-13**.

6.17 Air Mixing Systems

Mixing will be required in the following process tanks at the RRF:

- The one (1) 20,000-gallon brine recycle tanks

Mixing will be achieved in these tanks using an air mixing system. Air compressors will provide pulses of air to multiple accumulator plates installed in the bottom of the tanks. The air will accumulate beneath each plate and eventually be released as one large bubble which will rise through the tank contents to provide mixing. The air mixing system will be provided with a control station, accumulator plates, air line filters and regulators, and air injection valves. Design criteria for the air compressors and air mixing systems are given in **Table 6-44** and **Table 6-45**, respectively.

Table 6-44: Design Criteria for Air Compressors

Design Criteria	Amount
Number of Air Compressors	1 Total; one duty
Discharge Pressure, psi	120
Minimum Capacity, acfm	80
Motor Horsepower, HP	20
Number of Air Dryers	1 Total; one duty
Inlet Pressure, psi	125
Design Inlet Temperature, °F	120
Dew Point, °F	35-39
Capacity, cfm	80
Number of Air Receivers	One (1)
Design Pressure, psig	200
Nominal Volume, gallons	200

Table 6-45: Design Criteria for Air Mixing Systems

Design Criteria	Brine Recycle Tanks
Number of Control Stations	1
Injection Valves per Tank	2
Accumulator Plates per Tank	7

7. Structural and Geotechnical Design

The basis of the structural design used for the various structures comprising the SBA and RRF are presented in this section, including the governing codes and standards, the applicable design loads, and the design requirements of all construction materials.

Structural design for new construction at the Strong Base Anion Exchange Treatment Sites and Central Resin Regeneration Facility will be performed in accordance with the requirements of the California Building Code, California Code of Regulations, Title 24 (CBC). Standards from the American Concrete Institute (ACI) and the American Institute of Steel Construction (AISC) will also be used as applicable for both building structures and process structures. Loading conditions will be based on the worst operating scenario to design for static conditions. Above grade structures will also be designed conservatively in keeping with the essential nature of the facility.

A geotechnical investigation will be performed during the detailed design phase to determine design parameters and foundation requirements for structure design. If confirmed by the geotechnical investigation, foundation requirements will consist of reinforced concrete mat foundations for building structures and equipment supported on grade, with deeper structures/elements designed to resist buoyant forces from elevated groundwater conditions. The geotechnical investigation will also address issues including impact of groundwater on design and construction, excavation support and backfill recommendations, potential soil corrosivity, potential for soil liquefaction, and consideration of means for resisting buoyant forces due to any elevated groundwater conditions.

7.1 Codes, Standards, References

7.1.1 Governing Code

The strength, serviceability, and quality standards will not be less than stipulations required by the governing code. The governing code used for the proposed design is the 2013 California Building Code.

Materials and construction will be designed in accordance with the California Building Code, and other codes as presented within this report. The California Building Code consists of the 2012 International Building Code as adopted and amended by the State of California.

7.1.2 Supplemental Design Codes

Selected provisions from the following codes may also be used for the project.

- ASCE 7 – Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers
- AISC – Manual of Steel Design, 14th Edition, American Institute of Steel Construction
- ACI 350.4 – Design Considerations for Environmental Engineering Concrete Structures, latest edition, American Concrete Institute

7.1.3 Codes and Standards for Specific Materials

Design of specific materials will be performed in accordance with the standards, codes, and specifications adopted by the governing code as listed below.

7.1.3.1 All Materials

The American Society for Testing and Materials (ASTM) standards, as referenced by the governing code or the other codes, standards, or specifications listed herein.

7.1.3.2 Concrete

- ACI 318 – Building Code Requirements for Structural Concrete, Latest Edition, American Concrete Institute.
- ACI 301 – Specifications for Structural Concrete, Latest Edition, American Concrete Institute.
- ACI 350 – Code Requirements for Environmental Engineering Structures and Commentary, Latest Edition, American Concrete Institute.

7.1.3.3 Masonry

- ACI 530/530.1 – Building Code Requirements and Specification for Masonry Structures, Latest Edition, American Concrete Institute.

7.1.3.4 Steel

- AISC 360 – Specification for Structural Steel Buildings, Latest Edition, American Institute of Steel Construction.
- AISC 303 – Code of Standard Practice for Steel Buildings and Bridges, Latest Edition, American Institute of Steel Construction.
- AISC 341 – Seismic Provisions, Latest Edition, American Institute of Steel Construction.
- AISC 348 –Specification for Structural Joints Using High Strength Bolts, Latest Edition, American Institute of Steel Construction.
- AWS D1.1 – Structural Welding Code - Steel, Latest Edition, American Welding Society.

7.1.3.5 Stainless Steel

- ASCE 8 – Specifications for the Design of Cold-Formed Stainless Steel Structural Members, Latest Edition, American Society of Civil Engineers.
- AWS D1.6 – Structural Welding Code – Stainless Steel, Latest Edition, American Welding Society.

7.1.3.6 Aluminum

- Aluminum Design Manual, Latest Version, Aluminum Association.

- AWS D1.2 – Structural Welding Code - Aluminum, Latest Version, American Welding Society.

7.1.3.7 Fiberglass Reinforced Plastic (FRP)

There are no nationally recognized codes, standards, or specifications for the design of FRP. The following proprietary design manual is provided for reference: Extren Fiberglass Structural Shapes-Design Manual, Strongwell, Inc., Latest Version.

7.2 Design Loads

7.2.1 Dead Loads

Dead loads are those resulting from the weight of all permanent non-removable stationary construction, such as walls, floors, roofs, permanent partitions, framing, ceilings, cladding, and equipment bases. Loads from process liquids within the structure and from soil and groundwater outside the structure will not be considered as dead loads. Dead loads will be in accordance with the governing code and as shown in **Table 7-1**.

Table 7-1: Dead Loads

Parameter	Unit	Load
Concrete	pcf	150
Steel and Stainless Steel	pcf	490
Aluminum	pcf	169
Fiberglass reinforced plastic (FRP)	pcf	120
Masonry, CMU, 8” Medium Weight	psf	78 (grouted solid) 55 (grouted at 32” oc) 36 (hollow)
Masonry, CMU, 12” Medium Weight	psf	124 (grouted solid) 80 (grouted at 32” oc) 53 (hollow)
Wood	pcf	30 to 40
Select Fill	pcf	130
Aggregate Base	pcf	135

7.2.2 Live Loads

Live loads technically include all nonpermanent loadings that can occur, in addition to the dead loads. Live loads are those resulting from occupancy, furnishings, and equipment. Live loads will be used in accordance with the governing code, unless a larger value is listed in **Table 7-2**.

Table 7-2: Live Loads

Parameter	Unit	Load
Working roofs	psf	100
Non-working roof loads	psf	As per code, including wind
Office floors	psf	80
Corridors and stairways (process areas)	psf	150
Pipe supports	psf	25 to 100
Electrical control rooms	psf	250
Light storage	psf	150
Heavy storage	psf	300
Grated access platforms and walkways	psf	150
Catwalks	psf	100
Pipe loads	psf	Design for actual live loads for pipes > 16" diameter Where beams may support pipes ≤16" diameter, add 1000 pounds at midspan
Truck accessible areas	-	HL-93 loading per AASHTO
Liquid chemicals	pcf	Per specified specific gravity
Liquid loads (all unless specified otherwise)	pcf	63
Lifting points	-	Vertical load = 2 * (heaviest piece of equipment lifted) Horizontal load = 0.20 * (vertical load)

7.2.3 Equipment Loads

Process area operating floors will be designed for the load case resulting in the maximum stresses from the following live load conditions:

- 300 psf on the entire floor area, with no additional load from equipment included
- 150 psf on the areas not directly under equipment, plus actual equipment loads

Equipment loads obtained from manufacturers will be used when available, and other equipment loads will be assumed for the preliminary design. These loads will be confirmed prior to completion of design. In addition to the equipment's operating weight (including any fluids contained), other loads due to moving parts, malfunction, and maintenance will be designed for. Examples of these other loads include but are not limited to the following:

- Loads from rotating equipment will include moment, torque, and lateral thrust.
- Loads from all equipment will include those for required maintenance, such as the removal of large components that may be temporarily placed on the adjacent floor.

The load option which creates the highest stress conditions will be used. The weight of equipment components, which could be placed on or transported across the floor, will be located to create maximum stress conditions.

7.2.4 Piping Loads

For preliminary design, the live loads listed above will be considered to include the loads from process piping that are supported by the floor below the piping. On floors and roofs that will support process piping suspended below, an additional live load allowance will be included for the preliminary design. This allowance ranges from 10 psf to 100 psf, depending on the size and quantity of piping, anticipated to be suspended below the floor or roof.

Upon completion of piping layout, these allowances will be reviewed for accuracy with the actual pipe configurations for pipes less than 16 inches in diameter, and the actual concentrated loads from pipes 16 inches and larger will be considered.

7.2.5 HVAC, Ducts, Plumbing, and Electrical Raceway Loads

Loads from HVAC ducts, plumbing, and electrical raceways are typically relatively light and included within the live loads listed above. However, if the loads are significant at selected locations, the increased loads will be considered prior to completion of design.

7.2.6 Wind Loads

Wind loads on any above grade structures will be in accordance with the governing code and ASCE 7.

7.2.7 Snow Loads

Not Applicable.

7.2.8 Seismic Loads

Seismic loads resulting from seismic acceleration of the structure dead and live loads, including equipment and piping, will be determined in accordance with the governing code and ASCE 7, and applicable codes for seismic design.

7.3 General Basis for Design

7.3.1 Load Combinations

The load combinations given in **Table 7-3** will be used in the design of structures. Additional load combinations as recommended by the governing codes, which may produce a maximum stress condition, will also be considered, as appropriate. Note that combinations which clearly do not govern will not need to be fully analyzed.

Table 7-3: Load Combinations

Parameter
Dead Load + Construction (if unusual construction loads occur)
Dead Load + Live Load + Permanent Equipment Load
Dead Load + Normal Operating Equipment Load + Seismic

7.3.2 Safety Factors

Structures will be designed on the basis of determining the service loads and applying a suitable ratio of material or soil strength to these loads which is termed a safety factor. Either the service loads will be multiplied by a suitable set of load factors and compared with the ultimate strength or the structural material or yield strength will be divided by a suitable safety factor. Safety factors are listed in **Table 7-4**.

Table 7-4: Safety Factors

Parameter	Unit	FS
Overturning	-	1.5
Sliding	-	1.5
Buoyancy for Groundwater, Design Elevation	-	1.25
Buoyancy for Groundwater, 100-yr Flood Elev.	-	1.10

Forces resisting buoyancy will be a combination of structure dead load, weight of soil directly over footings (considering buoyant soil weight), and the tensile resistance of piles and/or tension anchors (based on allowable load values provided by the geotechnical report), if applicable. Where there are superstructures above grade, the drawings will indicate at what level of completion dewatering operations can be terminated.

7.4 Serviceability Considerations

7.4.1 Introduction

Serviceability of a structure is defined as its ability to behave under load in a manner that does not adversely affect the intended use of the structure or provide discomfort to its occupants. Harsh chemical environments may require a special coating to protect the concrete. Some processes may also require more concrete cover over the reinforcement than typically provided for the structure as a whole to limit possible structural deterioration. Deflections and vibrations are behaviors of a structure that do not necessarily cause damage to the structure itself, but if excessive can cause minor damage or wear to equipment or discomfort and annoyance to occupants. Structures will be designed to limit deflections and vibrations as stated below such that the intended use and performance of the structures are not adversely affected.

7.4.2 Deflection

Maximum allowable deflections used for design are shown in **Table 7-5**. An asterisk (*) indicates the deflection limit applies to live loads only.

Table 7-5: Maximum Allowable Deflection

Parameter	Unit	Deflection
Floors, concrete	-	Per ACI 318
Floors, structural metal framed *	-	L/360
Grated access platforms *	-	L/240
Roofs *	-	L/240
Beams, lintels, or slabs supporting masonry	-	L/720

7.4.3 Vibration

The design should provide appropriate protection against structural or mechanical deterioration and occupant discomfort from the effects of vibrations. The guidelines stated below will be used to mitigate the effects of vibration.

- The operating frequencies, unbalanced loads, and specific design recommendations from equipment manufacturers will be considered in the design
- To minimize resonant vibrations, the structure supporting the equipment will be designed such that the ratio of its natural frequency to the operating frequency of the equipment is less than 0.50 or more than 1.50.
- Equipment will be mounted on concrete foundations rather than metal support systems whenever possible and appropriate.
- Concrete pads or foundations will be provided with a mass equal to ten times the rotating mass of the equipment or three times the gross mass of the equipment, whichever is greater.
- Vibration isolators or dampeners will be used on equipment foundations where appropriate.

7.5 Seismic Design

The basis for determining acceleration values and corresponding factors for design are given in the section presenting load criteria. Structures will be designed according to the governing code and ASCE 7 requirements using the values given in the appropriate code formulas.

Seismic forces due to vertical acceleration result from all dead loads, including the total mass of water above slabs (especially suspended slabs). The direction of force (up or down) will be selected to create maximum stresses when combined with horizontal seismic forces. The design of foundations resisting overturning must assume that balancing dead loads are reduced by vertical accelerations.

Transitory live loads will not be used to produce seismic loading nor combined with seismic with the following exceptions. In storage areas, the loading which is anticipated to be in place the majority of the

time will be used but not less than 25% of the total live load. Equipment, partition walls, and other fixed items will be considered as dead loads for determining seismic forces.

Because the performance of non-structural components (e.g. equipment, pipe supports, etc.) and non-building structures (vessels, tanks, etc.) can adversely impact the cost & recovery time associated with earthquakes, non-building structures and non-structural components will be restrained and braced for earthquake forces such that displacements will not impede component functionally or containment immediately following a seismic event. Seismic resistant elements and supports will be designed to minimize damage to building contents during a seismic event, thereby limiting disruption of service. Process buildings will be designed to be immediately accessible following the design seismic event.

7.6 Concrete Design

All portions of the structure that are in contact with soil or that contain process liquids (including slabs over process liquids) will be designed by the following design method:

- Ultimate Strength Design, per ACI 318 with revised load factors and durability coefficients recommended in ACI 350R.

Portions of the structure not included above may be designed per ACI 318 without including the ACI 350R recommendations.

Materials for use in concrete design will be specified to have the minimum properties listed in **Table 7-6**.

Table 7-6: Minimum Properties for Concrete Design

Parameter	Unit	Properties
Concrete Class A1 – Structural: (all applications unless otherwise noted)		
28 day compressive strength (f'c)	psi	4500
Cementitious Materials	-	Cement shall be Type conforming to ASTM C150 plus mandatory addition of pozzolan such as Class C or Class F fly ash or slag cement
Maximum water/cementitious materials ratio	-	0.42
Air content	%	4.0 to 6.5
Deformed reinforcing bars (unless otherwise noted)	-	ASTM A615 Grade 60
Concrete Class B: (thrust blocks, encasements, concrete fill)		
28 day compressive strength (f'c)	psi	3000
Cementitious Materials	-	Cement shall be Type I, conforming to ASTM C150
Maximum water/cementitious materials ratio	-	0.50
Deformed reinforcing bars (unless otherwise noted)	-	ASTM A615 Grade 60
Welded wire fabric	-	ASTM A185

Minimum required amounts of reinforcing will be determined per ACI 318 recommendations depending on the spacing of movement joints provided. Amounts of reinforcing used will be as required for structural strength, but not less than these minimum amounts. Maximum spacing of reinforcing bars will be 18 inches on-center.

Finishes on concrete surfaces will be provided in accordance with ACI 301, and as is appropriate for their use and exposure. Interior exposed walls, columns, ceilings, and beams in habitable spaces will receive a smooth rubbed finish. Interior walls above the water surface of open tanks and any exterior exposed walls above grade will receive a grout-cleaned finish. Floors of tanks and floors in areas likely to be intermittently wet due to washdown or maintenance of equipment will receive a floated finish. Floors in habitable areas intended to be dry at all times will receive a steel troweled finish.

Waterproof coatings will be provided on all walls and slabs that are in contact with liquid on one side and dry habitable spaces on the other. Concrete sealers will be provided on all floors that are exposed, not intended to be immersed, and have no other type of coating.

7.7 Masonry Design

Masonry will be designed in accordance with ACI 530 and ACI 530.1. Materials for use in masonry design will be specified to have the minimum properties listed in **Table 7-7**.

Table 7-7: Minimum Properties for Masonry Design

Parameter	Unit	Properties
Compressive strength of masonry (f'm)	psi	1500
Concrete masonry units	-	ASTM C90, Grade N Type
Compressive strength of masonry units	psi	1900
Mortar	-	ASTM C270, Type S
Grout	-	ASTM C476
Compressive strength of grout	psi	2000
Deformed reinforcing bars	-	ASTM A615, Grade 60
Horizontal joint reinforcing	-	ASTM A82

Minimum required amounts of reinforcing for seismic loads will be provided in accordance with ACI 530 and ACI 530.1. Amounts of reinforcing used will be as required for structural strength, but not less than these minimum amounts. All cells containing reinforcing will be grouted. Maximum spacing of horizontal joint reinforcing will be 16 inches on-center vertically.

7.8 Structural Metals Design

Structural steel will be designed in accordance with AISC Specification for Structural Steel Buildings – Allowable Strength Design or Load and Resistance Factor Design, with modifications as stated in the governing code.

Steel joists will be designed in accordance with the Steel Joist Institute (SJI) Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders with the modifications as stated in the governing code.

Steel decking will be designed in accordance with the Steel Deck Institute (SDI) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Deck Floor Systems with Electrical Distribution. Diaphragm action of steel decks will be designed in accordance with the SDI Diaphragm Design Manual.

Cold-formed steel structural members will be designed in accordance with the American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members, with modifications as stated in the governing code.

Cold-formed stainless steel structural members will be designed in accordance with ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members.

Aluminum members will be designed in accordance with the Aluminum Association's Specifications for Aluminum Structures.

Materials for use as structural metals will be specified to have the minimum properties listed in **Table 7-8**.

Table 7-8: Minimum Properties for Structural Metals

Parameter	Unit	Properties
Structural steel shapes, plates, and bars	-	ASTM A992, Grade 50
Structural steel tubing	-	ASTM A500, Grade B
Structural steel pipe	-	ASTM A53, Type E or S, Grade B
High strength steel bolts	-	ASTM A325 or ASTM A490
Steel anchor bolts and threaded rods	-	ASTM A307 or ASTM F1554
Stainless steel shapes	-	ASTM A276, Type 316
Stainless steel plates and sheet	-	ASTM A167, Type 304 or 316
Stainless steel bolts	-	ASTM F593, Type 304 or 316
Aluminum structural shapes	-	ASTM B308, 6061-T6
Aluminum extruded rods, shapes, and tubes	-	ASTM B221, 6063-T6
Aluminum plates	-	ASTM B209, 6061-T6
Aluminum sheet	-	ASTM B221, 3003

7.9 General Description of Structural Systems

7.9.1 IX Vessels and Bag Filters at SBA Sites

The IX vessels and bag filters at the SBA well sites will require a structure to provide screening from visibility to the public, as well as protection from weather and sunlight. These screens will consist of pre-engineered metal canopy structures supported on reinforced concrete mat foundations. The anticipated geotechnical investigation will determine if other means, such as deep foundation systems, will be necessary for foundation support. The pre-engineered metal structural frame of the canopy will be consistent with normal pre-engineered metal building construction using non-prismatic sections to span the entire extents of the structure. The column bases will be pinned with all forces transferred to the reinforced concrete foundation mat slab. Where the concealing is needed, removable metal wall panels will be provided that are attached to the structural frame.

7.9.2 Concrete Drain Pads at SBA Sites

Concrete drain pads will be provided adjacent to the structures containing the IX vessels and bag filters. These pads will consist of concrete slab-type construction, grade supported and sloped as necessary to retain spillage from the vessels and bag filters. Catch basins will be included to collect and contain the fluid in these areas.

7.9.3 Resin Regeneration Facility

The design of the CWA RRF will follow the options outlined in Section 1-Overview of this Basis of Design Report. If option A is selected, in which resin is transported to the neighboring CVWD CRRF for resin regeneration, then no hazardous brine is generated and construction of a new RRF is not needed. If

option B is selected, then a resin regeneration facility constructed at one of CWA's designated parcels located near the corner of 52 Avenue and Education Way, will be used for resin regeneration only. Hazardous brine hauling will still be needed in which CWA will contract with a licensed facility to haul, treat, and dispose of the brine. As an alternative location, Ave 54 Wastewater Treatment Plant may be used for the RRF site. If option C is selected, it will be similar to Option B, except the RRF will also treat hazardous brine on site. The RRF will consist of two separate building structures, one to house the resin regeneration process and treatment areas, including electrical and office rooms, and the second will house the brine treatment area.

If the CWA RRF is to be designed based on option B or C, the building superstructure(s) will enclose the RRF process and treatment areas in order to provide cover and screening. However, the size and geometry of the building(s) depends on the RRF design option selected. The building superstructure will be consistent with normal pre-engineered metal building-type construction, which includes built-up structural steel framing with metal deck roof and metal wall panel siding. CMU non-loadbearing walls on the interior of the building may be used to separate process areas. The building will be supported on a reinforced concrete mat foundation. The anticipated geotechnical investigation will determine if other means such as a deep foundation system will be necessary for foundation support of the building structures and process equipment at grade.

The chemical containment areas will consist of reinforced concrete perimeter walls supported on the mat foundation. Coating systems and chemical resistant waterstops will be used as necessary to resist the materials being contained and to provide the necessary protection of the concrete.

7.9.4 Miscellaneous Support Pads at SBA Sites and Resin Regeneration Facility

Several reinforced concrete support pads for equipment and small light-framed buildings may be constructed at each of the SBA sites and the RRF. These grade-supported pads will support various types of equipment and appurtenances including generators, transformers, process tanks, storage tanks, electrical buildings (if needed), and chemical buildings. If confirmed acceptable by the anticipated geotechnical investigation, all of these support pads will be supported directly on grade.

8. Architectural

The following section outlines approaches to the architectural design for the CWA RRF. The Section includes code compliance issues related to occupancy, type of construction, fire resistance of materials and separation requirements, interior finishes, fire prevention and separation, fire protective systems, means of egress, accessibility, interior environment, exterior wall construction, roof construction, and exterior appearance.

8.1 Codes and Standards

Codes, standards, and references will provide the minimum standard for fire resistance, serviceability and quality of materials used for construction. Buildings are required to conform with the California Building Standards Code, Title 24, California Code of Regulations which includes the California Building Code, which references and modifies the International Building Code (IBC) as adopted and amended by the State of California will act as the governing building code. Accessibility issues will be governed by Chapter 11B of the California Building Code. Provisions of California Fire Code, California Green Building Standards Code, California Plumbing Code, California Mechanical Code, California Energy Conservation Code and California Electrical Code will be applied as required the Title 24. All code and standards will include adopted supplements and errata. Additional federal, state and local codes, standards and references will be coordinated and applied in accordance with the California Building Code. A partial list of these codes and standards follow.

- 29 CFR 1910 – Occupational Safety and Health Standards
- ACI 530/ASCE 5/TMS 402 – Building Code Requirements for Masonry
- ACI 530.1/ASCE 6/TMS 602 – Specification for Masonry Structures
- NFPA 10 – Portable Fire Extinguishers
- NFPA 13 – Installation of Sprinkler Systems
- NFPA 80 – Fire Doors and Fire Windows
- NFPA 704 – Identification of Fire Hazards of Materials
- UL Fire Resistance Directory

In addition to the State and Federal codes, local regulations additionally impact the design of the buildings and include the local Zoning Regulations. The impact of these regulations includes developed area, parking, landscaping, signage and noise.

8.2 Well Sites

8.2.1 Code Requirements

The primary occupancy and use of the well sites as defined by the California Building Code will be Utility (U). The sites are not continuously occupied and are frequented as required for monitoring and maintenance. Based on final chemical selections and quantities stored chemical spaces storing chemicals may be classified as an H-4 (Physical Hazards) occupancy. H-4 occupancies will be required to separate from F-2 occupancies with a two hour fire wall.

Support structures will be constructed of Type V construction. The buildings size will require only one door. Treatment tanks will be freestanding and covered by a canopy of Type IIB construction. Fire extinguishers will be required on site, however additional fire suppression or detection systems will not be required, unless the local authority having jurisdiction requires them or the chemical quantities on site exceed 500 gallons.

The buildings will not be required to accessible as Chapter 11B, paragraph 203.5 states that machinery spaces are not required to meet accessibility requirements when the facilities are frequented only for maintenance, repair, and occasional monitoring.

8.2.2 Design

Canopies will be utilized at well sites. The canopies are intended to provide screening from nearby neighbors and provide shading for employees. The canopies will wrap the treatment tanks leaving the center above the tanks open. This will allow easily removal of treatment tanks in the future, while providing visual screening and shading. The canopies will include a steel structure with removable side panels to allow additional access to the treatment tanks when required. Structural members and removable panels will be bolted where access to the treatment tanks and accessories is necessary to perform maintenance. The will have a mansard roof with tile. The canopies will begin at the treatment pad edges and extend approximately 4’-6” beyond the pad. The side wall panels will extend to approximately 7’-0” above the pad. The wall panels will be attached to the structural system with bolts and be designed to allow the panels to be removed. Eye-hooks will be incorporated into the design to allow the inclusion of fabric shades over the open center to allow for additional shading. The fabric shading can be easily removed when the tanks are removed through the center opening.

Support structures will be constructed utilizing wood framed construction with a stucco finish and hipped roof. The roofing system will be tile. Doors and frames will be painted hollow metal. Interior of support structures will not be painted.

8.3 Regeneration Facility

8.3.1 Code Requirements

The primary occupancy and use of the regeneration facility as defined by the California Building Code will be F-2 Low Hazard Factory Industrial. A secondary occupancy of H-4 Health Hazard may be required based on the final chemical selections and quantities of stored chemicals.

Regeneration facilities will be Type IIB (non-combustible) construction and non-protected. The buildings will have a footprint below the maximum of 23,000 square feet as allowed by the CBC without area increases. If additional area is required area increases will be applied as allowed by Chapter 5 of the California Building Code. The regeneration facilities will require a minimum of 2 exits from each building or portion of the building where travel distance exceeds 75 feet. Exit doors will be provided with standard locksets, except electrical rooms and chemical rooms will be required to have panic hardware.

The plumbing code will require the addition of a unisex toilet, if the local authorities agrees with a reduced occupancy. The plumbing code requires the number of fixtures to be determined by area and occupancy as defined the CBC. Using the CBC area per occupant numbers the regeneration facilities will be considered to have more than 50 occupants. However, the plumbing code allows for reductions where occupancy levels are proven to the satisfaction of the local authority having jurisdiction. Provided the local authority having jurisdiction agrees we should be able to have a single unisex toilet.

The control room and toilet facilities will be required to be accessible in accordance with Chapter 11B of the California Building Code. The process areas will be exempt from full accessibility requirements in accordance with the requirements for a Work Space as defined by Chapter 11B of the California Building Code.

8.3.2 Design

Regeneration facilities will utilize pre-engineered metal building systems. Standard exposed fastener wall panels will be used. The roofs will be pitched at 1” in 12” and include a standing seam metal roof system. Walls and ceilings will be insulated with batt insulation and vinyl linear on the inside. Walls will include a metal or plywood liner panel to protect the insulation and vinyl liner from damage to a height of about 8’-0”. Areas such as electrical rooms, control room, toilet rooms and storage rooms will utilize concrete masonry unit construction constructed within the shell of the pre-engineered metal building. Interior finishes will be limited to painted metals that have not received a factory finish. Chemical containment will receive containment liners. Floors will receive a sealer. Control and toilet room will receive acoustical lay-in ceilings, painted walls, and resilient flooring.

9. Electrical

The purpose of this section of the memorandum is to present preliminary engineering information and design concepts for the electrical distribution system related to the CWA Hexavalent Chromium Treatment Facilities Project. This section will focus on the necessary modifications to the existing electrical power systems at the Strong Base Anion (SBA) well sites and the new electrical power system at the Resin Regeneration Facility (RRF). Modifications at the SBA well sites are necessary to supply the new loads associated with the water treatment process.

The latest version of all applicable local, state, and national codes and standards will be adhered to as part of the electrical design. These include:

- National Electric Code (NEC)
- California Electrical Code
- California Energy Code
- National Fire Protection Association (NFPA)
- National Electric Manufacturers Association (NEMA)
- Institute of Electrical and Electronic Engineers (IEEE)
- California Energy Commission (CEC), Title 24
- The American National Standards Institute (ANSI)
- Underwriters' Laboratories (UL)
- Occupational Safety and Health Administration (OSHA)
- Imperial Irrigation District Standards
- InterNational Electrical Testing Association (NETA)
- National Institute of Standards and Technology (NIST)
- Local Electrical Codes
- Applicable Portions of Local Building Code
- South Coast Air Quality Management District (SCAQMD) or Imperial County Air Quality District

The following is a list of electrical scope items included in this project:

- Supply power to new process equipment at each well site.
- Evaluate the capacity of existing utility and standby power systems at each well site.
- Provide a new power distribution system to supply equipment at the Resin Regeneration Facility.

Specifically, this document will address the following topics:

<u>Well Sites</u>

- Existing Electrical Systems at each well site
- Proposed new loads for SBA Treatment
- Well Site proposed modifications for new SBA Treatment

Resin Regeneration Facility

- RRF Proposed New Electrical System
- Project Design Standards

All referenced drawings are included in **Appendix A** at the end of this report.

9.1 Existing Electrical Systems at Well Sites

There are five (5) SBA well sites involved in the CWA Hexavalent Chromium Treatment Facilities Project. The treatment described in **Section 5** will be added to each. Details of the existing electrical systems at each well site are described herein.

The SBA well sites are all supplied with electric utility power from Imperial Irrigation District (IID). Each site has an outdoor pad-mount style utility transformer with a 480/277VAC solidly grounded wye secondary. The secondary conductors are routed to a switchboard that includes utility metering and a main circuit breaker or fusible main disconnect switch. The switchboard voltage is 480VAC at each site, but the bus current ratings differ by site based upon the load it is serving.

9.1.1 Well Site 12

Well Site 12 is a combination well/booster pump station site. Reference **Drawing E-121** for a single line of the existing electrical system. The electrical distribution system provides for both the well pump and the associated controls and starters for the booster pump station. The existing IID utility transformer supplies the normal side of a 480VAC, 1000A, 3-phase, 3-wire automatic transfer switch, which provides power to the existing distribution switchboard, labeled SWBD-MSA.

SWBD-MSA is a 480VAC, 3-phase, 4-wire, 1000A lineup consisting of one distribution section filled with feeder breakers for the booster pumps (3) and an existing 2-section motor control center. Over the years, the motor control center has been modified due to well pump size increases, but currently it contains a stepdown transformer and lighting panelboard for 120VAC loads within the pump station as well as a feeder breaker to the stand-alone RVSS starter for the existing well pump.

Figure 9-1: Electrical Equipment at Well 12

Well Site 12 has an existing standby diesel engine generator with a built-in radiator mounted load bank and a base mounted fuel tank. The generator is rated 480VAC, 250kW, with the potential to output 376 Amps at full load. This is equivalent to starting and operating any combination of two (2) of the three (3) 100hp booster pumps and/or the single 100hp well pump. Theoretically, three (3) of these loads could be operated at the same time but starting the last pump in the sequence may be an issue.

The existing Well Site 12 calculated electrical load is summarized in **Table 9-1** below. As indicated in the table, the connected and operating loads of the site are well within the ratings of the existing power distribution equipment. Modifications to Well Site 12 which are required to accommodate the new process loads are described in **Section 9.2.**

Table 9-1: Well Site 12 Existing Equipment Load List

		Connected Load				Demand Factor	Operating Load	
	Starter	HP	kW	kVA	FLA		FLA	kW
Booster Pump No.1	VFD	100	-	-	124	0.9	112	79
Booster Pump No.2	VFD	100	-	-	124	0.9	112	79
Booster Pump No.3	VFD	100	-	-	124	0.0	0	0
Transformer for Lighting Panel	BKR	-	-	9	11	0.5	5	4
Well Pump	RVSS	100	-	-	124	0.9	112	79
Totals					507	-	340	240

The operating load values within the table are calculated by multiplying the connected load by a demand factor. The demand factor allows for the connected load values to be de-rated to approximate a more realistic demand load. These demand factors also take into consideration the firm capacity of unit processes. Firm capacity is the installation of multiple units of equipment (e.g. pumps) to handle the design flow of the well site. True demand load as measured by the serving electrical utility will be less than the operating load presented in the Table.

9.1.2 Well Site 16

Well Site 16 is a typical well site. Reference **Drawing E-161** for a single line of the existing electrical system. The existing IID utility transformer supplies the normal side of a 480VAC, 600A, 3-phase, 3-wire manual transfer switch. The load side of the transfer switch is cable connected directly to the bus of a two (2) section motor control center. The motor control center is a 480VAC, 3-phase, 3-wire, 600A lineup.

The existing MCC consists of one section for a step down transformer and lighting panel for the site's 120VAC loads. The second section is dedicated to the reduced voltage soft starter for the existing 250hp well pump.

Figure 9-2: Electrical Equipment at Well 16

The entire electrical distribution lineup (incoming pull section, main circuit breaker, MTS, and MCC) is located outdoors in a NEMA 3R enclosure, exposed to the outdoor environment. A portable generator connection is installed on the back of the MTS section, suitable for cam-lock connections from a CWA generator. There is currently no generator on-site at this particular well site.

The existing Well Site 16 calculated electrical load is summarized in **Table 9-2** below. As indicated in the table, the connected and operating loads of the site are well within the ratings of the existing power distribution equipment. Modifications to Well Site 16 which are required to accommodate the new process loads are described in **Section 9.2.**

Table 9-2: Well Site 16 Existing Equipment Load List

		Connected Load				Demand Factor	Operating Load	
	Starter	HP	kW	kVA	FLA		FLA	kW
Transformer for Lighting Panel	BKR	-	-	5	6	0.5	3	2
Well Pump	RVSS	250	-	-	302	0.9	272	192
Totals					308	-	275	194

The operating load values within the table are calculated by multiplying the connected load by a demand factor. The demand factor allows for the connected load values to be de-rated to approximate a more realistic demand load. These demand factors also take into consideration the firm capacity of unit processes. Firm capacity is the installation of multiple units of equipment (e.g. pumps) to handle the design flow of the well site. True demand load as measured by the serving electrical utility will be less than the operating load presented in the Table.

9.1.3 Well Site 17

Well Site 17 contains a well pump building and associated electrical equipment. Reference **Drawing E-171** for a single line of the existing electrical system. The existing IID utility transformer supplies the normal side of a 480VAC, 600A, 3-phase, 3-wire automatic transfer switch. The load side of the automatic transfer switch is cable connected to the normal side of a manual transfer switch. The load side of the manual transfer switch is cable connected directly to the 400AF/400AT molded case circuit breaker within the well pump starter enclosure.

Figure 9-3: Electrical Equipment and Pump Bldg. at Well 17

The well pump starter for Well Site 17 is a variable frequency drive with a reduced voltage soft starter bypass, allowing the pump to operate at variable frequency under normal conditions, and to switch to full speed (reduced voltage starting) if the VFD was ever required to be down for maintenance.

Figure 9-4: VFD with RVSS Bypass Starter at Well 17

The main breaker of the starter enclosure is tapped on the line side and 480VAC is supplied to a wall-mounted circuit breaker enclosure, which supplies a step-down transformer and 120VAC lighting panel for 120VAC loads within the facility.

This site is not equipped with any type of 480VAC power distribution equipment (e.g. switchboard, motor control center, power panelboard, etc.).

Figure 9-5: Standby Generator at Well 17

Well Site 17 has an existing standby diesel engine generator and a base mounted fuel tank. The generator is rated 480VAC, 200kW, with the potential to output 301 Amps at full load. This is sufficient for starting and operating the existing 200hp well pump plus any 120VAC loads that may be required to operate the well site.

The existing Well Site 17 calculated electrical load is summarized in **Table 9-3** below. As indicated in the table, the connected and operating loads of the site are well within the ratings of the existing power distribution equipment. Modifications to Well Site 17 which are required to accommodate the new process loads are described in **Section 9.2.**

Table 9-3: Well Site 17 Existing Equipment Load List

		Connected Load				Demand Factor	Operating Load	
	Starter	HP	kW	kVA	FLA		FLA	kW
Transformer for Lighting Panel	BKR	-	-	15	18	0.5	9	6
Well Pump	VFD w/ RVSS	200	-	-	240	0.9	216	153
Totals					258	-	225	159

The operating load values within the Table are calculated by multiplying the connected load by a demand factor. The demand factor allows for the connected load values to be de-rated to approximate a more realistic demand load. These demand factors also take into consideration the firm capacity of unit processes. Firm capacity is the installation of multiple units of equipment (e.g. pumps) to handle the design flow of the well site. True demand load as measured by the serving electrical utility will be less than the operating load presented in the Table.

9.1.4 Well Site 18

Well Site 18 is a combination well/booster pump station site. Reference **Drawing E-181** for a single line of the existing electrical system. The electrical distribution system provides for both the well pump and the associated controls and starters for the booster pump station. The existing IID utility transformer supplies the normal side of a 480VAC, 2000A, 3-phase, 3-wire automatic transfer switch, which provides power to the existing power distribution switchboard.

Figure 9-6: Power Distribution Equipment at Well 18

The power distribution switchboard is a 480VAC, 3-phase, 4-wire, 2000A lineup consisting of two (2) distribution sections filled with feeder breakers for the booster pumps (4) and panelboards for low voltage equipment. Variable Frequency Drive starters with RVSS bypass are installed for the booster pumps in stand-alone enclosures on the opposite side of the isle from the switchboard.

The well pump and associated electrical equipment is located within another building on the far end of the site. A 400AF/250AT molded case feeder circuit breaker from the distribution switchboard supplies an existing motor control center located in the well pump building via an underground ductbank.

Figure 9-7: Well 18 Site View from Booster Pump Bldg. to Well Pump Bldg.

The motor control center is a 480VAC, 3-phase, 4-wire, 600A lineup consisting of two (2) distribution sections. The MCC does not contain a main breaker. The existing 100hp well pump RVSS starter is located within one section and a feeder breaker for the HVAC unit is located within the adjacent section. A bus tap supplying a molded case circuit breaker within a separate enclosure supplies a transformer and lighting panelboard to provide power to the 120VAC loads throughout the well pump building.

Figure 9-8: Well Pump and MCC at Well 18

Well Site 18 has an existing standby diesel engine generator with a base mounted fuel tank. The generator is rated 480VAC, 900kW, with the potential to output 1353 Amps at full load. This generator can easily start and operate any combination of the existing loads currently at the site.

The existing Well Site 18 calculated electrical load is summarized in **Table 9-4** below. As indicated in the table, the connected and operating loads of the site are well within the ratings of the existing power distribution equipment. Modifications to Well Site 18 which are required to accommodate the new process loads are described in **Section 9.2.**

Table 9-4: Well Site 18 Existing Equipment Load List

		Connected Load				Demand Factor	Operating Load	
	Starter	HP	kW	kVA	FLA		FLA	kW
Booster Pump HP1	VFD	200	-	-	240	0.9	216	153
Booster Pump HP2	VFD	200	-	-	240	0.9	216	153
Booster Pump LP1	VFD	125	-	-	156	0.9	140	99
Booster Pump LP2	VFD	125	-	-	156	0.9	140	99
Transformer T1	BKR	-	-	15	18	0.5	9	6
Transformer T2	BKR	-	-	25	30	0.5	15	11
HVAC Unit Booster Pump Bldg.	BKR	-	-	-	31	0.9	28	20
Well Pump	RVSS	100	-	-	124	0.9	112	79
Transformer Well Bldg.	BKR	-	-	5	6	0.5	3	2
HVAC Unit Well Bldg.	BKR	-	-	-	10	0.9	9	6
Totals					1011	-	888	628

The operating load values within the table are calculated by multiplying the connected load by a demand factor. The demand factor allows for the connected load values to be de-rated to approximate a more realistic demand load. These demand factors also take into consideration the firm capacity of unit processes. Firm capacity is the installation of multiple units of equipment (e.g. pumps) to handle the design flow of the well site. True demand load as measured by the serving electrical utility will be less than the operating load presented in the Table.

9.1.5 Well Site 19

Well Site 19 contains a well pump building and associated electrical equipment. Reference **Drawing E-191** for a single line of the existing electrical system. The existing IID utility transformer supplies the normal side of a 480VAC, 600A, 3-phase, 3-wire automatic transfer switch. The load side of the automatic transfer switch is cable connected to the normal side of a manual transfer switch. The load side of the manual transfer switch is cable connected directly to the 400AF/350AT molded case circuit breaker within the well pump starter enclosure.

Figure 9-9: Electrical Equipment and Pump Bldg. at Well 19

The well pump starter for Well Site 19 is a variable frequency drive with a reduced voltage soft starter bypass, allowing the pump to operate at variable frequency under normal conditions, and to switch to full speed (reduced voltage starting) if the VFD was ever required to be down for maintenance.

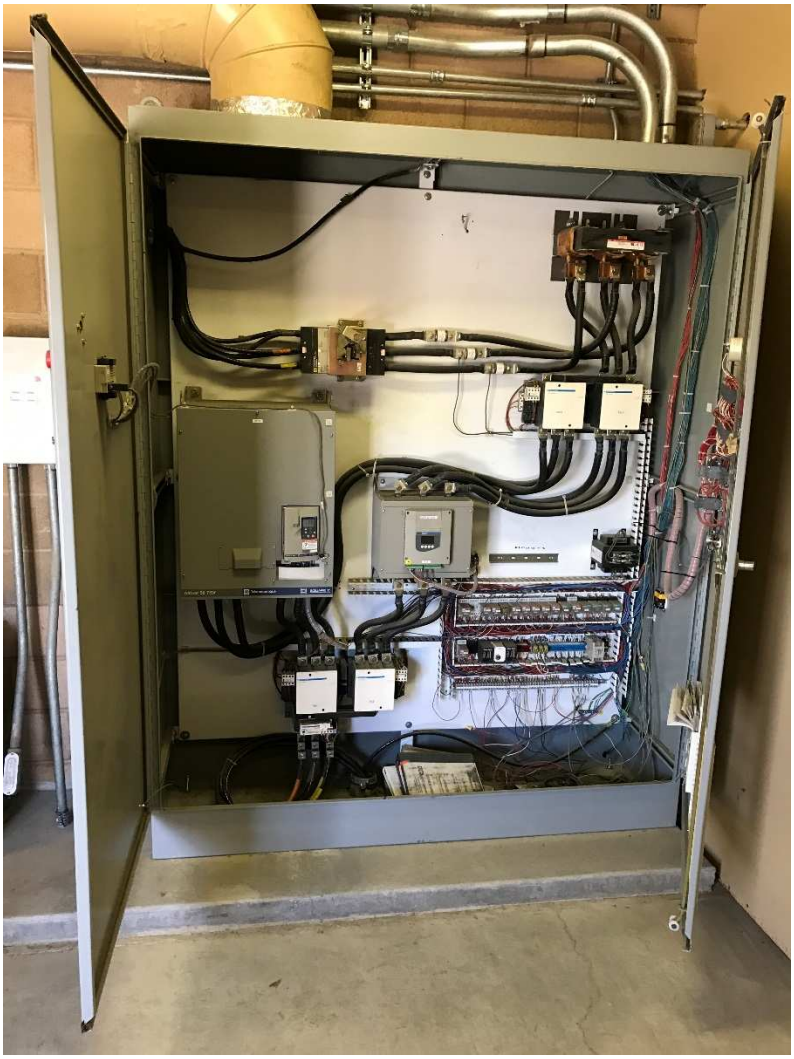


Figure 9-10: VFD with RVSS Bypass Starter at Well 19

The main breaker of the starter enclosure is tapped on the line side and 480VAC is supplied to a wall-mounted circuit breaker enclosure which supplies a step-down transformer and 120VAC lighting panel for 120VAC loads within the facility.

This site is not equipped with any type of 480VAC power distribution equipment (e.g. switchboard, motor control center, power panelboard, etc.).

Figure 9-11: Standby Generator at Well 19

Well Site 19 has an existing standby diesel engine generator and a base mounted fuel tank. The generator is rated 480VAC, 200kW, with the potential to output 301 Amps at full load. This is sufficient for starting and operating the existing 200hp well pump plus any 120VAC loads that may be required to operate the well site.

The existing Well Site 19 calculated electrical load is summarized in **Table 9-5** below. As indicated in the table, the connected and operating loads of the site are well within the ratings of the existing power distribution equipment. Modifications to Well Site 19 which are required to accommodate the new process loads are described in **Section 9.2.**

Table 9-5: Well Site 19 Existing Equipment Load List

		Connected Load				Demand Factor	Operating Load	
	Starter	HP	kW	kVA	FLA		FLA	kW
Transformer for Lighting Panel	BKR	-	-	15	18	0.5	9	6
Well Pump	VFD w/ RVSS	200	-	-	240	0.9	216	153
Totals					258	-	225	159

The operating load values within the table are calculated by multiplying the connected load by a demand factor. The demand factor allows for the connected load values to be de-rated to approximate a more realistic demand load. These demand factors also take into consideration the firm capacity of unit processes. Firm capacity is the installation of multiple units of equipment (e.g. pumps) to handle the design flow of the well site. True demand load as measured by the serving electrical utility will be less than the operating load presented in the Table.

9.2 Proposed New Loads for SBA Treatment

As described in previous sections, the addition of new treatment equipment for chromium 6 removal from the groundwater introduces system head loss and flow reduction. Based on the hydraulic analysis included in **Section 5**, the size of the pumps will need to increase at each of the well sites. Along with pump increases, new motor operated valves, chemical dosing systems, and resin transfer pumps are required. These process additions and modifications require additional electrical equipment for operation.

Modifications are required to the existing electrical power distribution system at each site to support these new loads. In general, the modifications to each site's electrical system are as follows:

- Add one power panelboard
- Add one dry-type step down transformer
- Add one lighting panelboard
- Well pump motor starter upgrades (see table below)
- Electrical Distribution System upgrades (see table below)
- Generator upgrades (see table below)
- Electrical Utility upgrades

The well pump starters at the well sites were evaluated on a site-by-site basis to determine if they are adequately sized for the pump/motor increase. This topic was discussed at the Electrical and I&C Design Meeting on September 28. In addition to the requirements of this project, CWA indicated that the current well pump conductors are likely inadequate if the well pump/motor becomes larger at Well Site 12. CWA also requested that a VFD be added for Well Site 16 and they indicated that the VFD at Well Site 19 may need improvements.

See **Table 9-6** below summarizing the pump, motor, and motor starter modifications:

Table 9-6: SBA Well Site Pump Modification Summary

Well Site	Existing Motor HP	Existing Motor Starter	New Motor HP	New Motor Starter
Site 12	100	VFD with RVSS bypass	200	VFD with RVSS bypass
Site 16	250	RVSS only	300	VFD with RVSS bypass
Site 17	200	VFD with RVSS bypass	300	VFD with RVSS bypass
Site 18	100	RVSS only	200	VFD with RVSS bypass
Site 19	200	VFD with RVSS bypass	250	VFD with RVSS bypass

Appendix D presents a detailed list of the existing and proposed new loads at each of the SBA well sites. Overall loads in Amperes (A) and Kilowatts (kW) for the existing and proposed new site equipment can be found at the top of each load list. **Table 9-7** below summarizes the details indicated within the load lists.

Table 9-7: SBA Well Site Loads Summary

Well Site	Existing Load, kW	Proposed New Process Operating Load, kW	Total Load, kW	Existing Generator, kW	New Generator, kW
Site 12	240	124/203*	364/443*	250	500*
Site 16	194	108	302	N/A	350
Site 17	159	143	302	200	350
Site 18	628	123	751	900	Keep Existing
Site 19	159	105	264	200	350

* Sizing provides the ability to start and run all booster pumps and the well pump. If n+1 is adequate, generator sizing can be reduced appropriately.

As evidenced by **Table 9-7**, it is recommended that Well Sites 12, 16, 17, and 19 all upgrade their standby power capabilities to meet the requirements of new loads provided under this project. Refer to **Section 9.3.6** for further discussion regarding the generators.

9.3 Proposed Well Site Modifications

See the **Electrical Drawings** within **Appendix A** for single line diagrams of the proposed modifications to the existing electrical system as a result of the new SBA treatment equipment and expected pump/motor HP increase. A single line diagram is provided for each well site.

Well sites will require various modifications due to the existing equipment. Each site is addressed below on a site-by-site basis.

9.3.1 Well Site 12

Well Site 12's current configuration supplies the existing 100hp well pump from a starter that is electrically supplied from the existing motor control center. The project will increase the 100hp motor to 200hp, requiring the starter, conduit, wire, and feeder breaker to be increased in size. Furthermore, the supply from the switchboard to the MCC is via a 225A circuit breaker. This will be insufficient to supply power for the new well pump. A new 600A circuit breaker and appropriately sized conductors will be installed to supply the MCC, a new starter will be provided to supply the new well pump motor, and the appropriate conduit and wire will be installed from the electrical room out to the well pump via a new concrete encased, electrical ductbank.

Figure 9-12: IID Transformer Pad at Well Site 12

Drawing E-121 in **Appendix A** shows a single line diagram for Well Site 12.

The new electrical load information for this site will need to be discussed with IID to determine if they require the electrical service to be upgraded. During that discussion, the structural integrity of the transformer pad shall be inspected to confirm it is not compromised. Refer to **Figure 9-12**.

A new generator, conduit and wire will also be provided at this site. Refer to **Table 9-7** and **Section 9.3.7** for further details.

9.3.2 Well Site 16

Well Site 16 was noted by CWA at the Electrical and I&C Design Meeting on September 28 to add a generator and add a VFD with RVSS bypass starter for the well pump. Adding a generator will require an automatic transfer switch (ATS). Logistics and space requirements to attempt to add the VFD with RVSS bypass starter and ATS to the existing lineup does not seem like a suitable alternative. In addition, the existing electrical equipment is outdoors. A VFD should be in a conditioned space, where it can be kept at a cooler temperature for efficient operation.

Given the modifications planned for Well Site 16 and the current state of the electrical equipment, it is recommended that a new electrical distribution equipment lineup be furnished and installed in a new, conditioned, electrical building. A new or existing PLC could be located in the conditioned electrical building as well.

Drawings E-161 and **E-162** in **Appendix A** show a single line diagram and expected electrical building layout for Well Site 16 with new electrical distribution equipment and a new electrical building.

The new electrical load information for this site will need to be discussed with IID to determine if they require the electrical service to be upgraded. Discussion should include construction sequencing and power supply to the existing lineup and the transition to supplying the new lineup. Temporary power alternatives shall also be considered during the power transition.

A new generator, conduit and wire will also be provided at this site. Refer to **Table 9-7** and **Section 9.3.7** for further details.

9.3.3 Well Site 17

The existing electrical equipment associated with Well Site 17 is in good condition, but the overall interconnection of all of the components is not ideal.

- The current electrical configuration of Well Site 17 does not include any power distribution equipment (e.g. a distribution switchboard, MCC, or power panelboard)
- Taps within the well pump starter enclosure are used to provide power to multiple devices
- The electrical system includes both an ATS and an MTS in series with each other.
- The motor upgrade will require the existing starter to be replaced.
- The physical space within the existing pump house is very limited.
- The HVAC unit is ducted directly into the VFD/RVSS enclosure to provide cooling.

These are all good indications to provide a new electrical power distribution system for the well site.

A new electrical distribution equipment lineup will be furnished and installed in a new, conditioned electrical building. The existing PLC could be relocated in the conditioned electrical building or a new one could be provided as part of the project.

Drawings E-171 and **E-172** in **Appendix A** show a single line diagram and expected electrical building layout for Well Site 17 with new electrical distribution equipment and a new electrical building.

The new electrical load information for this site will need to be discussed with IID to determine if they require the electrical service to be upgraded. Location of the transformer should also be discussed and coordinated with the new location of the new electrical building, keeping secondary conductor lengths to a minimum to reduce costs.

A new generator, conduit and wire will also be provided at this site. Refer to **Table 9-7** and **Section 9.3.7** for further details.

9.3.4 Well Site 18

The current overall electrical system configuration for Well 18 has adequate ampacity to handle the well pump increase from 100hp to 200hp and the associated process loads for the IX treatment. For this particular site, the well pump building is located several hundred feet from the booster pump station and the main electrical equipment.

The exiting feeder to the well pump building is only adequate for 250Amps, and is required to be upgraded for this project. A new concrete encased, reinforced ductbank will be constructed between the booster pump building and the well pump building to provide 600Amp worth of capacity for the well pump and associated loads.

Drawing E-181 in **Appendix A** shows a single line diagram for Well Site 18. As indicated, a new feeder breaker will be provided in the booster pump switchboard, new ductbank will be provided, and a new starter will be provided within the well pump building for the larger well pump motor. The existing HVAC equipment will be evaluated and modified as required to ensure the new VFD with RVSS bypass for the well pump is conditioned properly.

The new electrical load information for this site will need to be provided to IID, but it is very unlikely that the utility service will need modifications.

The existing 900kW generator will be adequate to start and run all equipment at Well Site 18 including any modifications provided under this project. No changes are required to the generator. Refer to **Table 9-7** for further details.

9.3.5 Well Site 18 (with Booster Pump Additions)

There are currently two (2) low pressure zone and high pressure zone booster pumps at Well Site 18, 125hp and 200hp each, respectively. If Well Site 20 is added to the system, the intent would be to install a 3rd booster pump for each zone, for a total of six (6) installed booster pumps (3-125hp and 3-200hp).

The existing electrical power distribution system, including the well pump upgrades, and the addition of the booster pumps and associated starters would still be adequately sized to handle the additional loads.

The exiting 900kW generator would be able to start and run 4 of 6 booster pumps, as well as the well pump and IX treatment. To start and run any more booster pumps with the existing generator, further investigations would be required, with the possibility of having to upgrade the generator.

9.3.6 Well Site 19

The existing electrical equipment associated with Well Site 19 is in good condition, but the overall interconnection of all of the components is not ideal. This is essentially an identical situation to Well Site 17.

- The current electrical configuration of Well Site 19 does not include any power distribution equipment (e.g. a distribution switchboard, MCC, or power panelboard)
- Taps within the well pump starter enclosure are used to provide power to multiple devices
- The electrical system includes both an ATS and an MTS in series with each other.
- The motor upgrade will require the existing starter to be replaced.
- The physical space within the existing pump house is very limited.
- The HVAC unit is ducted directly into the VFD/RVSS enclosure to provide cooling.
- Being a small site, the generator and possibly the utility transformer will need to be relocated to make room for the IX treatment.

These are all good indications to provide a new electrical power distribution system for the well site.

A new electrical distribution equipment lineup will be furnished and installed in a new, conditioned electrical building. The existing PLC could be relocated in the conditioned electrical building or a new one could be provided as part of the project.

Drawings E-191 and **E-192** in **Appendix A** show a single line diagram and expected electrical building layout for Well Site 17 with new electrical distribution equipment and a new electrical building.

The new electrical load information for this site will need to be discussed with IID to determine if they require the electrical service to be upgraded. Location of the transformer should also be discussed and coordinated with the new location of the new electrical building, keeping secondary conductor lengths to a minimum to reduce costs as well as fit all of the equipment on the site and keeping truck turning radii in mind.

A new generator, conduit and wire will also be provided at this site. Refer to **Table 9-7** and **Section 9.3.7** for further details.

9.3.7 Generators

As mentioned previously, the topic of generators was discussed during the Electrical and I&C Design Meeting on September 28. During this meeting, the decision was made to include a new generator in the design for Well 16. The remaining well sites have existing generators that can supply all or some of the

existing loads. However, the existing generators do not have adequate capacity to power the larger pumps required to overcome the added headloss, which will be incurred due to the additional SBA treatment.

A diesel-fueled standby engine-generator set will be included in the design for all locations indicated in **Table 9-7**. The generators will be located outdoors, in close proximity of the electrical equipment, and will be connected to new/existing automatic transfer switches.

All new generators will be provided with an integral base-mounted diesel fuel storage tank that is UL-142 listed and has secondary containment. The fuel storage tank will be designed to operate for 24 hours at 75% load. The generator will be provided in an outdoor, weather-proof enclosure with sound attenuation to achieve a noise level of no more than 78 dBA at 23ft.

Source (utility, generator) switching will be open-transition. At no time will the two power sources be connected in parallel. A resistive load bank with automatic controller will be included as part of the standby engine-generator set equipment package for all new units. For the standby engine-generator set to be effectively exercised, it needs to be electrically loaded to 35% or more of its full load kW capacity to prevent a condition known as wet stacking. Wet stacking can violate the equipment warranty for the unit. The load bank will be used to load the engine-generator set in discrete steps automatically, so operations will not be interrupted.

9.4 Resin Regeneration Facility Electrical System

The Resin Regeneration Facility (RRF) is a new facility to be constructed as part of this project and will be located on a parcel of land on Avenue 52 (**Figure 9-13**). The facility will require a new electrical utility service from IID. Electrical service will likely be provided to the facility from the utility lines routed along Avenue 52.

Figure 9-13: Proposed Ave 52 RRF Location

Single line diagrams of the proposed new electrical distribution system are included as **Drawings E-501**, **E-502**, **E-503**, and **E-504** in **Appendix A**. Details of the distribution system are discussed in further detail below.

Appendix D presents a detailed listing of the planned RRF site loads for this project. Overall loads in Amperes (A) and Kilowatts (kW) for the proposed site equipment can be found at the top of each section throughout the load list. As evidenced by the load list, total operating load is summarized below in **Table 9-8**.

Table 9-8: Resin Regeneration Facility Electrical Loads Summary

	Connected Load				Demand Factor	Operating Load	
	HP	kW	kVA	FLA		FLA	kW
SWBD-REGEN-A	-	-	-	844	-	675	477
SWBD-REGEN-B	-	-	-	722	-	578	408
Total				**1566**		**1253**	**885**

The *operating* load values are calculated by multiplying the *connected* load by a *demand factor*. The demand factor allows for the connected load values to be de-rated to approximate a more realistic demand load. These demand factors also take into consideration the *firm capacity* of unit processes. Firm capacity is the installation of multiple units of equipment (e.g. pumps) to handle the entire treatment facility with the largest unit out of service. True demand load as measured by the serving electrical utility will be less than the operating load presented in the table.

9.4.1 Distribution Equipment

As shown on the single line diagrams, a utility service from IID will serve the site via an outdoor liquid-filled, pad-mount style transformer. The secondary voltage from the transformer will be 480/277VAC. It is expected a 1500kVA transformer will be provided.

Secondary conductors will be routed from the outdoor transformer to an outdoor utility metering switching section and a S. E. (Service Entrance) rated switchboard section (SWBD-MAIN) near the transformer. The load side of the utility breaker will be routed to a circuit breaker switchboard (SWBD-REGEN) located in the electrical room. SWBD-REGEN will be designed in a “Main-Tie-Main” configuration. Under normal operation, the utility main circuit breaker and tie circuit breaker are closed and the generator circuit breaker is open.

The main, tie, and generator circuit breakers will be electrically operated and will be controlled by an automatic transfer controller (ATC) located within the SWBD-REGEN. Switching to and from the standby generator will be open transition. Power monitoring and surge protection devices will be provided on the incoming main lines from the utility and the generator within SWBD-REGEN.

The SWBD-REGEN will be a 480VAC, 3-phase, 3-wire switchboard rated for 2000A. Molded case feeder circuit breakers will supply power to larger loads and the motor control centers (MCC-REGEN and MCC-BRINE). Larger loads include equipment such as power panelboards, HVAC loads, and air mixing compressors. **Drawings E-501** and **E-502** illustrate all of the loads to be served by SWBD-REGEN. The main-tie-main arrangement splits the process equipment between the ‘A’ bus and the ‘B’ bus.

SWBD-REGEN also includes feeder breakers to supply MCC-REGEN. For improved safety and maintenance procedures, the main circuit breakers at MCC-REGEN will be kirk-key interlocked with the tie circuit breaker in the MCC. The MCC-REGEN assembly will be a 480VAC, 3-phase, 3-wire motor control center rated for 600A. **Drawings E-503** and **E-504** illustrate the loads to be served by MCC-

REGEN. The full voltage non-reversing (FVNR) motor starters and VFDs for the pumps will be located in the MCC-REGEN structures. Power monitoring and surge protection devices will be provided on the incoming lines from the SWBD-REGEN in MCC-REGEN. Similar to SWBD-REGEN, the main-tie-main arrangement splits the process equipment between the 'A' bus and the 'B' bus.

SWBD-REGEN also includes feeder breakers to supply MCC-BRINE. MCC-BRINE will also be provided with main-tie-main circuit breakers, kirk-key interlocked with the tie circuit breaker. The MCC-BRINE assembly will be a 480VAC, 3-phase, 3-wire motor control center rated for 1200A. **Drawings E-601** and **E-602** illustrates the loads to be served by MCC-BRINE. The feeder circuit breakers for larger loads and VFD starters for the pumps will be located in the MCC-BRINE structures. Power monitoring and surge protection devices will also be provided.

Wall-mounted 480VAC 3-phase, 3-wire power panelboards will also be located in the main electrical room. These panelboards will provide power to MOV's, small treatment pumps, transformers, and other miscellaneous treatment equipment. An example power panelboard schedule is provided in **Drawing E-505**.

Floor-mounted dry-type transformers, currently sized at 30-45kVA, will supply lighting panelboards. The wall-mounted 208/120VAC, 150A, 3-phase, 4-wire lighting panelboards will supply instrumentation, lighting, receptacles, and other miscellaneous loads. An example lighting panelboard schedule is also provided in **Drawing E-505**.

9.4.2 Electrical Rooms

The main electrical room is located within the RRF building. It will contain the power distribution equipment, including the distribution switchboard SWBD-REGEN and motor control center MCC-REGEN. **Drawing E-500** provides the layout for this 45ft X 20ft electrical room. The liquid-filled, pad-mount style transformer and standby generator will be located outdoors, in close proximity to the electrical room.

There will also be an electrical room associated with the brine treatment portion of the building. **Drawing E-600** provides the layout for this 15ft X 25ft electrical room that will contain MCC-BRINE, starters and power distribution for the brine treatment process loads. MCC-BRINE will be supplied from SWBD-REGEN via a pair of molded case feeder circuit breakers.

The proposed location of the electrical rooms are shown on the mechanical drawings in **Appendix A**.

9.4.3 Generators

A diesel-fueled standby engine-generator set will be installed for the RRF. The generator will be located outdoors, in close proximity of the main electrical room, and will supply SWBD-REGEN.

The generator will be provided with an integral base-mounted diesel fuel storage tank that is UL-142 listed and has secondary containment. The fuel storage tank will be designed to operate for 24 hours at 75% load. The generator will be provided in an outdoor, weather-proof enclosure with sound attenuation to achieve a noise level of no more than 78 dBA at 23ft.

Source (utility, generator) switching will be open-transition. At no time will the two power sources be connected in parallel. A resistive load bank with automatic controller will be included as part of the standby engine-generator set equipment package. For the standby engine-generator set to be effectively exercised, it needs to be electrically loaded to 35% or more of its full load kW capacity to prevent a condition known as wet stacking. Wet stacking can violate the equipment warranty for the unit. The load bank will be used to load the engine-generator set in discrete steps automatically, so RRF operations will not be interrupted.

The standby engine-generator set will be sized to operate the entire RRF operation. It is currently sized at 1250kW.

9.5 Design Standards

The design standards detailed below will be used throughout the design for the CWA Hexavalent Chromium Treatment Facilities Project.

9.5.1 Lighting

For interior areas, LED fixtures will be specified and used for the lighting design. While the LED equivalents to linear fluorescent fixtures initially cost more, rebates exist in many areas to help offset the capital cost difference. No HID lighting systems will be designed for interior locations.

Emergency and exit lighting will be designed in accordance with NFPA 101 Life Safety Code requirements as well as NEC Article 700. Emergency units, consisting of a base and remote heads, and exit lights will be specified with battery back-up and will be connected to the same lighting circuit of general lighting in the space installed. Exit lights will be specified as LED style with red letters and white face.

Pole mounted fixtures controlled by a photocell system will be provided at the location of the standby engine-generators to illuminate the area so that night time maintenance or re-fueling can safely take place if the need should arise. Site lighting will be provided from a lighting contactor with an HOA bypass control switch and one photocell. These same fixtures will be provided to light the roadways, if desired by CWA.

9.5.2 Raceway and Wiring Systems

An area designation plan drawing for each area of work on the project will designate the areas considered wet process areas, dry process areas, dry non-process areas, type 1 and type 2 chemical storage/transfer areas. Specifications will list the required materials of construction for conduits, enclosures, boxes, and other general materials.

All conduit will be routed concealed in or under the slab. When ductbanks are specified, they will be concrete encased and reinforced. All exposed conduit will be rigid heavy wall aluminum. Schedule 40 PVC conduit will be installed in ductbanks for power and control conductors. Instrumentation cable will be installed in PVC coated rigid galvanized steel conduit when installed in ductbanks. All underground bends 45º and larger will be done with PVC coated rigid galvanized steel conduit, including risers, which

will extend 3”-6” above finished grade, depending on location. In no case shall aluminum conduit be in direct contact with concrete.

For lighting and receptacle wiring only, #12 AWG or #10 AWG solid wire with type THHN/THWN insulation will be specified. For all other applications, stranded type THHN/THWN wiring will be specified. In the special case of the wiring connected to the load side of VFDs, VFD cable will be specified.

9.5.3 Materials of Construction

Convenience receptacles will be located at 18” above finished floor (AFF) in control and electrical rooms and located at 48” AFF in process areas, parts storage areas, and restrooms. Metallic weatherproof in-use outlet covers will be specified for exterior receptacles.

Electrical equipment enclosures in outdoor and corrosive locations will be specified as NEMA 4X, 316-stainless steel. Other enclosures will be rated NEMA 1, NEMA 12, or NEMA 3R to suite the application. All enclosures will be specified as galvanized or stainless steel, depending on the application. Non-metallic enclosures will not be specified unless required within a chemical area.

Concrete housekeeping pads will be designed for all transformer and floor mounted electrical equipment installations.

9.5.4 Grounding

A comprehensive grounding and bonding system, including building counterpoises that bond to the building structural members and reinforcing steel in slabs, will be designed in accordance with NEC article 250. Electrical and mechanical equipment enclosures, handrails, stairways, transformers, and equipment ground busses will be bonded to the counterpoise ring. Equipment grounding conductors will be specified for all raceway systems.

The grounding counterpoise will be designed as #4/0 AWG stranded bare tinned copper wire with 5/8”x10’ copper clad ground rods and test wells. The overall grounding system ohmic resistance will be specified to not be greater than 5 ohms when measured after the surrounding earth has been dry for 48 consecutive hours. Connections to all buried conductors will be specified as exothermic weld type. Connections to ground rods will also be specified as exothermic weld type with one connection in each system a mechanical connection for system testing.

10. Instrumentation and Controls

The new chromium treatment facilities will be provided with instrumentation and controls to allow fully automatic operation. Remote manual control will also be possible, along with local manual controls that will allow operation in case the automatic controls are inoperative.

10.1 Existing Controls

The wells to be provided with chromium treatment are currently connected to CWA's existing Supervisory Control and Data Acquisition (SCADA) system for monitoring and control purposes. CWA uses Schneider Electric's Wonderware as the Human-Machine Interface (HMI) software. All wells are currently equipped with local controllers which will be evaluated for expansion or replacement during the detailed design phase of the project. The SCADA system communicates with the wells via radio links that are essentially line-of-sight. CWA staff reports that the radio link for Well 17 is problematic and experiences loss of communication during poor weather such as windstorms.

Wells 17 and 19 are operated to maintain system pressure. Wells 12 and 18 are operated based on their local reservoir levels, with their associated reservoir booster pumps being operated to maintain system pressure. Well 16 runs based on a timer and is only operated during peak demand periods. The wells are capable of being manually started and stopped via the SCADA system.

10.2 Proposed Controls

10.2.1 Wells

The new controls for the ion exchange treatment process will be coordinated with the existing well controls through an Ethernet communication link. All status, alarm, and operating data from the site will be transmitted to the SCADA system. The new chromium treatment facilities at each site will be provided with their own new PLC, manufactured by Allen-Bradley (Rockwell Automation) to match CWA's existing installed base. The new PLC will monitor and control all aspects of the treatment system. The project team will determine the overall control requirements for the wells as they operate within the CWA distribution system.

A locally mounted, graphical operator interface such as an Allen-Bradley PanelView Plus will be installed in the PLC cabinet for local access to the control system. The operator interface will not depend upon the SCADA system for operation, and so will be available for local monitoring and control even if SCADA communications are down. All automated equipment will have local manual controls as well as the ability to perform remote manual operation through the control system.

The bypass operation will be controlled through a flow signal to the electronic valve controller for a hydraulically operated flow control valve and based on an operator-entered bypass percentage setpoint. All isolation valves directing flow to the ion exchange treatment vessels will be provided with motor operators and will be controlled through the PLC. It will be possible for an operator to select a specific

operational mode, such as normal flow or backwash, and the control system will place the valves in the appropriate position. The chlorine feed system will be automatically flow paced.

The radio communication link for Well 17 will be checked for proper installation, antenna mounting and placement, and line-of-sight with the central receiver.

10.2.2 Resin Regeneration Facility

The Resin Regeneration Facility will be provided with a new PLC-based system that will provide for complete monitoring and control of the RRF. Like the wells, the PLCs will be manufactured by Allen-Bradley. PC-based operator workstations will be provided for operator interface, and will use the same Wonderware HMI software as the overall SCADA system.

Redundant servers located in the Regeneration Building control room will be provided for the HMI software. Virtualized servers are usually recommended, although this is not required. Virtualization is a software technique used to separate applications such as the HMI software from the hardware and operating system on which they run. Images of the server are regularly stored for ease of restoration in the event of hardware failure, malware attacks, or software upgrade malfunctions. Virtualization allows servers to be completely restored in a matter of one or two hours as opposed to the many hours or even days it would take to reload the operating system, the application software, and all associated updates and patches in the proper order.

The PLCs will be located close to the electrical motor controls for all equipment and/or the power panels for the motor operated valves to simplify and shorten the runs for cable and conduit. This would place one PLC each in the main electrical room, the regeneration area at the far end of the Regeneration Building, and in the electrical room for the Brine Treatment Building. Because the Regeneration Building is relatively small, the use of touchscreen operator interface panels in the PLC cabinets there would not be as useful as the corresponding units at the wells. If desired, however, they can be supplied. A touchscreen panel in the brine treatment PLC cabinet would be more useful.

Communications among the PLCs and servers for the HMI software will be through the industry standard Ethernet protocol. The layout of the building will allow for a convenient perimeter communication loop, which can be configured as a redundant, fault tolerant ring using either fiber optic cable or Category 6 (Cat 6) unshielded copper cable. Fiber is usually recommended because it is completely immune to electromagnetic interference and the incremental cost over copper cable is minimal. However, the low frequency of lightning strikes in the Coachella Valley makes copper cable a more viable option.

10.2.3 Field Instruments

The field instruments required for the well sites generally include various pressure devices, magnetic flow meters, and level instruments. Field instruments for the RRF will be much more extensive and will include those types of devices supplied for the wells plus other instruments such as radar level instruments, thermal mass flow meters, pH and conductivity analyzers, and residual chlorine analyzers. CWA has reported no specific preference for instrument manufacturers. Therefore, Hazen will suggest manufacturers based on experience and the firm's master specifications.

11. Maintenance of Plant Operations During Construction

The intent of this section is to outline the minimum requirements necessary to provide continuous groundwater pumping, water treatment, and finished water distribution for the CWA's SBA Treatment Sites throughout the construction of the Chromium Treatment Facilities.

Water pumping, treatment and distribution will be continuously maintained by CWA during the entire construction period as described below. Work will be scheduled and conducted by the Contractor so as not to impede any treatment process, reduce the quality of the finished water, or result in any other nuisances. Contractor will plan and schedule work to meet well site and distribution system operating requirements and the constraints as outlined below. Contractor will be responsible for coordinating the general construction and mechanical, electrical and instrumentation construction schedules and for ensuring that permanent or temporary power is available for all existing, proposed, and temporary facilities that are required to be on-line at any given time.

For the majority of the well sites, all groundwater pumping and treatment processes will be maintained in continuous operation during the construction period except during approved process interruptions. Other well sites will require long-term shutdowns for pump replacement or major electrical work.

Contractor must schedule short-term and long-term shutdowns in advance and must present all desired shutdowns in the 30 and 60-day schedules at the progress meetings. Shutdowns must be fully coordinated with CWA at least 48 hours before the scheduled shutdown. CWA personnel will operate CWA's facilities involved in the short-term and long-term shutdowns and diversions.

Short term shutdowns in well site flow will be allowed for tie-ins to existing facilities, etc. All such shutdowns must be scheduled with CWA and must be limited to eight (8) hours or less depending on distribution system demand and storage volume in the distribution system. Any shutdown of a duration longer than eight (8) hours will be defined as a long-term shutdown.

CWA will have the authority to order work stopped or prohibited that would, in their opinion, unreasonably result in interrupting the necessary functions of system operations.

11.1 Specific Operational Constraints

Listed in this section are specific construction constraints required for the different project components. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements and constraints, and construction requirements.

11.1.1 Well Sites to be Taken Offline during Construction

All well sites will require shutdowns to allow for the replacement of manifold components, the relocation of electrical components, and modifications to the pump to waste systems. Several sites will require long term shutdowns for pump replacements as described in **Section 5**.

Some of the well sites will also require significant electrical modifications. For these sites, the well site will be taken offline while electrical modifications are being performed.

A shutdown of an individual wellsite under average demand conditions will typically not impair the ability of the overall system to meet demands. However the combined shutdown of a number of wells in an average demand conditions or the shutdown of any well during peak demand conditions could lead to inability to meet system demand. These limitations unique for each pressure zone, but related to one another. A detailed discussion of these limitations is provided below.

11.1.2 Sequence of Work

Shutdowns must be limited within each pressure zone to prevent creating supply shortages within the zone.

Low Pressure Zone

All five active wells that serve this pressure zone are receiving treatment facilities. Well 18 must be handled uniquely as it serves both the Low and 150 Zone through the Well 18 Booster Station. During maximum demand months, none of the wells may shutdown for a long term duration without the provision of supply mitigation. Potentially mitigation measures include (1) running the currently inactive Well 11, (2) upgrading the Well 12 Booster Station and/or Well 18 Low Zone Booster Station, (3) upgrading the existing pressure reducing station, or (4) a combination thereof. During average or lower demand months, up to one (1) well may be shutdown for a long term duration at any point in time.

150 Pressure Zone

The sole well that serves this pressure zone is receiving treatment facilities, which is Well 18, through the Well 18 150 Zone Booster Station. As this well is the sole source of supply to the 150 Zone, it may not be shutdown for a long term duration during maximum demand months. During average or lower demand months, Well 18 may not be shutdown for any period longer than two (2) days, unless a reliable, continuous supply of water is introduced into the 150 Zone with a firm capacity capable of meeting the required demands. Prior to any shutdown of Well 18, a stand-by source of water with back-up must be prepared, for example, a temporary pump with stand-by pump and emergency generator capable of boosting water from the Low Zone into the 150 Zone. Also, the 1.5 MG Dillion Road Reservoir must be filled completely prior to any shutdown.

12. Opinion of Probable Cost

This section presents the Base Estimate for the Project and associated Operations and Maintenance (O&M) Costs. Hazen and Sawyer's Cost Estimating Group developed a Base Estimate that reflects the project scope at the 15% design stage. The Base Estimate is typically conservative and can be used by the owner to budget for the construction of the project. In general, the Base Estimate is the statement of probable cost based on previous experience, current available information from trusted sources, project location, project-specific conditions, and fixed period.

- Labor is based on current prevailing wage rates for Riverside County as determined by State of California Department of Industrial Relations.
- Equipment rates are based on current published rental rates as listed in the AED Blue Book, supplemented by RS Mean's data, CalTrans and the AED Green Book and local rental suppliers.
- Crews, equipment and productivity used for work items are based mostly on standards specific to each trade. Construction references are available, such as Walker' Building Estimating Reference Book, MCAA, and NECA published man hours. Some information is supplemented by RS Mean's data and modified where necessary by estimator judgment.
- Material costs are based on vendor quotes, historical data, and construction references, such as R.S. Means and EPIC database.
- Markups include overhead, profit, bond and insurance, escalation to midpoint of construction, and design contingency. Escalation is based on historical average of 3% per year.

12.1 Capital Cost

A summary of capital costs for the SBA Treatment sites and the CWA RRF Options is provided in **Table 12-1** and **Table 12-2**. The estimate is considered an AACE Class 3 level estimate. Class 3 typically has an accuracy range of -20% to +30%. A 20% design contingency has been added to the estimate based on current status of the design documents, the nature of the project and the estimate classification.

12.1.1 SBA Treatment

Assumptions:

- Well pump replacement cost is based upon assumed pump horsepower
- Assume reuse of excavated material as backfill
- Assume no hazardous or contaminated soil onsite
- Assume excess excavated material is disposed of offsite at a landfill or similar facility
- Site lighting number and location is assumed
- Buried yard piping is assumed direct buried with a gravel bed, but no concrete encasement or cradle
- Aboveground conduit is 3/4-inch rigid galvanized steel, duct bank conduit is 4-inch PVC

- Routing of aboveground conduits and duct banks are assumed based upon location of equipment and electrical equipment
- Power wire number and sizing is assumed at 3 #12 gauge wires per unit, and control wire size is assumed to be #14 gauge.
- Canopies are steel frame with stucco undercoating and terra cotta tile roof
- Electrical buildings are wood frame buildings with stucco finish and terra cotta tile roof, no HVAC or insulation is provided
- Electrical buildings are provided at Well Sites 16, 17 and 19

Cost Basis:

- Bag filter costs are based upon a quote from Eaton
- IX vessel costs are based upon the average cost of quotes from Calgon, Evoqua, and Loprest and include resin traps
- Resin costs are based upon resin costs from Purolite from 2015
- Rebar is assumed at 150 lbs/cy

12.1.2 CWA RRF (Option A)

Assumptions:

- Assumed dewatering is required for Regeneration Building
- Assumed excavated material will be reused for backfill as possible, and an excess disposed offsite at a land fill or other facility
- Shelf spares were included for all pumping systems
- Assume no hazardous or contaminated soil onsite
- Buried yard piping is assumed direct buried with a gravel bed, but no concrete encasement or cradle
- Aboveground conduit is 3/4-inch RGS, duct bank conduit is 4-inch PVC
- Routing of aboveground conduits and duct banks are assumed based upon location of equipment and electrical equipment
- Power wire number and sizing is assumed at 3 #12 gauge wires per unit, and control wire size is assumed to be #14 gauge.

Cost Basis:

- Standby diesel generator is based upon 2,500 kW generator quote from HO Penn from 2014, escalated to 2016 and factored to specific capacity
- Pricing for resin hauling trucks and trailers is based on a budgetary quote from Peterbilt and Polar Tank, respectively.
- Pricing for GAC vessels is based on a budgetary quote from Lyons Filter.
- Pricing for ductile iron piping and valves is from Hazen and Sawyer database.
- Pricing for transfer pumps is based on a budgetary quote from FlowRox. A shelf spare was included for this system.
- Pricing for regen vessels is based on a budgetary quote from Lyons Filter.
- Pricing for cartridge filters is based on a budgetary quote from Eaton.

- Pricing for FRP tanks is based on a budgetary quote from Belco, factored to specific capacity.
- Pricing for brine recycle tank air mixing system is based on a budgetary quote from Pulsair.

12.1.3 CWA RRF (Option B)

Assumptions for the CWA RRF Option B include those for Option A and the following:

- Pricing for filter press feed pumps is based on a budgetary quote from Flowrox. A shelf spare was included for this system.
- Pricing for plate and frame filter press is based on a budgetary quote from Evoqua.
- Pricing for electrocoagulation system is based on a budgetary quote from Powell Water System.
- Assumed the material for treated brine tanks and buffer tanks is FRP; pricing is based on budgetary quote from Belco, factored to specific capacity.

Table 12-1: Capital Cost Breakdown

Description	
Well Site 12	***$2,629,533***
Sitework/Yard Piping	*$666,418*
Chemical Building	*$66,661*
Electrical	*$53,874*
IX Treatment	*$1,705,783*
Canopy	*$136,796*
Well Site 16	***$2,632,162***
Sitework/Yard Piping	*$443,872*
Chemical Building	*$66,580*
Electrical Building	*$309,588*
IX Treatment	*$1,665,783*
Canopy	*$136,796*
Well Site 17	***$2,655,542***
Sitework/Yard Piping	*$451,747*
Chemical Building	*$66,580*
Electrical Building	*$309,588*
IX Treatment	*$1,690,830*
Canopy	*$136,796*
Well Site 18	***$2,562,761***
Sitework/Yard Piping	*$762,464*
Chemical Building	*$66,732*
Electrical	*$55,101*
IX Treatment	*$1,541,667*
Canopy	*$136,796*

Well Site 19	***$2,599,466***
Sitework/Yard Piping	*$404,697*
Chemical Building	*$67,020*
Electrical Building	*$305,464*
IX Treatment	*$1,685,489*
Canopy	*$136,796*
Well Sites Subtotal:	***$13,080,000***
Option B - CWA RRF with Regeneration	***$15,130,000***
Utility Feed and Generator	*$1,685,109*
Site Improvements (Paving, Landscaping, Fencing, Ductbanks)	*$1,284,748*
Electrical (Including MCC, Switchgear, electrical equipment)	*$1,764,844*
Regeneration Building	*$5,521,564*
Makeup Feed	*$2,521,799*
Regeneration Process	*$2,350,279*
Total Well Sites + Option B:	**$28,210,000**
Option C - CWA RRF with Regeneration and Brine Treatment	***$20,910,000***
Option B - Regeneration	*$15,130,000*
Brine Treatment Building	*$2,695,905*
Brine Treatment Process	*$3,075,137*
Total Well Sites + Option C:	***$33,990,000***

Table 12-2: Capital Cost Summary (Millions)

	Option A – CVWD CRRF[1]	Option B – CWA RRF with Regen	Option C – CWA RRF with Regen and Brine Treatment
SBA Treatment Sites	$13.1	$13.1	$13.1
CWA RRF	-	$15.1	$20.9
TOTAL	$13.1	$28.2	$34.0

[1]Capital cost for Option A - CVWD CRRF includes SBA well sites only, the capital cost for the CVWD CRRF would be reflected in an O&M agreement between CVWD and CWA as described in Section 12.2 below.

12.2 Annual O&M

A summary of annual O&M costs for the SBA Treatment sites and the CWA RRF Options is provided in **Table 12-3.**

- **Well Utilization and Regeneration Frequency**: CWA's average well utilization was used to develop the O&M estimates (2013 averages range from 29 to 83%). Based on the average production and specific well water quality, regeneration frequencies ranged from 7 regenerations a year to 22 regenerations a year, or a total of 67 regenerations a year for all five of CWA wells.

- **Labor**: Treatment labor estimates were based on 2, 4, and 6, full-time equivalents (FTEs) for Options A, B, and C, respectively. These estimates represent 2 FTEs for maintaining SBA Treatment at the five well sites, 2 FTEs for the resin transfer team, 2 FTEs for the resin regeneration operations, and 2 FTEs for the brine treatment operations. Salary estimates were based on the U.S. Bureau of Labor Statistics average salary for a Water Operator in the State of California and an assumed burdened rate of 1.6 ($65,500*1.6 = $105,000).
- **Residuals**:
    - Regeneration frequency was estimated based on average CWA well production and a treatment target Cr(VI) concentration of 6 ppb resulting in 67 regenerations per year. Actual regeneration frequency can be optimized by modifying well utilization to prioritize use of the higher quality wells to meet the Cr(VI) MCL.
    - Hazardous brine hauling was estimated based on a quote from Clean Harbors at $3.00/gallon. Lower estimates have been obtained during past evaluations; however, those estimates have been updated based on budgetary quotes for a specific brine quality. Specifically, the vendor was required to accept uranium concentrations in the hazardous brine in excess of 5 mg/L.
    - Backwash and rinse water flows (and treated brine in Option C) would be sent to the WWTP. A cost of $0.01/gallon was reflected in the estimate to account for treating these flows at the WWTP.
    - Iron Solids are generated during brine treatment in Option C. Solids generation and quality were estimated based on a projected CWA brine water quality and the estimated iron dose to meet treatment objectives in the brine. The estimate includes an iron dose of 5 g/L in the EC unit that will generate approximately 1.2 tons of solids per regeneration. These solids will be classified as a TENORM waste with an associated disposal cost of $482/ton at Clean Harbor. There is the potential to generate a LLRW depending on the uranium concentrations in the brine, which would increase the solids disposal cost to $2,271/ton at Energy Solutions.
- **Chemicals**:
    - Sodium hypochlorite is already used for disinfection at CWA well sites. It will also be used at the CWA RRF in small quantities (approximately 2 gallons of 12.5% per regeneration) for disinfection of the resin transfer tanker trucks.
    - Sodium Chloride (salt) solution is used to regeneration the spent resin at the CWA RRF. The regeneration process uses a 12% salt solution, requiring approximately 4500 pounds of salt per regeneration.
    - Granular activated carbon (GAC) is used to remove the chlorine residual from the potable water source that is used as feed water for the regeneration process. It is estimated that 1350 cf of GAC will need to be replaced every two years for this process.
    - Iron blades are dissolved in the EC process to treat the spent brine at the CWA RRF in Option C. It is estimated that for a 5 g/L iron dose, 188 pounds of iron blades will be consumed for each regeneration.

  - Hydrochloric Acid is used periodically to clean the iron blades in the EC process. The acid can be recycled for multiple uses and it is estimated that six, 500 gallon totes will be consumed for a year of brine treatment operations in Option C.

- **Energy**: Energy costs were estimated at $0.119 per KWh. Energy costs associated with this project include the increased electricity consumption from the higher horsepower motors at the wells (needed to overcome the headloss of SBA treatment without losing capacity) and operations of the CWA RRF facility.
- **Replacements**: The SBA treatment process includes bag filters to remove sand and silt from the well water prior to the resin vessels. The bags are replaced periodically based on a pressure differential set point. Although the resin is regenerated to restore its capacity for Cr(VI) removal, there is typically a resin performance warranty and the resin must be periodically replaced. These estimates assume resin replacement every seven years.
- **Analytical**: There will be increased analytical monitoring associated with SBA treatment. This includes monitoring of the treatment effluent and in Options B and C, monitoring of the brine and iron solids.
- **Regeneration Contract:** cost estimates for utilizing the CVWD CRRF in Option A were based on costs presented at a Regional Chromium Meeting hosted by CVWD on August 18, 2016 **(Appendix E)**. The costs presented by CVWD ranged from $12,900/regeneration to $27,500/regeneration based on CVWD's estimated O&M and O&M plus capital. For the purposes of this estimate, the rate of $27,500/regeneration was used.

Table 12-3: O&M Cost Summary

	Option A – CVWD CRRF	Option B – CWA RRF with Regen	Option C – CWA RRF with Regen and Brine Treatment
Labor	0.42	0.63	0.74
Residuals	-	0.90	0.16
Chemicals	-	0.02	0.03
Energy	0.13	0.19	0.19
Replacements	0.20	0.20	0.20
Analytical	0.12	0.13	0.14
Maintenance			
Regeneration Contract	1.83	-	-
TOTAL	**$2.7**	**$2.1**	**$1.5**

12.3 Lifecycle

To compare CWA options for resin regeneration, lifecycle costs were estimated as the sum of the capital debt service plus the annual O&M. These annualized costs assume a DWSRF 30-year loan at 1.6% interest (**Table 12-4**). CWA is actively pursuing grants for this project. By obtaining grants for a CWA RRF, the lifecycle costs of those options will decrease.

Table 12-4: Annualized Lifecycle Costs ($Millions/Year)

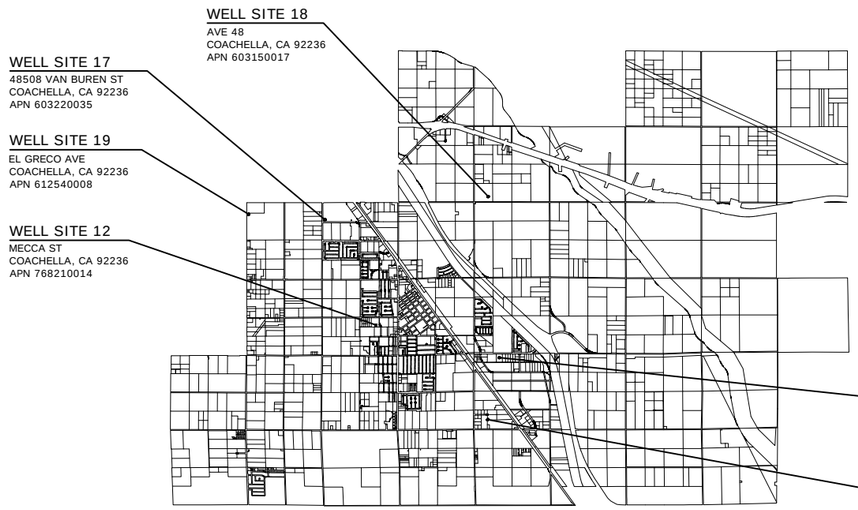
	Option A – CVWD CRRF	Option B – CWA RRF with Regen	Option C – CWA RRF with Regen and Brine Treatment
CAPITAL	$13.1	$28.2	$34.0
O&M	$2.7	$2.1	$1.5
LIFECYCLE	$3.3	$3.3	$2.9

Appendix A: 15 Percent Drawings

CITY OF COACHELLA

RIVERSIDE COUNTY, CALIFORNIA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT



VICINITY MAP
1" = 1 MILE

BASIS OF DESIGN REPORT
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REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	E. DOLE
DRAWN BY:	K. OVERBY
CHECKED BY:	S. GHIU

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

MECH SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

GENERAL COVER

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: G-001

File: \\172.20.210\PROJECTS\20050-RIA\20050-003\DRAWINGS\GEN\G-001 Saved By: KOVERBY Save Date: 2016/11/09 9:30 AM

GENERAL

DWG NO	DWG TITLE
G-001	COVER
G-002	DRAWING INDEX
G-003	ABBREVIATIONS, SYMBOLS, AND LEGENDS
STRONG BASE ANION TREATMENT SITES	
G-004	PROCESS FLOW DIAGRAM
RESIN REGENERATION FACILITY	
G-005	PROCESS FLOW DIAGRAM - MAKEUP FEED
G-006	PROCESS FLOW DIAGRAM - REGENERATION PROCESS
G-007	PROCESS FLOW DIAGRAM - SPENT BRINE HANDLING

CIVIL

DWG NO	DWG TITLE
WELL SITE 12	
C-122	SITE PLAN
WELL SITE 16	
C-162	SITE PLAN
WELL SITE 17	
C-172	SITE PLAN
WELL SITE 18	
C-182	SITE PLAN
WELL SITE 19	
C-192	SITE PLAN
RESIN REGENERATION FACILITY	
C-300	SITE PLAN

MECHANICAL

DWG NO	DWG TITLE
RESIN REGENERATION FACILITY	
M-500	OVERALL ISOMETRIC VIEW
M-501	ISOMETRIC VIEW
M-502	OVERALL PLAN
M-503	SECTIONS
BRINE TREATMENT BUILDING	
M-600	ISOMETRIC VIEWS
M-601	BOTTOM PLAN
M-602	TOP PLAN
M-603	SECTIONS

ELECTRICAL

DWG NO	DWG TITLE
GENERAL	
E-001	LEGEND AND SYMBOLS
E-002	ABBREVIATIONS AND GENERAL NOTES
WELL SITE 12	
E-121	EXISTING AND MODIFIED SINGLE LINE DIAGRAMS
WELL SITE 16	
E-161	DEMOLITION AND MODIFIED SINGLE LINE DIAGRAMS
E-162	SWBD ELEVATION AND ELECTRICAL BUILDING PLAN
WELL SITE 17	
E-171	DEMOLITION AND MODIFIED SINGLE LINE DIAGRAMS
E-172	SWBD ELEVATION AND ELECTRICAL BUILDING PLAN
WELL SITE 18	
E-181	EXISTING AND MODIFIED SINGLE LINE DIAGRAMS
WELL SITE 19	
E-191	DEMOLITION AND MODIFIED SINGLE LINE DIAGRAMS
E-192	SWBD ELEVATION AND ELECTRICAL BUILDING PLAN
RESIN REGENERATION FACILITY	
E-500	ELECTRICAL ROOM PLAN
E-501	SWBD SINGLE LINE DIAGRAM
E-502	SWBD ELEVATION
E-503	MCC SINGLE LINE DIAGRAM
E-504	MCC ELEVATION
E-505	PANEL SCHEDULES
BRINE TREATMENT BUILDING	
E-600	ELECTRICAL ROOM PLAN
E-601	MCC SINGLE LINE DIAGRAM
E-602	MCC ELEVATION

INSTRUMENTATION

DWG NO	DWG TITLE
GENERAL	
I-001	SYMBOLS AND LEGEND
STRONG BASE ANION TREATMENT	
I-100	PRETREATMENT
I-101	IX AREA
I-102	SODIUM HYPOCHLORITE DOSING SYSTEM
I-103	PRODUCT WATER

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GENERAL DRAWING INDEX

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	G-002

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ABBREVIATIONS

A	
AB	ANCHOR BOLT
AC	ALTERNATING CURRENT
ACT	ACOUSTIC TILE
AD	AREA DRAIN
ADDL	ADDITIONAL
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AGGR	AGGREGATE
AL	ALUMINUM
ALLOW	ALLOWANCE OR ALLOWABLE
ALT	ALTERNATE
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASB	ASBESTOS
ASPH	ASPHALT
AT	ASPHALT TILE
B	
B	BORING
BD	BOARD
BFE	BOTTOM OF FITTING ELEVATION
BFV	BUTTERFLY VALVE
BITUM	BITUMINOUS
BL	BASELINE OR BUILDING LINE
BLDG	BUILDING
BLK	BLOCK
BM	BENCH MARK
BOC	BACK OF CURB
BOT	BOTTOM
BRG	BEARING
BRK	BRICK
BRZ	BRONZE
BSMT	BASEMENT
BT	BOLT
BUR	BUILT-UP ROOFING
BV	BALL VALVE
C	
C	CLOSET/CARPET/CHANNEL
CAB	CABINET
CAVRV	COMBINATION AIR/VACUUM RELIEF
CB	CATCH BASIN
CC	CENTER TO CENTER
CE	CONSTRUCTION EASEMENT
CEM	CEMENT
CER	CERAMIC
CF	CUBIC FEET
CFM	CUBIC FEET PER MINUTE
CI	CAST IRON OR CUBIC INCHES
CIP	CAST IRON PIPE
CL	CENTER LINE
CL_2	CHLORINE
CLG	CEILING
CLKG	CAULKING
CLR	CLEAR
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE
CONST	CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACTOR
CORP	CORPORATION
CORR	CORRIDOR
CP	CONCRETE PLANK
CRS	COURSE
CT	CERAMIC TILE
CTJ	CONTROL JOINT
CU	COPPER
CV	CHECK VALVE
CW	COLD WATER
CY	CUBIC YARD
D	
DC	DIRECT CURRENT
DET	DETAIL
DF	DRINKING FOUNTAIN
DIA (Ø)	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DISCH	DISCHARGE
DIST	DISTRIBUTION
DJ	DOUBLE JOIST
DL	DEAD LOAD
DN	DOWN
DO	DISSOLVED OXYGEN
DOZ	DOZEN
DR	DOOR
DWG	DRAWING
DWL	DOWEL

E	
E	EAST OR EASEMENT
EA	EACH
ECC	ECCENTRIC
EF	EACH FACE
EFF	EFFLUENT
EIP	EXIST IRON PIPE
EL OR ELEV	ELEVATION
ELEC	ELECTRIC OR ELECTRICAL
ELL	ELBOW
ENGR	ENGINEER
ENT	ENTRANCE
EOG	EDGE OF GRAVEL
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQPT	EQUIPMENT
EW	EACH WAY
EX/EXIST	EXISTING
EXC	EXCAVATE
EXH	EXHAUST
EXP	EXPANSION
EXT	EXTERIOR
F	
FAB	FABRICATE
FB	FLAT BAR
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FC	FLUSHING CONNECTION
FD	FLOOR DRAIN
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FF	FINISH FLOOR
FH	FIRE HYDRANT
FIN	FINISH
FIX	FIXTURE
FL	FLASHING OR FLOOR
FLEX	FLEXIBLE
FLG	FLANGE
FLGxFLG	FLANGE BY FLANGE
FLGxPE	FLANGE BY PLAIN END
FLUOR	FLUORESCENT
FLXC	FLEXIBLE CONNECTION
FM	FORCE MAIN
FPRF	FIREPROOF
FRP	FIBERGLASS REINFORCED POLYESTER LAMINATE
FT	FEET
FTG	FOOTING OR FITTING
FURR	FURRING OR FURRED
G	
G	GAS OR GAS LINE
GA	GAUGE
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GEN	GENERATOR
GI	GALVANIZED IRON
GL	GLASS
GPM	GALLONS PER MINUTE
GR	GRADE
GV	GATE VALVE
GW	GUY WIRE
GWB	GYPSUM WALL BOARD
GWF	GLAZED WALL FINISH
GYP	GYPSUM
H	
H	HEIGHT
HDW	HARDWARE
HEX	HEXAGONAL
HM	HOLLOW METAL
HORZ	HORIZONTAL
HP	HORSEPOWER
HPT	HIGH POINT
HSS	HOLLOW STRUCTURAL SECTION
HTR	HEATER
HVAC	HEATING,VENTILATION AND AIR CONDITIONING
HW	HOT WATER
HWL	HIGH WATER LEVEL
HWY	HIGHWAY
HYD	HYDRAULIC, HYDRANT

I	
I	IRON
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INCL	INCLUDED
INF	INFLUENT
INS	INSULATION
INT	INTERIOR
INV	INVERT
J	
J	JOIST
JB	JUNCTION BOX
JCT	JUNCTION
JT	JOINT
L	
L	LENGTH OR ANGLE
LA	LINE AHEAD
LAB	LABORATORY
LAM	LAMINATED
LAT	LATERAL
LAV	LAVATORY
LB	POUND OR LINE BACK
LF	LINEAR FEET
LG	LONG
LL	LIVE LOAD
L/L	LEAD / LAG
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LP	LIGHT POLE
LPT	LOW POINT
LR	LONG RADIUS
LT	LIGHT
LTG	LIGHTING
LVR	LOUVER
LWL	LOW WATER LEVEL
M	
MAINT	MAINTENANCE
MATL	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MEMB	MEMBRANE
MET	METAL
MFR	MANUFACTURER
MG	MILLION GALLONS
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MJxFLG	MECHANICAL JOINT BY FLANGE
MJxMJ	MECHANICAL JOINT BY MECHANICAL JOINT
MJxPE	MECHANICAL JOINT BY PLAIN END
MJxRJ	MECHANICAL JOINT BY RESTRAINED JOINT
MLDG	MOLDING
MO	MASONRY OPENING
MOD	MODIFY OR MODIFIED
MON	MONUMENT
MOT	MOTOR
MOV	MOTOR OPERATED VALVE
MTD	MOUNTED
MTG	MOUNTING
MULT	MULTIPLE
N	
N	NORTH
NA	NOT APPLICABLE
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NPW	NON POTABLE WATER
NTS	NOT TO SCALE
O	
OC	ON CENTER
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
OFF	OFFICE
OPER	OPERATOR
OPNG	OPENING
OPP	OPPOSITE
ORIG	ORIGINAL
OT	OPEN TRUSS
OVHD	OVERHEAD
OVS	OVERSIZE

P	
PAR	PARALLEL
PC	POINT OF CURVE OR PIECE
PCC	POINT OF COMPOUND CURVE
PCF	POUNDS PER CUBIC FOOT
PD	PULSATION DAMPENER
PE LINING	POLYETHYLENE LINING
PERF	PERFORATED
PERP	PERPENDICULAR
PI	POINT OF INTERSECTION
PL	PROPERTY LINE OR PLATE
PNL	PANEL
PP	POWER POLE
PREFAB	PREFABRICATED
PRV	PRESSURE RELIEF VALVE
PS	PUMPING STATION
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENT, POINT OR PAINT
PTN	PARTITION
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PW	POTABLE WATER
Q	
QTY	QUANTITY
R	
R	RADIUS OR RISER
RCP	REINFORCED CONCRETE PIPE
RD	ROAD OR ROOF DRAIN
RECIR	RECIRCULATION
RECP	RECEPTACLE
RECT	RECTANGULAR
RED	REDUCER
REF	REFERENCE
REG	REGISTER
REINF	REINFORCING
REM	REMOVE
REQD	REQUIRED
REST	RESTRAINED
REV	REVISE
RF	ROOF
RFG	ROOFING
RJ	RESTRAINED JOINT
RJxFLG	RESTRAINED JOINT BY FLANGE
RJxPE	RESTRAINED JOINT BY PLAIN END
RJxRJ	RESTRAINED JOINT BY RESTRAINED JOINT
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RT	RIGHT
RTU	REMOTE TERMINAL UNIT
RW	RAW WATER
R/W	RIGHT OF WAY
S	
S	SOUTH OR SLOPE
SAN	SANITARY
SBL	SURVEY BASELINE
SCH	SCHEDULE
SD	STORM OR SITE DRAIN
SECT	SECTION
SERV	SERVICE
SEW	SEWER
SF	SQUARE FEET
SHT	SHEET
SI	SQUARE INCH
SIM	SIMILAR
SJ	STEEL JOIST
SPEC	SPECIFICATION
SQ	SQUARE
SS	SANITARY SEWER
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STG	STORAGE
STIR	STIRRUP
STL	STEEL
STR	STRUCTURAL
SUB	SUBSTITUTE
SUP	SUPPLY
SUPT	SUPERINTENDENT
SUR	SURFACE
SUSP	SUSPENDED
SW	SWITCH
SWBD	SWITCHBOARD
SWD	SIDE WATER DEPTH
SYM	SYMMETRICAL

T	
T	TREAD
T1	TRAIN 1
T2	TRAIN 2
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
TAN	TANGENT
TBM	TEMPORARY BENCH MARK
TC	TOP OF CURB
TDH	TOTAL DYNAMIC HEAD
TECH	TECHNICAL
TEL	TELEPHONE
TEMP	TEMPERATURE
TER	TERRAZZO
THERMO	THERMOSTAT
THK	THICK
THRU	THROUGH
TOD	TOP OF DECK
TOF	TOP OF FOOTING
TOM	TOP OF MASONRY OR MANHOLE
TOS	TOP OF SLAB/STEEL
TOW	TOP OF WALL
TOL	TOLERANCE
TPS	TWISTED PAIR SHIELDED
TRANS	TRANSFORMER
TYP	TYPICAL
U	
UG	UNDERGROUND
UH	UNIT HEATER
UNFIN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UR	URINAL
UTIL	UTILITY
V	
VAC	VACUUM
VAT	VINYL ASBESTOS TILE
VCP	VITRIFIED CLAY PIPE
VEL	VELOCITY
VENT	VENTILATING OR VENTILATION
VERT	VERTICAL
VOL	VOLUME
VP	VENT PIPE
VWC	VINYL WALL COVERING
W	
W	WEST, WIDTH OR WIDE FLANGE
W/	WITH
WC	WATER CLOSET
WF	WIDE FLANGE
WH	WALL HYDRANT
WI	WROUGHT IRON
WL	WATER LEVEL
W/L	WATER LINE
WO	WINDOW OPENING
W/O	WITHOUT
WP	WATERPROOF
WPFG	WATER PROOFING
WPT	WALL PENETRATING TYPE
WSE	WATER SURFACE ELEVATION
WSP	WEATHERSTRIP
WT	WEIGHT
WV	WATER VALVE
WWF	WELDED WIRE FABRIC
Y	
YD	YARD
YR	YEAR

LINE TYPES

- PROPOSED ITEMS
- EXISTING ITEMS
- HIDDEN ITEMS
- DEMOLITION ITEMS
- CENTER LINE
- MATCH LINE

PROCESS PIPE DESIGNATIONS

ARD	AIR RELEASE DRAIN
BYP	BYPASS
BR	BRINE RECYCLE (NEAT BRINE)
BRES	BRINED RESIN
BRM	BRINE RECYCLE MAKEUP
BWD	BACKWASH DRAIN
BWOF	BACKWASH OVERFLOW
BWR	BACKWASH RECOVERY
BWREM	BACKWASH REMNANT
BWREMOF	BACKWASH REMNANT OVERFLOW
BWS	BACKWASH SUPPLY
BWW	BACKWASH WASTE
CA	COMPRESSED AIR
D	DRAIN
DIS	DISTILLATE
DRN	TREATED BRINE DRAIN
DSW	DECHLORINATED SERVICE WATER
ECD	ELECTROCOAGULATION DRAIN
FC	FERROUS CHLORIDE
FD	FLOOR DRAIN
FILL	TANK TRUCK FILL
FILLOF	TANK TRUCK OVERFLOW
FPABR	FILTER PRESS AIR BLOW RETURN
FPF	FILTER PRESS FILTRATE
FR	FAST RINSE
FRB	FAST RINSE RECYCLE TO BRINE
FRR	FAST RINSE RECYCLE
FW	FEED WATER
FWD	FEED WATER DRAIN
FWOF	FEED WATER OVERFLOW
FWRECIRC	FEED WATER RECIRCULATION
HCL	HYDROCHLORIC ACID
HF	HIGH FLOW
IWR	INTERNAL WATER REUSE
LF	LOW FLOW
MD	MEDIA DISCHARGE
MF	MEDIA FILL
MU	MULTI-USE
NPW	NON-POTABLE WATER
OF	OVERFLOW
PA	PROCESS AIR
POLY	POLYMER
PRD	PRESSURE RELEASE DRAIN
PW	POTABLE WATER
RD	ROOF DRAIN
RRES	REGENERATED RESIN
RW	RAW WATER
S	SAMPLE
SB	SATURATED BRINE
SBS	SODIUM BISULFITE
SBM	SATURATED BRINE MAKEUP
SBR	SPENT BRINE RECYCLE
SBT	SPENT BRINE TREATMENT
SD	STORM DRAIN
SDW	SOLID DEWATER
SH	SODIUM HYDROXIDE
SHC	SODIUM HYPOCHLORITE
SHCR	SODIUM HYPOCHLORITE RECYCLE
SOFT	SOFTENED WATER
SOFT WASTE	SOFTENED WATER WASTE
SPD	SUMP PUMP DISCHARGE
SR	SLOW RINSE
SRB	SLOW RINSE RECYCLE TO BRINE RECYCLE
SRES	SPENT RESIN
SRM	SLOW RINSE MAKEUP
SROF	SLOW RINSE OVERFLOW
SRR	SLOW RINSE RECYCLE
SS	SANITARY SEWER
STRES	STORED RESIN
TB	TREATED BRINE
TBD	TREATED BRINE DILUTION
TEC	TREATED ELECTROCOAGULATION
TRD	TROUGH DRAIN
TTD	TANK TRUCK DRAIN
VENT	TANK VENT
VRES	VIRGIN RESIN

LEGEND

MATERIALS

- GRADE OR EARTH
- ROCK
- ASPHALT PAVING
- STEEL
- SAND
- INSULATION
- GRAVEL
- WATER SURFACE
- CONCRETE
- GRATING
- CONC FILL OR GROUT
- CHECKERED PLATE
- CONC MASONRY UNIT
- GLASS
- BRICK
- WOOD BLOCKING

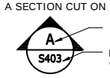
SYMBOLS

- GATE VALVE
- BUTTERFLY VALVE
- PLUG VALVE (NORMALLY OPEN)
- PLUG VALVE (NORMALLY CLOSED)
- SWING CHECK VALVE
- GLOBE VALVE
- PINCH VALVE
- DIAPHRAGM VALVE
- BALL VALVE
- BALL CHECK VALVE
- HARNESSED FLANGED ADAPTER
- HARNESSED SLEEVE TYPE COUPLING
- SLEEVE TYPE COUPLING
- HARNESSED FLEXIBLE COUPLING
- WALL PENETRATION
- MECHANICAL COUPLING
- WELDED JOINT
- FLANGED JOINT
- MECHANICAL, PUSH ON OR RESTRAINED JOINT
- SLUICE GATE
- SLIDE GATE OR STOP GATE
- FLUSHING CONNECTION
- HOSE BIBB
- QUICK DISCONNECT FITTING
- YARD HYDRANT
- FIRE HYDRANT
- SOIL BORING

SECTION AND DETAIL KEYING

DRAWINGS ARE CROSS REFERENCED IN THE FOLLOWING METHOD:

A) A SECTION CUT ON DRAWING A3 IS IDENTIFIED AS FOLLOWS:



SECTION LETTER

FIRST DRAWING IN SERIES WHERE SECTION IS SHOWN

B) THE SECTION SHOWN ON DRAWING A6 IS IDENTIFIED AS FOLLOWS:

SECTION LETTER

FIRST DRAWING IN SERIES FROM WHERE SECTION WAS TAKEN

DETAILS ARE CROSS REFERENCED IN A SIMILAR MANNER, EXCEPT DETAILS ARE IDENTIFIED BY A SQUARE WITH A NUMBER IN THE UPPER HALF.

STANDARD DETAILS ARE REFERENCED BY A UNIQUE SEVEN DIGIT NUMBER AND ARE SHOWN ON THE CONTRACT DRAWINGS BY ONE OF TWO METHODS:

1509203 → REFERENCED ITEM

OR:

SEE 1509203 → REFERENCED ITEM

STANDARD DETAILS ARE COMPILED IN APPROXIMATE NUMERICAL ORDER IN THE BACK OF THE CONTRACT DRAWINGS ON THE D* DRAWINGS.

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GENERAL ABBREVIATIONS, SYMBOLS, AND LEGENDS

DATE: NOVEMBER 2016
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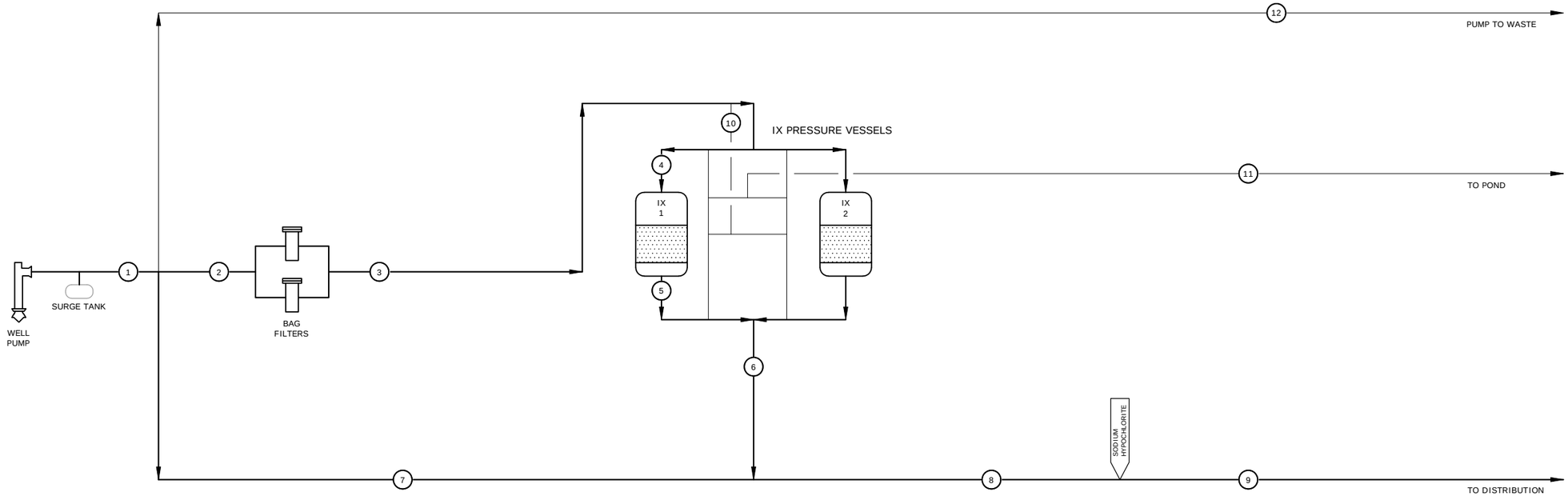

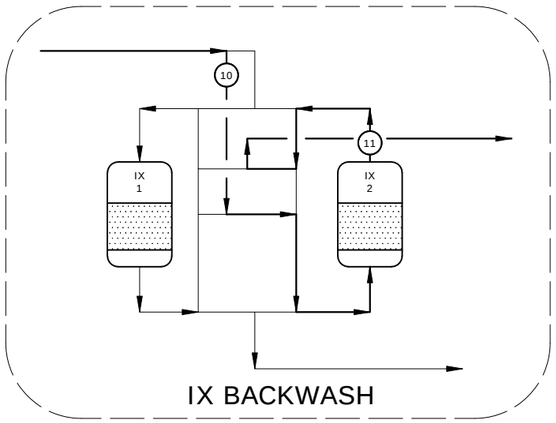

IX BACKWASH

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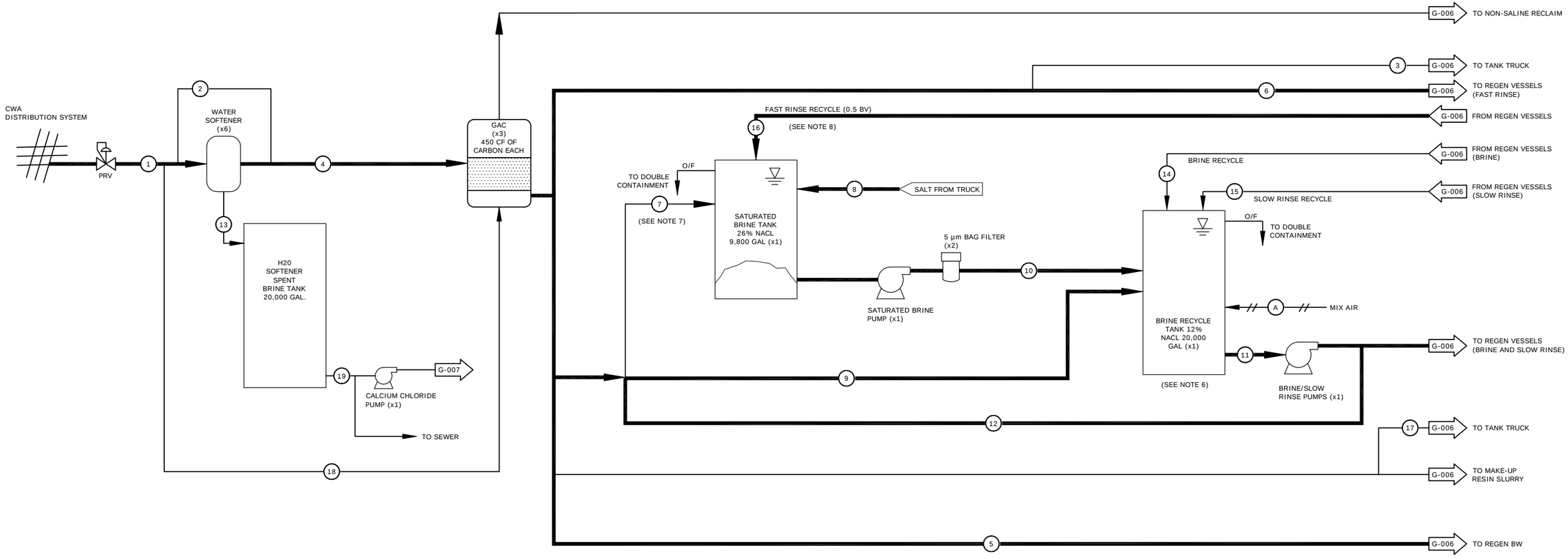
HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

STRONG BASE ANION
TREATMENT SITES
GENERAL
PROCESS FLOW DIAGRAM

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	G-004

File: \\172.20.1.10\PROJECTS\20050-003\DRAWINGS\GEN\G-004 Saved By KOVERBY Save Date: 2016/10/17 9:59 AM



PROCESS FLUID NAME	CHLORINATED / UNSOFTENED WATER	WATER SOFTENER BYPASS	HIGH FLOW GAC FOR TRUCK SLURRY WATER (BACKUP)	CHLORINATED / SOFTENED WATER	REGEN BACKWASH	HIGH FLOW GAC FOR REGEN FAST RINSE	LOW FLOW GAC FOR SATURATED BRINE	SALT FROM TRUCK	LOW FLOW GAC FOR BRINE RECYCLE	SATURATED BRINE	12% BRINE/SLOW RINSE PUMPS	SLOW RINSE MAKE-UP FOR SLOW RINSE PUMPS	SOFTENED SPENT BRINE WASTE	BRINE RECYCLE FROM REGEN VESSELS	SLOW RINSE RECYCLE BRINE	FAST RINSE RECYCLE (FAST BRINE)	RINSE WATER FOR TRUCK	GAC BW	CALCIUM CHLORIDE PUMP	MIX AIR FOR BRINE RECYCLE
PROCESS STREAM ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	A
DESIGN FLOW	4500 GPD	4500 GPD	1,350 GPM	450 GPM	283 GPM	1,350 GPM	450 GPM	22 TONS/10 DAYS	450 GPM	210 GPM	300	300	5 GPM (4500 GAL IN 16H)	300 GPM	300 GPM	1,330 GPM	95 GPM	400 GPM	200 GPM	12CFM
AVG PRESSURE (PSI)	90	90	28	32-48	35	48	20	-	22	23	10	10	90	12	12	48	50	60 (80 MAX)	12	

GENERAL NOTES:

1. EQUIPMENT (xN) DENOTES NUMBER PER TREATMENT TRAIN.
2. BOLD LINES DENOTE MAJOR PROCESS PIPES OR CHANNELS.
3. ALL PUMPS HAVE SHELF REDUNDANCY.

PROCESS NOTES:

1.
2.
3.
4. TOC REDUCED, DE-CHLORINATED WATER TO SUPPORT HIGHER FLOW PROCESS AND TANKS
5.
6. HOLDS 4 BV PER REGEN OF 10-12% SALINE BRINE USED FOR 600 CF REGENERATION; 3 OF 4 BV DIRECTLY RECYCLED W/ 1 BV REQUIRING FRESH MAKE-UP
7. SECONDARY SOURCE OF SATURATED BRINE MAKE-UP WATER; 1ST BV OF FAST RINSE IS PRIMARY SOURCE
8. 0-1 BV OF FAST RINSE RECYCLE HAS 3% TO 0.1% SALT
9.

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
DESIGNED BY: E. DOLE
DRAWN BY: K. OVERBY
CHECKED BY: S. GHIU
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

MECH SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

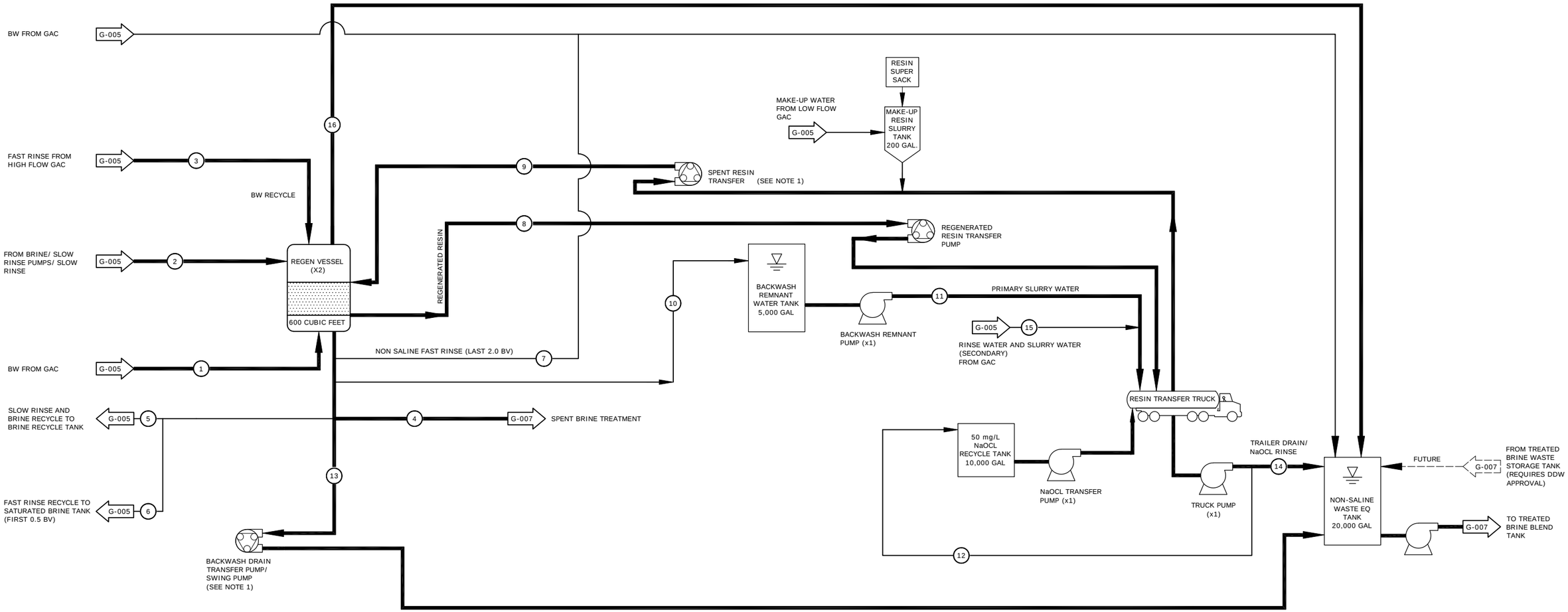
CITY OF COACHELLA
DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

CITY OF COACHELLA
HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

RESIN REGENERATION
FACILITY
GENERAL
PROCESS FLOW DIAGRAM
- MAKEUP FEED

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: G-005

File: \\172.30.2.10\PROJECTS\20050-014\20050-003\DRAWINGS\GEN\G-005 Saved By: KOVERBY Save Date: 2016/10/24 8:09 AM



PROCESS FLUID NAME	REGEN VESSELS BW	BRINE/SLOW RINSE PUMPS FOR REGEN VESSELS	HIGH FLOW GAC FOR REGEN FAST RINSE	SPENT BRINE FROM REGEN VESSELS	BRINE/SLOW RINSE RECYCLE BRINE	FAST RINSE RECYCLE (FAST RINSE)	FAST RINSE RECYCLE FOR FEEDWATER STORAGE	REGENERATED RESIN	SPENT RESIN	BACKWASH REMNANT	RINSE WATER FOR RESIN TRANSFER TRUCK	NAOCL RECYCLE	BACKWASH DRAIN TO NON-SALINE WASTE TANK	RESIN TRANSFER TRUCK DRAIN TO NON-SALINE WASTE TANK	RINSE WATER FOR TRUCK
PROCESS STREAM ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DESIGN FLOW	323 GPM	300 GPM	1,350 GPM	300 GPM	300 GPM	1,350 GPM	1,350 GPM	176 GPM	176 GPM	380 GPM	300 GPM	230 GPM	176 GPM	345 GPM	95 GPM
AVG PRESSURE (PSI)	42	12	48	12	12	35	48	109	109	10	20	11	20	6	50

PROCESS NOTES:

1. SWING PERISTALTIC PUMP CAN BE USED IN LIEU OF SPENT RESIN TRANSFER PUMP OR REGENERATED RESIN TRANSFER PUMP.
2. TOC REDUCED, DE-CHLORINATED WATER FOR CERTAIN OPERATION MODES OF SPENT BRINE TREATMENT.
3. CLOSED LOOP 5 MICRON FILTERED WATER BACKWASH WATER.
4. DIRTY BACKWASH FROM TOP OF VESSEL BACK TO BACKWASH RECOVERY TANK.

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
DESIGNED BY: E. DOLE
DRAWN BY: K. OVERBY
CHECKED BY: S. GHIU
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

MECH SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY
GENERAL
PROCESS FLOW DIAGRAM - REGENERATION PROCESS

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: G-006

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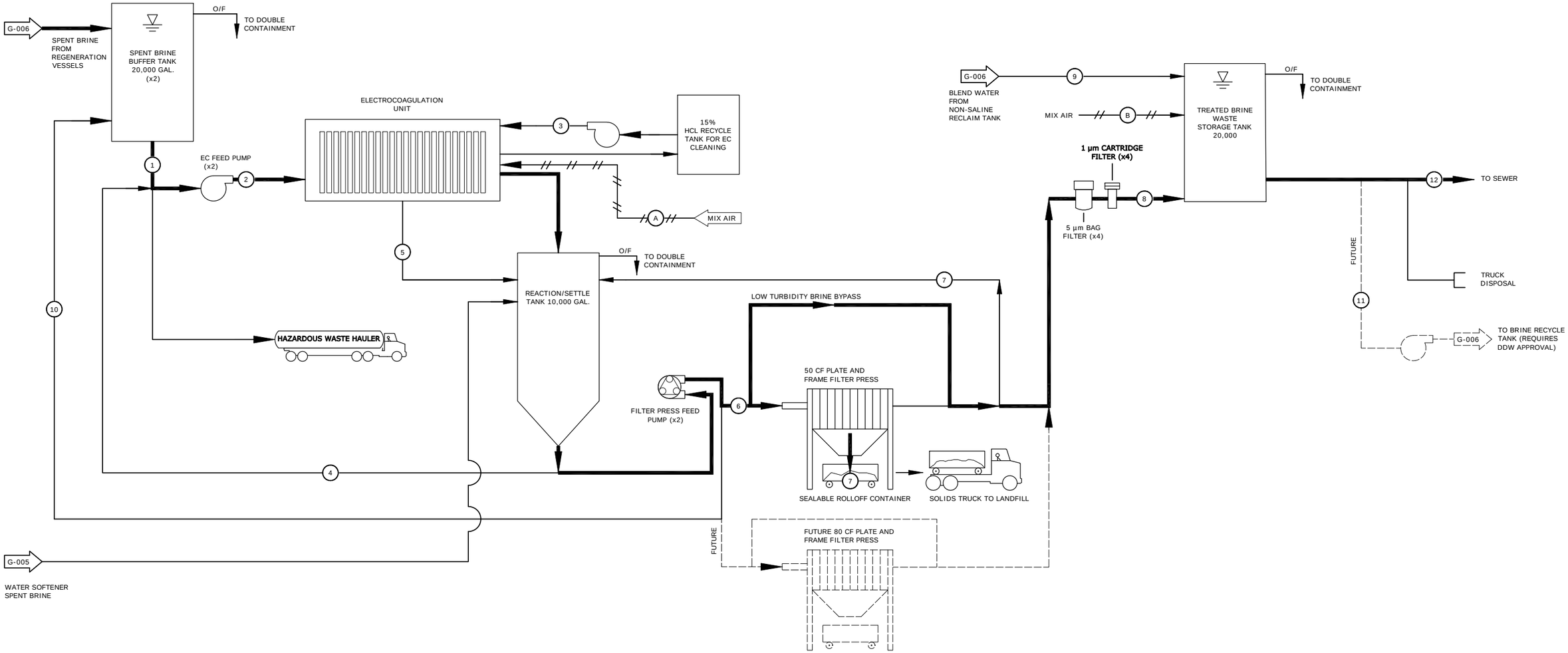


PROCESS FLUID NAME	SPENT BRINE	1ST STAGE EC TREATMENT	HYDROCHLORIC ACID TO EC	RETREAT/2ND STAGE EC	EC DRAIN	1ST STAGE EC TREATED	1ST STAGE EC SOLIDS	1 UM FILTRATE	FAST RINSE RECYCLE MIXING WATTER TO TREATED BRINE STORAGE TANKS	RE-TREATMENT/SEED	SPENT BRINE RECYCLE	TREATED BRINE	MIX AIR FOR EC	MIX AIR TO TREATED BRINE WASTE TANK
PROCESS STREAM ID	1	2	3	4	5	6	7	8	9	10	11	12	A	B
AVG FLOW	4,500 GPD	70 GPM	25 GPM	40 GPM	20 GPM	176 GPM	2 TONS/REGEN	176 GPM	1,330 GPM	176 GPM	4,000 GPD	5 GPM	3 CFM	12 CFM
AVG PRESSURE (PSI)	8.7	11	7	15	GRAVITY	109	-	109	48	20	60	GRAVITY		

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
DESIGNED BY: E. DOLE
DRAWN BY: K. OVERBY
CHECKED BY: S. GHIU
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

MECH SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

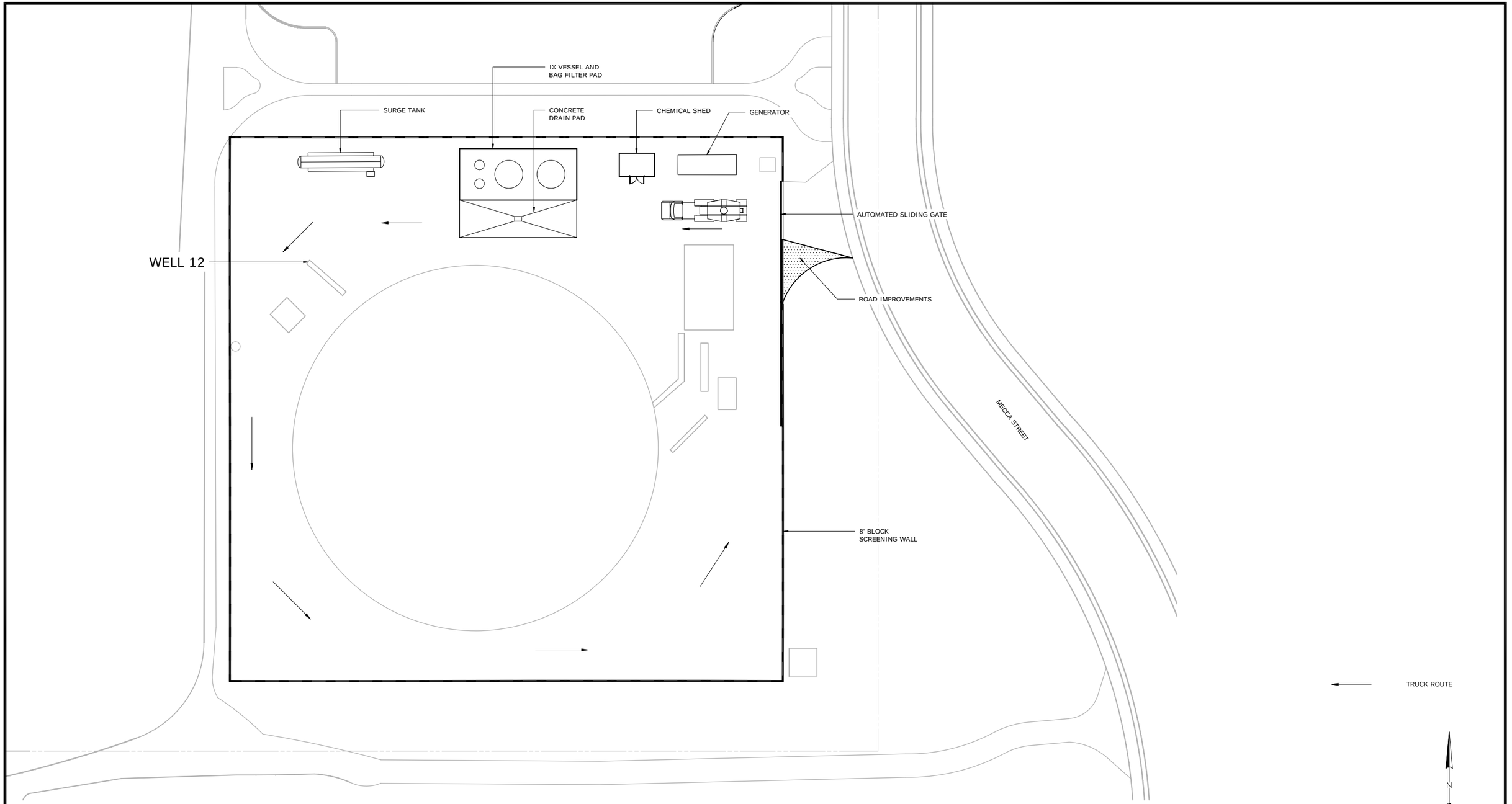
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY GENERAL PROCESS FLOW DIAGRAM - SPENT BRINE HANDLING

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: G-007

File: \\172.30.2.10\PROJECTS\20050-RAL\20050-003\DRAWINGS\GEN\G-007 Saved By KOVERBY Save Date: 2016/10/24 8:38 AM



BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	M. SANTOWASSO
DRAWN BY:	S. NASH
CHECKED BY:	S. VALDEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

CIVIL SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA
CALIFORNIA
INCORPORATED 1946

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

WELL SITE 12
CIVIL
SITE PLAN

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER:
C-122

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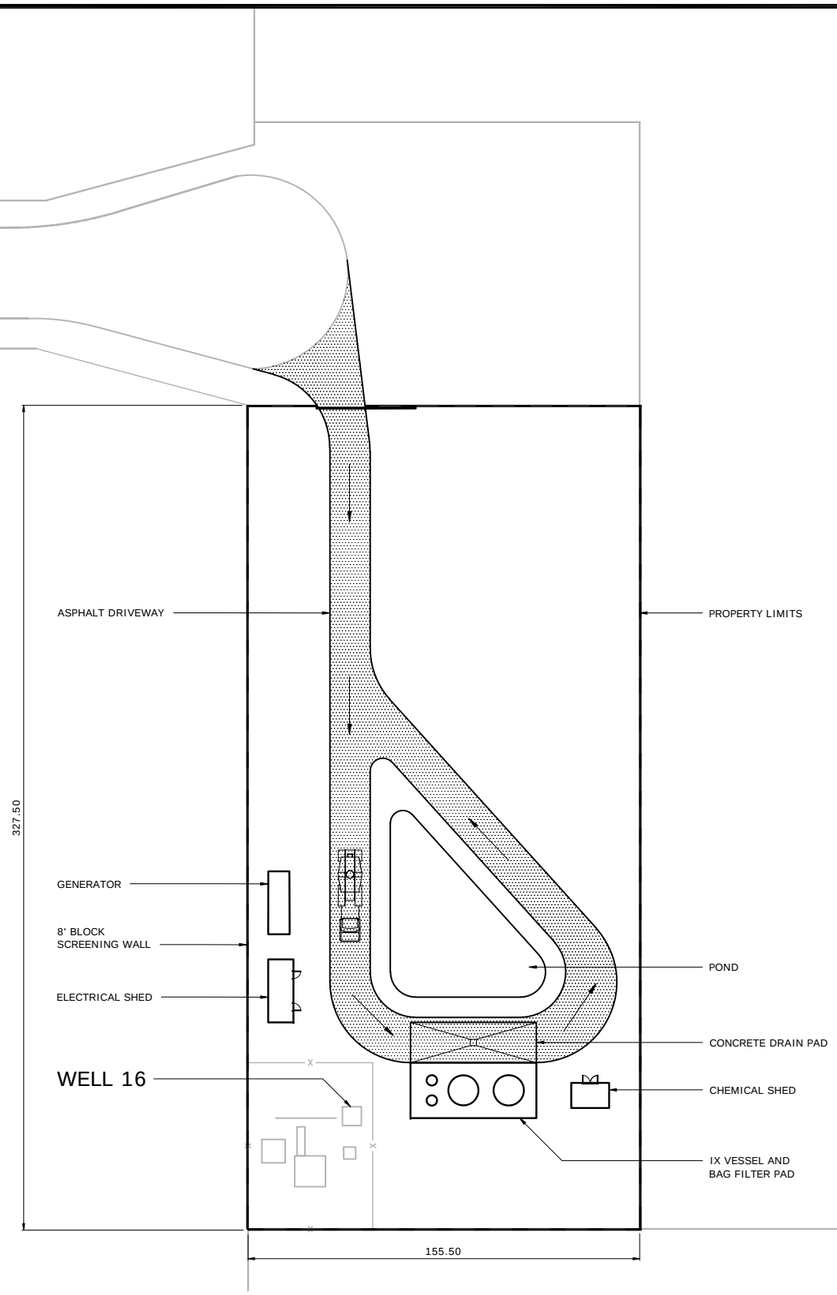

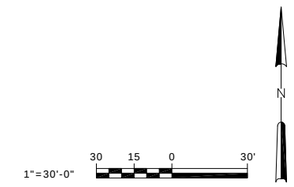

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	M. SANTOWASSO
DRAWN BY:	S. NASH
CHECKED BY:	S. VALDEZ
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

CIVIL SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

WELL SITE 16
CIVIL
SITE PLAN

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	C-162

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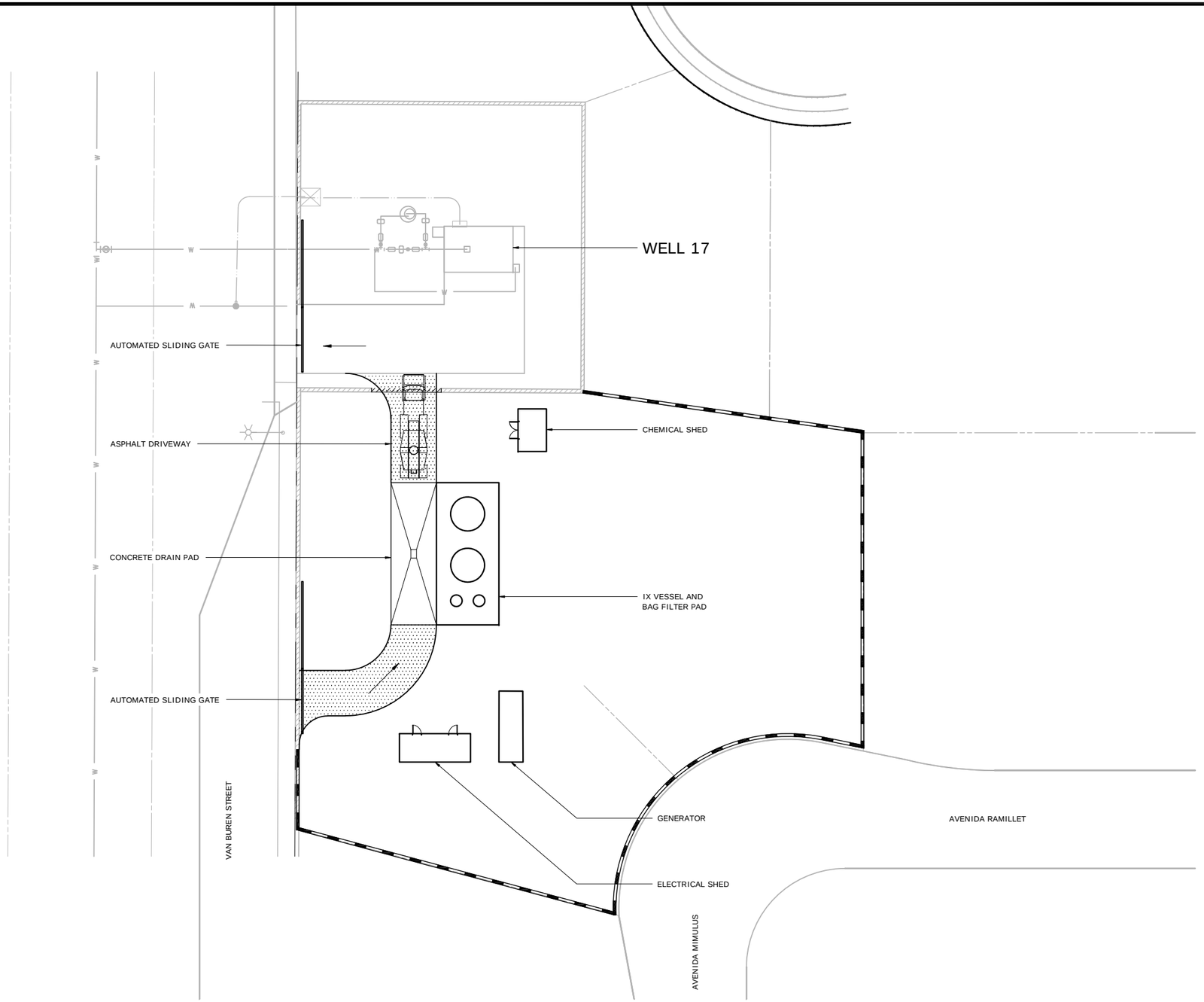

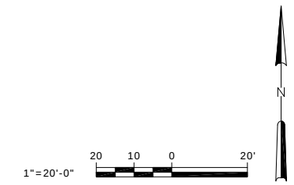

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	M. SANTOWASSO
DRAWN BY:	S. NASH
CHECKED BY:	S. VALDEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

CIVIL SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

WELL SITE 17
CIVIL
SITE PLAN

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER:
C-172

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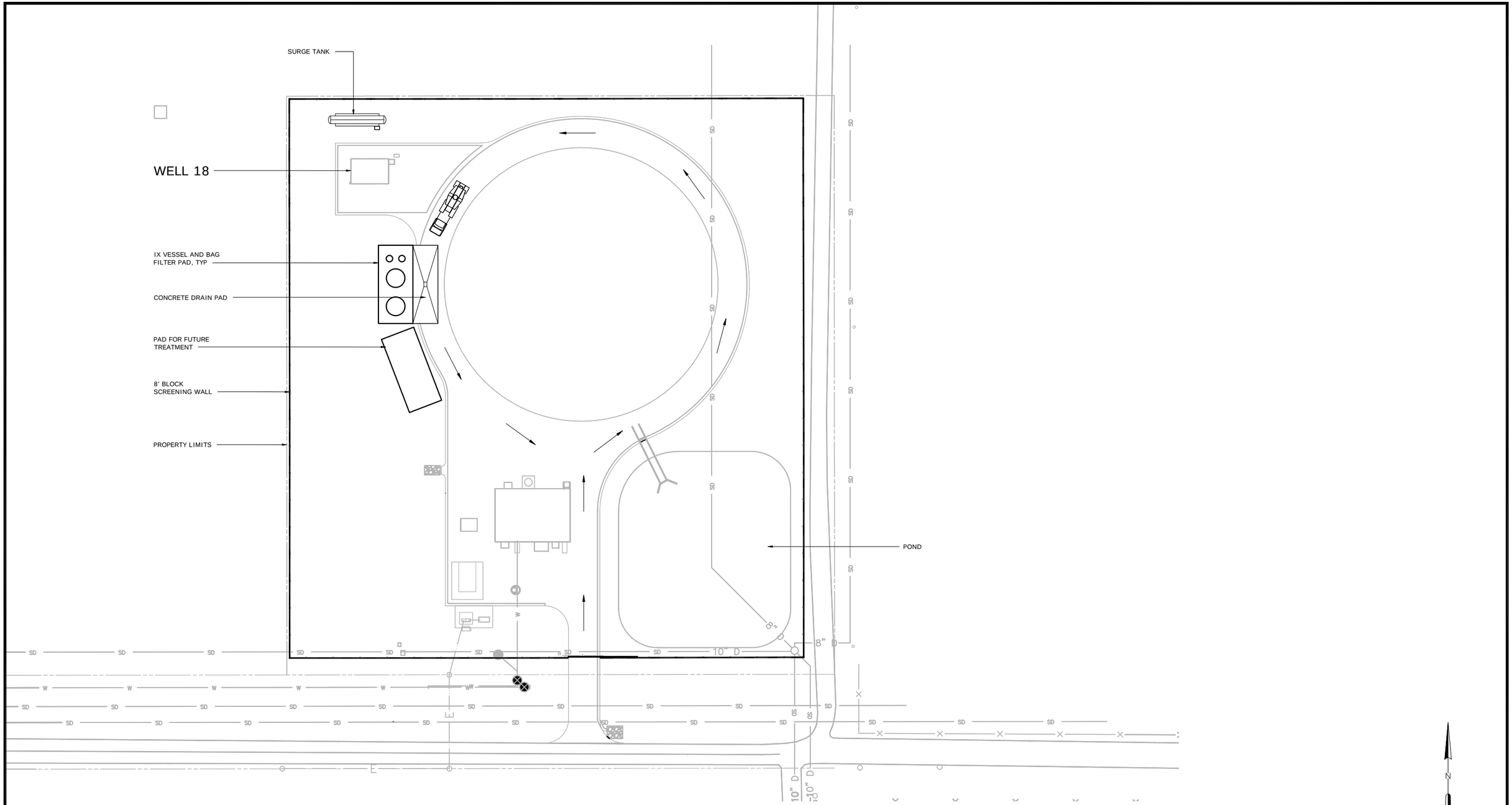

REV	ISSUED FOR	DATE	BY

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	M. SANTOWASSO
DRAWN BY:	S. NASH
CHECKED BY:	S. VALDEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

CIVIL SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA
CALIFORNIA
INCORPORATED 1946

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 18
CIVIL
SITE PLAN

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER:
C-182

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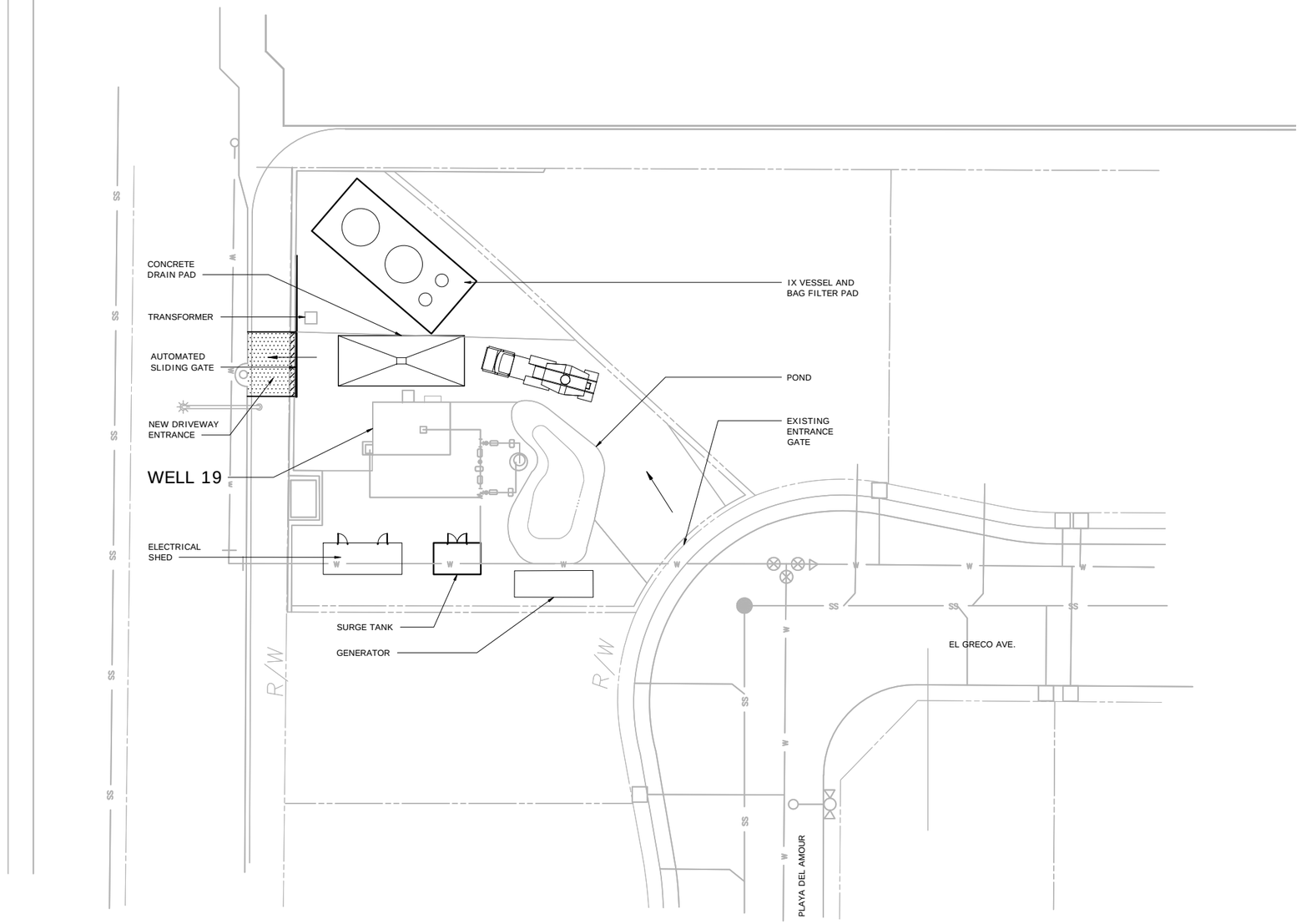

1"=20'-0" 20 10 0 20'

N

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	M. SANTOWASSO
DRAWN BY:	S. NASH
CHECKED BY:	S. VALDEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

CIVIL SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 19
CIVIL
SITE PLAN

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER:
C-192

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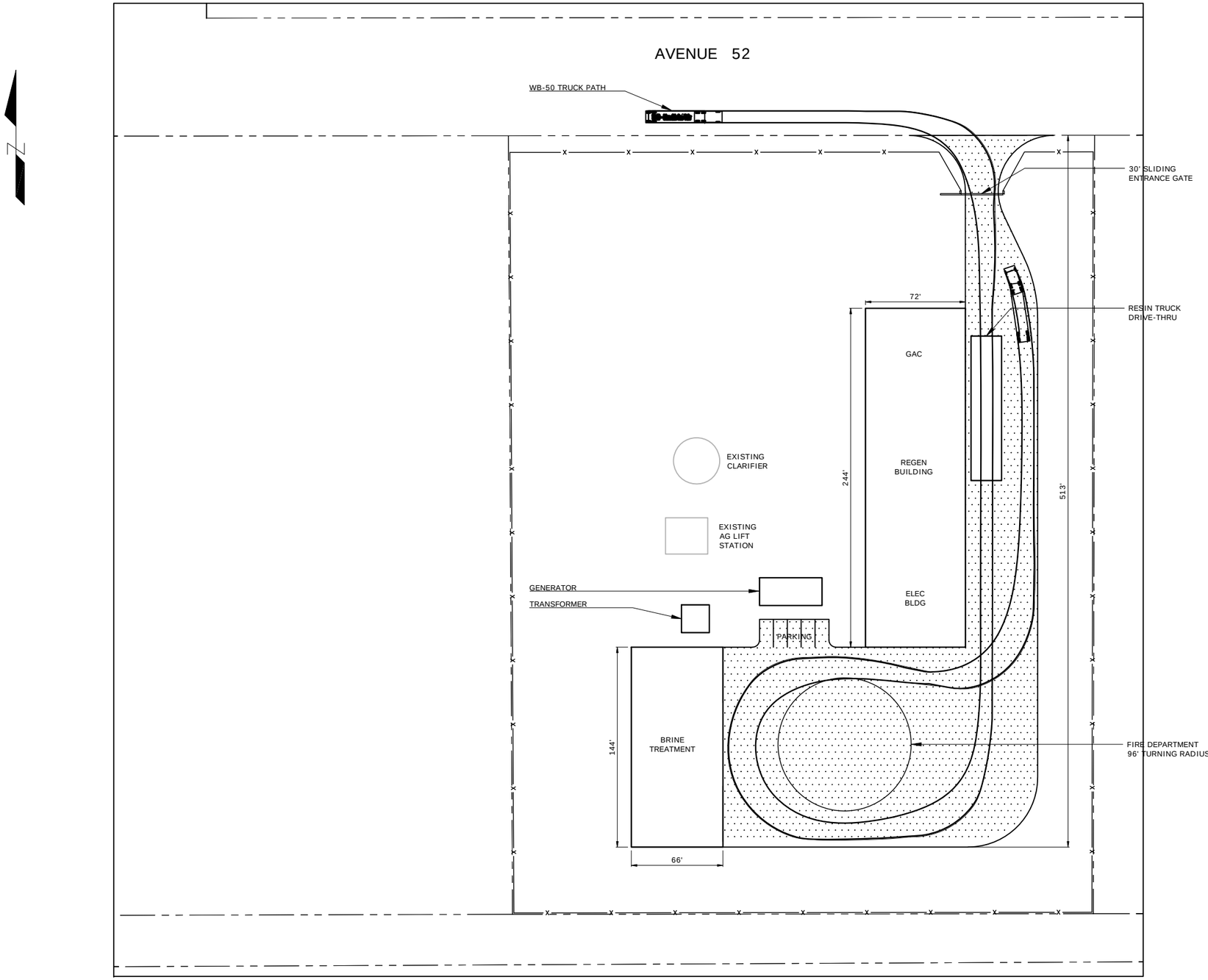


PLAN

SCALE: 1:40

SCALE: 1" = 40'

40 20 0 40'

REV	ISSUED FOR	DATE	BY

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	M. SANTOWASSO
DRAWN BY:	S. NASH
CHECKED BY:	S. VALDEZ

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

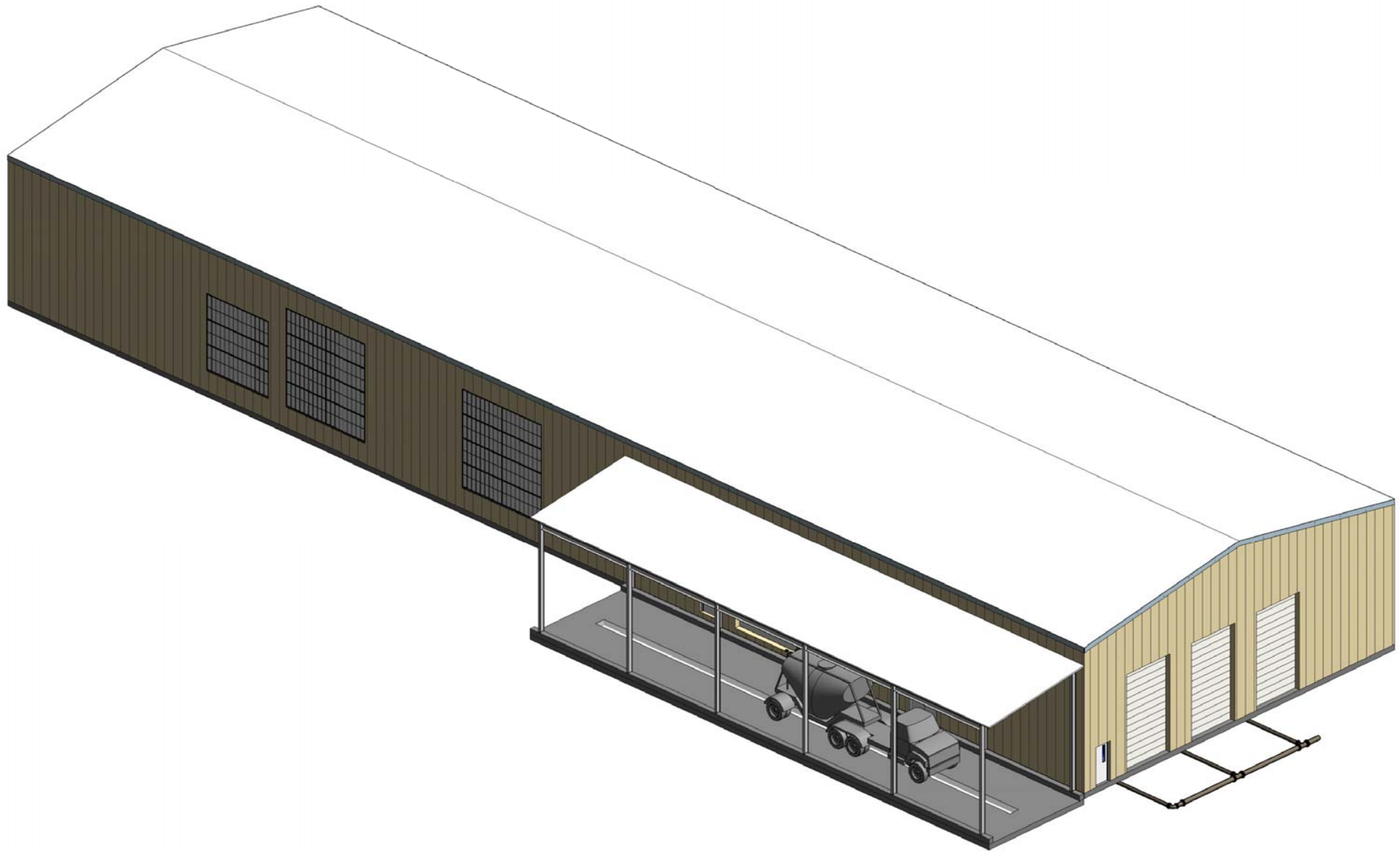
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY
CIVIL
SITE PLAN

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: ----

File: O:\20050-RIA\20050-003\DRAWINGS\CIVIL\REGEN\GP-ST-ALT3 Saved By: MSANTOWASSO Save Date: 2016/10/25 9:38 AM



ISOMETRIC VIEW

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	E. DOLE
DRAWN BY:	K. OVERBY
CHECKED BY:	S. GHIU

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

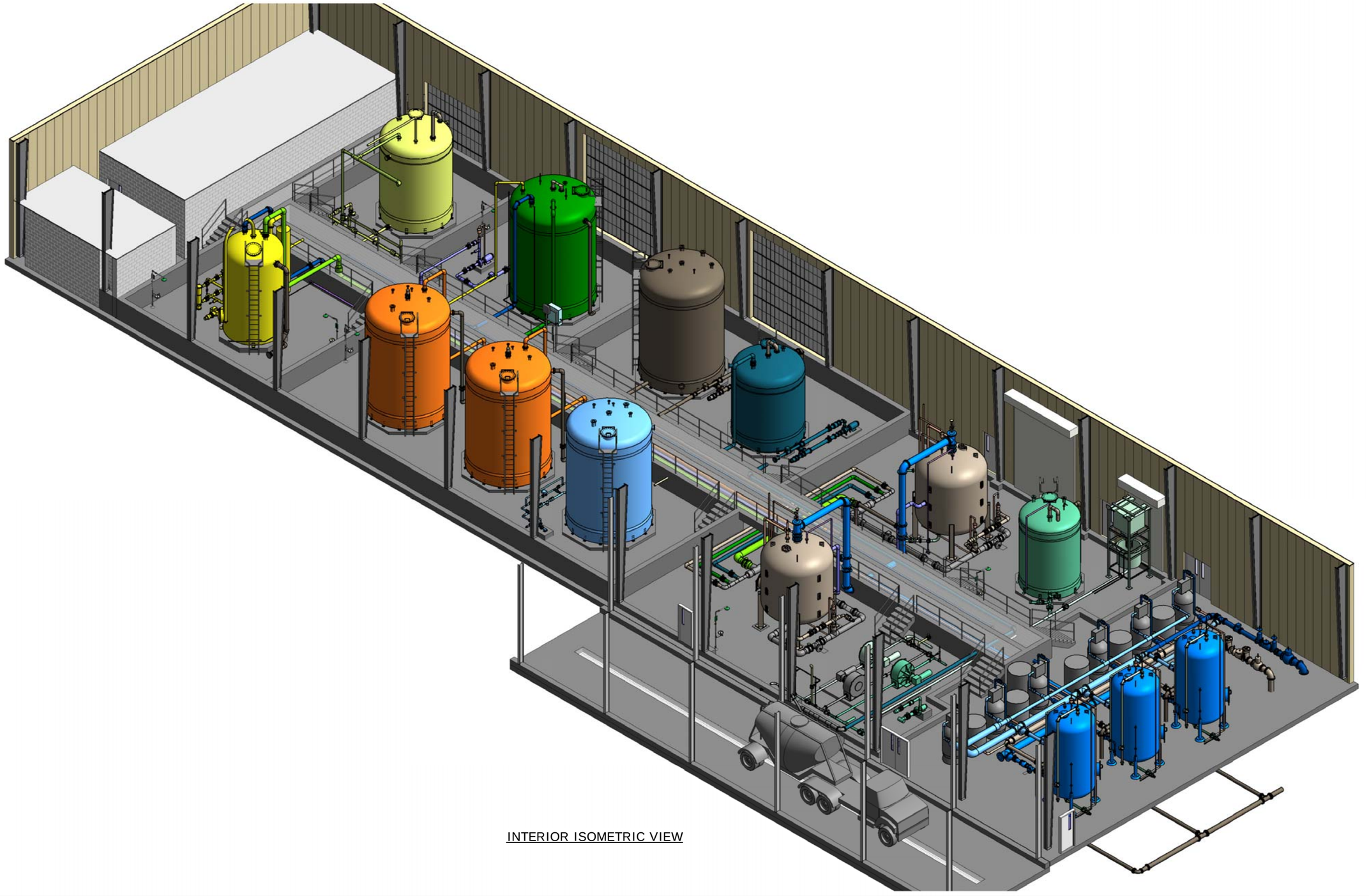
CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

RESIN REGENERATION
FACILITY
MECHANICAL
OVERALL ISOMETRIC VIEW

DATE:	SEPTEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-500

\\172.30.2.10\Projects\20050-RAL\20050-003\drawings\500-REGEN\20050-003-REGEN-M.rvt



INTERIOR ISOMETRIC VIEW

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	E. DOLE
DRAWN BY:	K. OVERBY
CHECKED BY:	S. GHIU
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

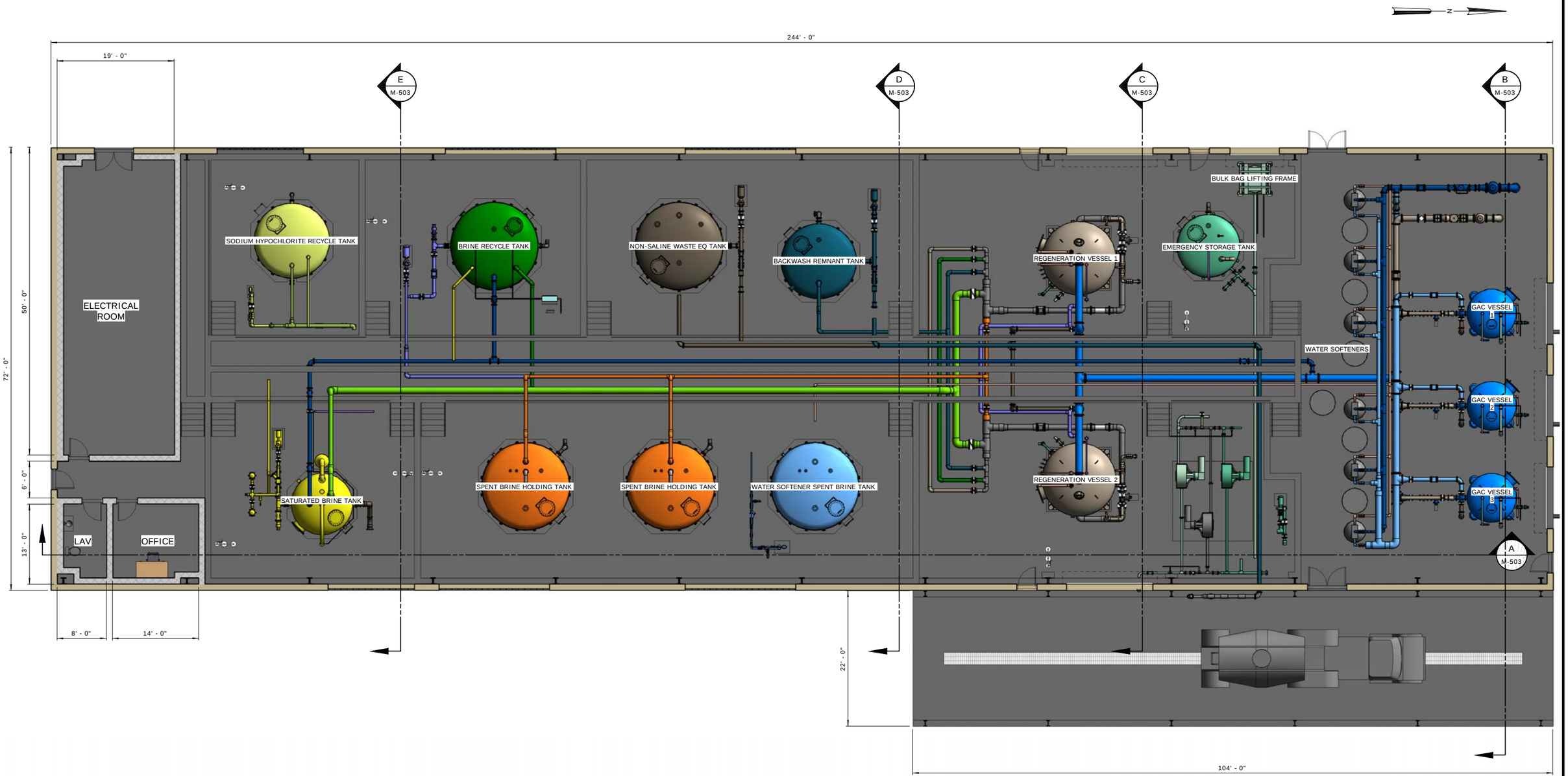
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY MECHANICAL ISOMETRIC VIEW

DATE:	SEPTEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-501

\\172.30.2.10\Projects\20050-RAL\20050-003\drawings\500-REGEN\20050-003-REGEN-M.rvt



BOTTOM PLAN

1/8" = 1'-0"

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	E. DOLE
DRAWN BY:	K. OVERBY
CHECKED BY:	S. GHIU

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

Hazen

HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

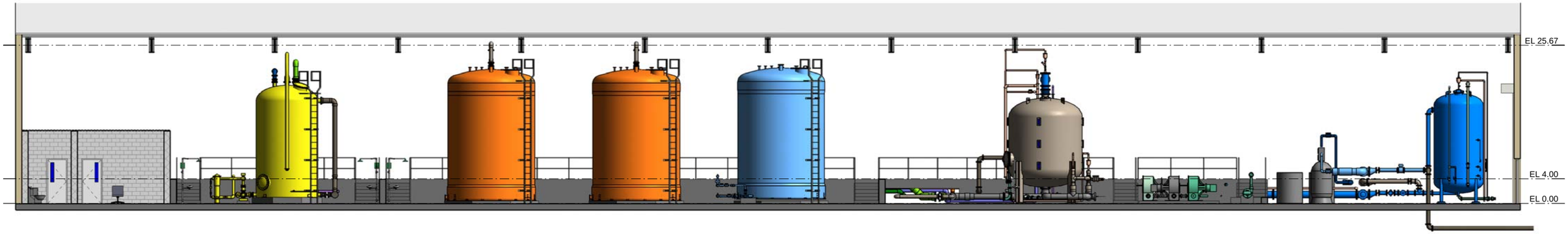
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

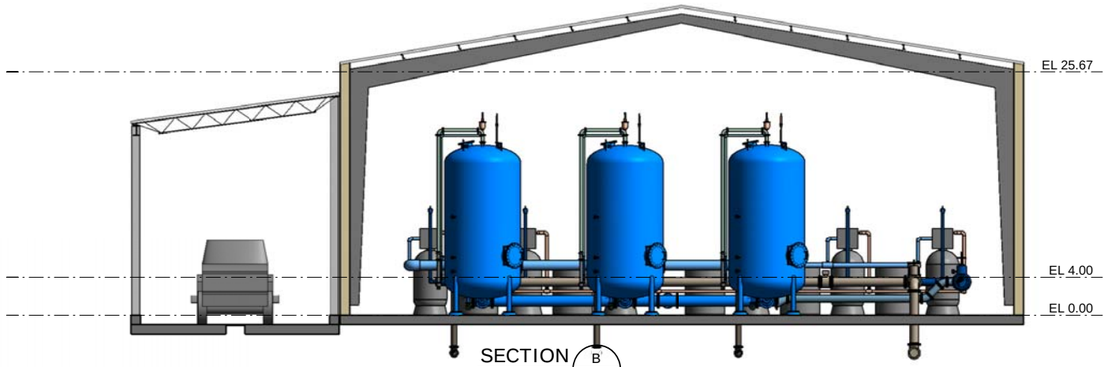
RESIN REGENERATION FACILITY
MECHANICAL
OVERALL PLAN

DATE:	SEPTEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-502

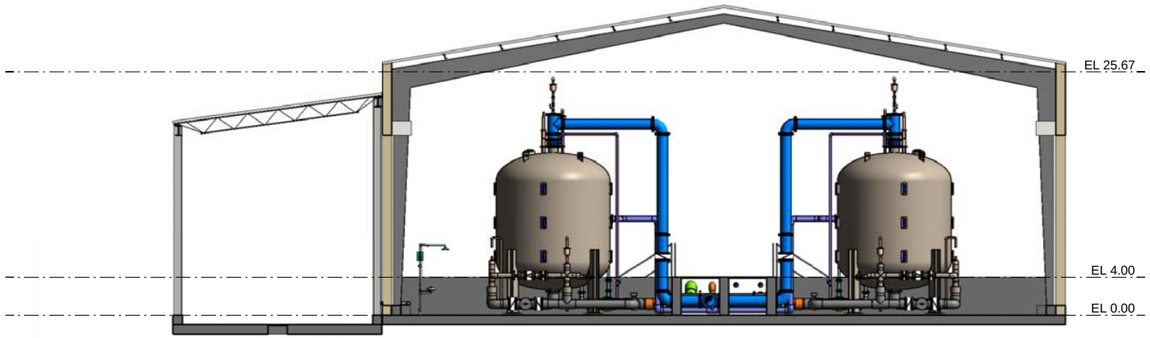
\\172.30.2.10\Projects\20050-RAL\20050-003\drawings\500-REGEN\20050-003-REGEN-M.rvt



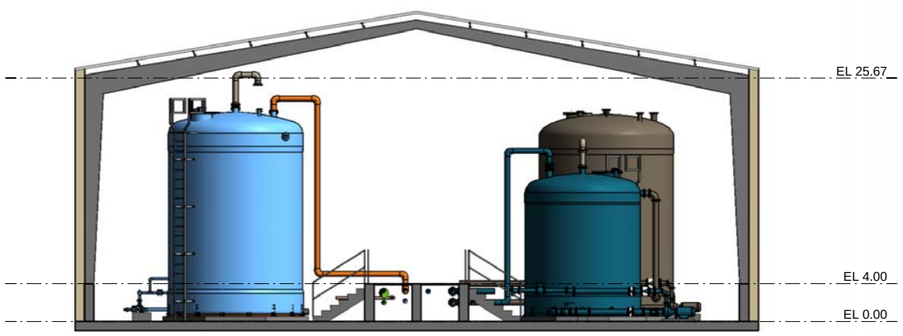
SECTION A
1/8" = 1'-0"
M-502



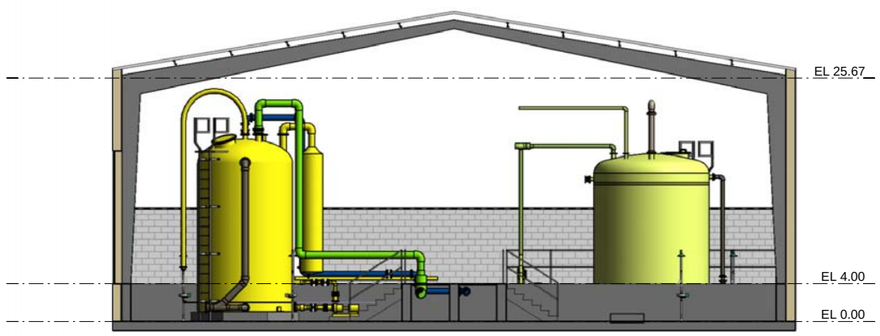
SECTION B
1/8" = 1'-0"
M-502



SECTION C
1/8" = 1'-0"
M-502



SECTION D
1/8" = 1'-0"
M-502



SECTION E
1/8" = 1'-0"
M-502

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PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	E. DOLE
DRAWN BY:	K. OVERBY
CHECKED BY:	S. GHIU

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

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PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
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Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY MECHANICAL SECTIONS

DATE: SEPTEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: M-503

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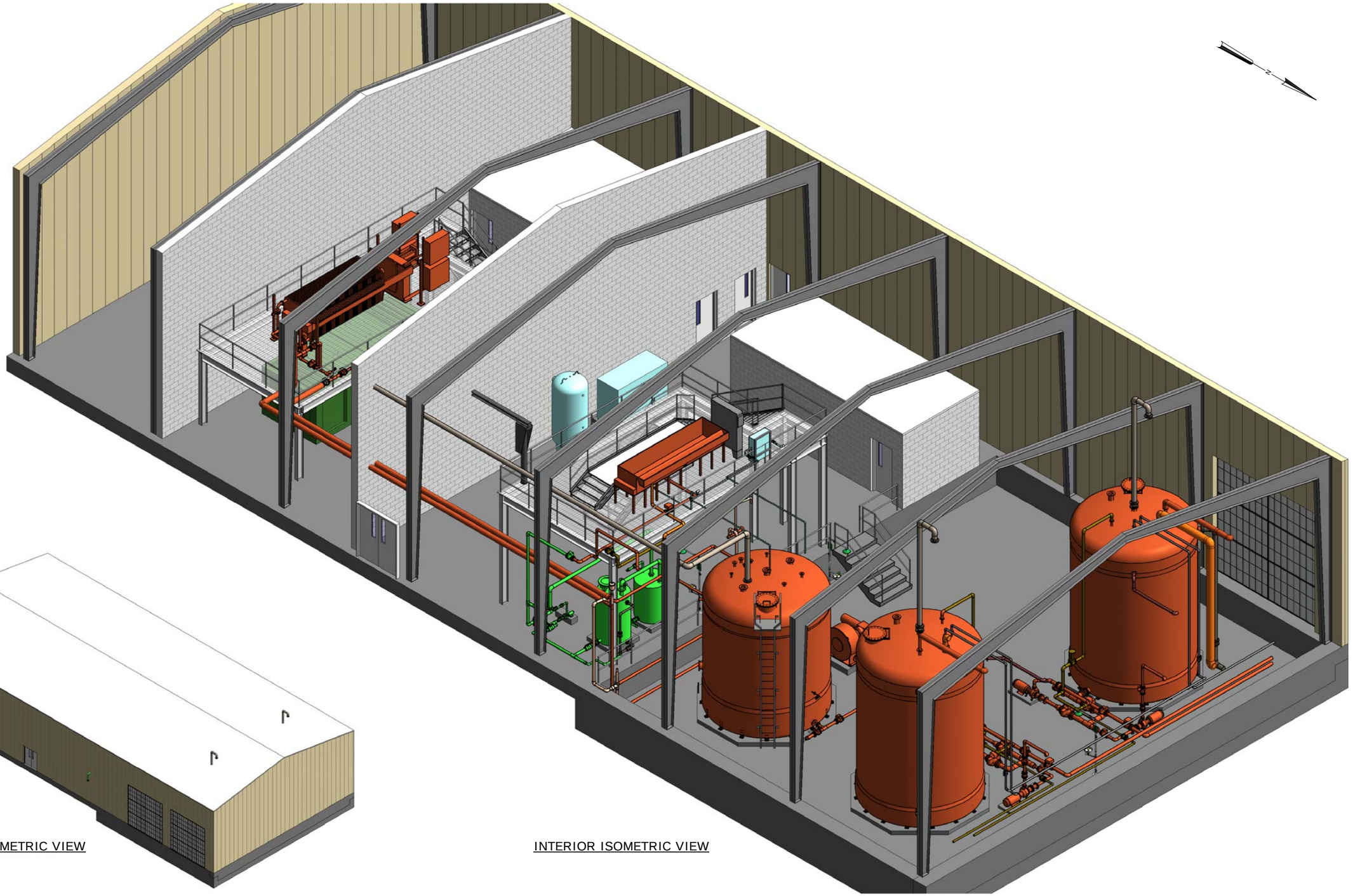

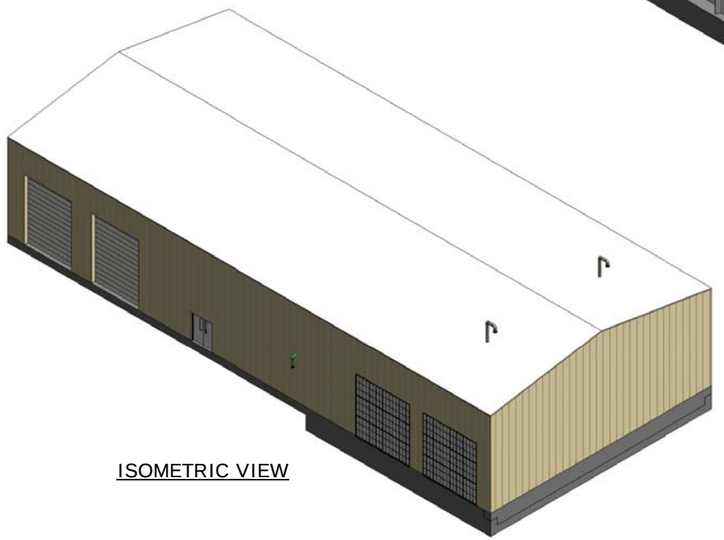

ISOMETRIC VIEW

INTERIOR ISOMETRIC VIEW

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PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	E. DOLE
DRAWN BY:	K. OVERBY
CHECKED BY:	S. GHIU

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Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

BRINE TREATMENT BUILDING MECHANICAL ISOMETRIC VIEWS

DATE:	OCTOBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-600

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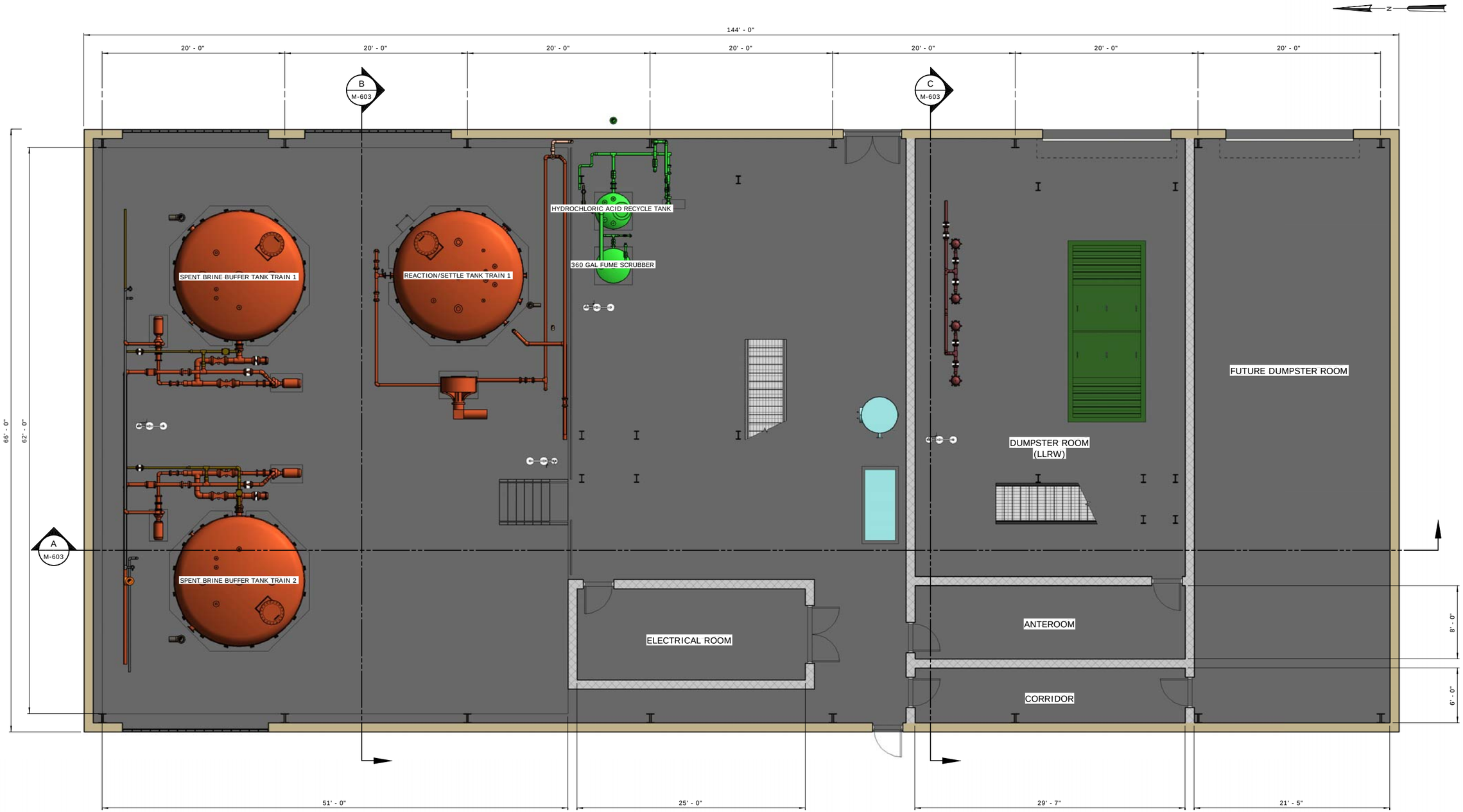

BOTTOM PLAN

3/16" = 1'-0"

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CHECKED BY:	S. GHIU

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Recommended: DIRECTOR OF ENGINEERING

Date:

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

BRINE TREATMENT BUILDING
MECHANICAL
BOTTOM PLAN

DATE:	OCTOBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-601

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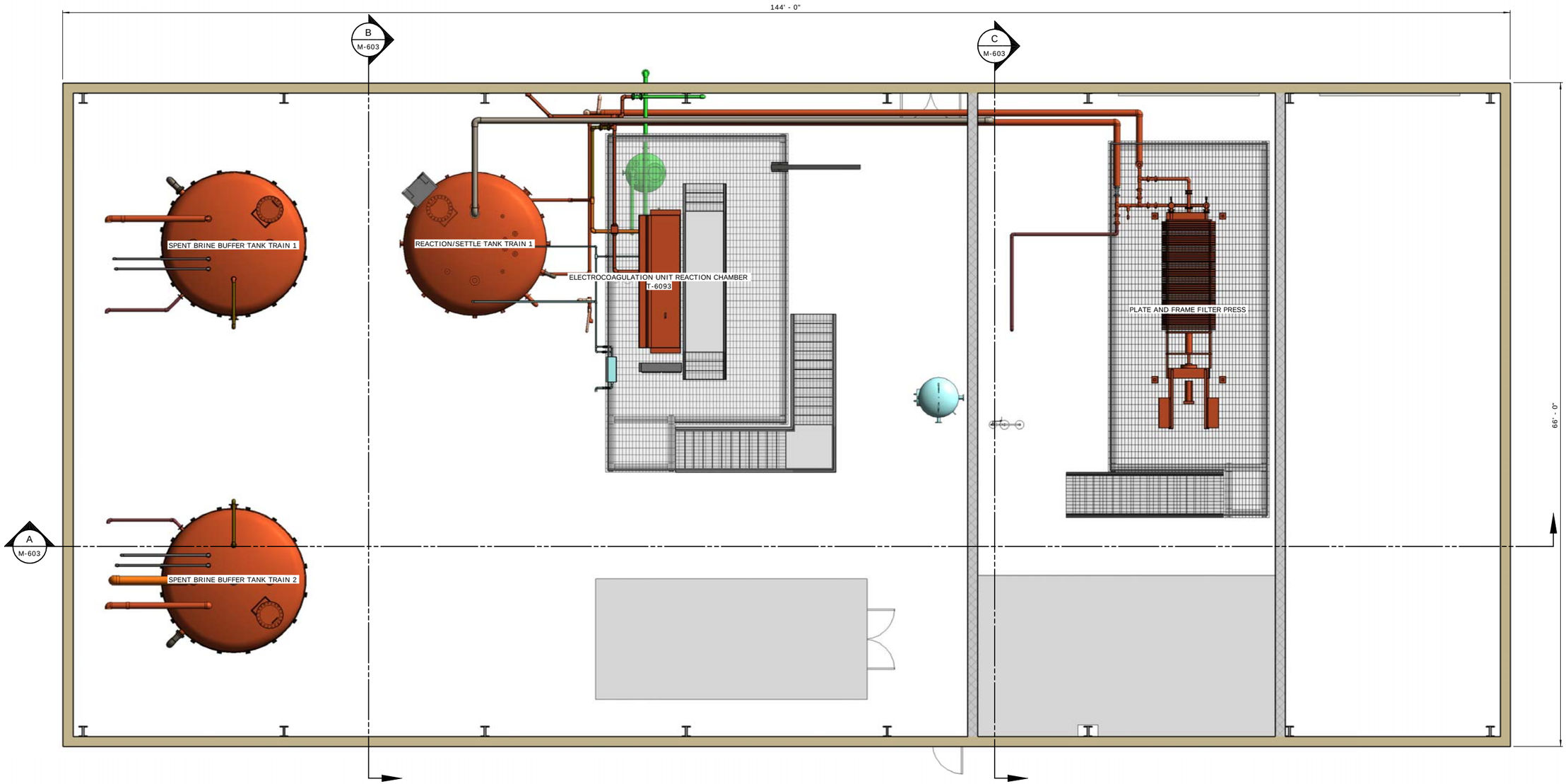

TOP PLAN

3/16" = 1'-0"

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DRAWN BY:	K. OVERBY
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DRAWING APPROVAL

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Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

BRINE TREATMENT BUILDING
MECHANICAL
TOP PLAN

DATE:	OCTOBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-602

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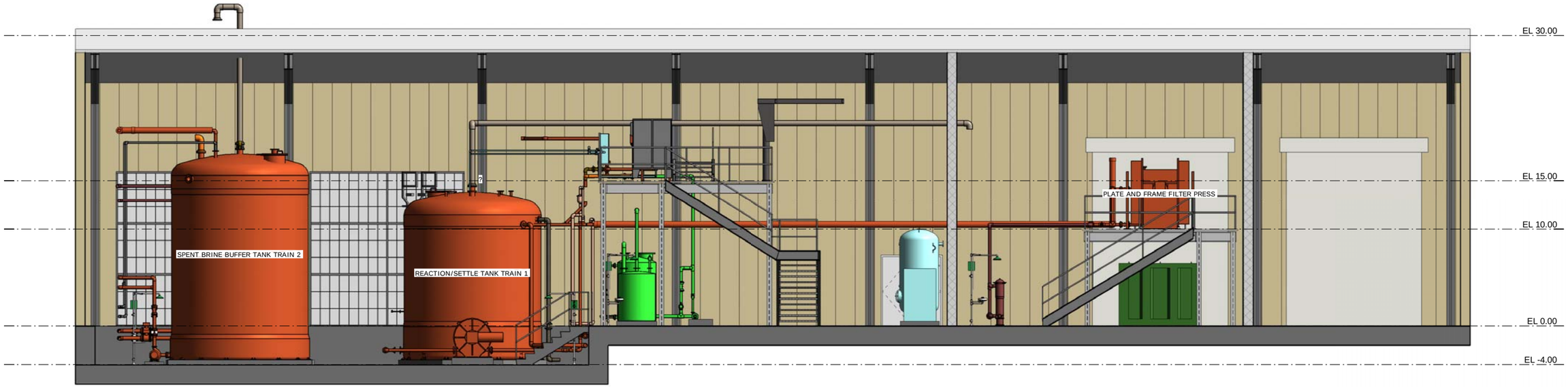
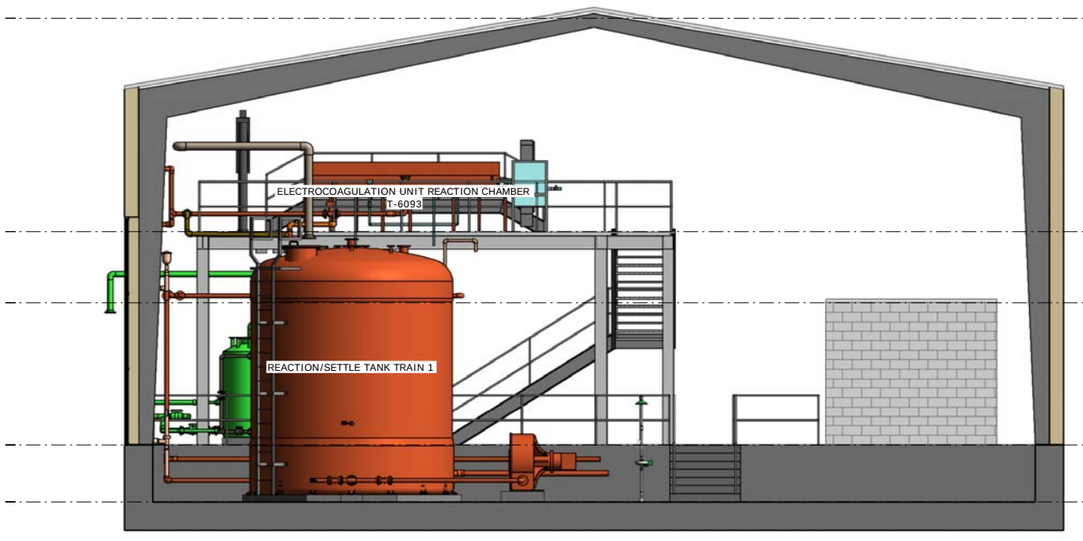
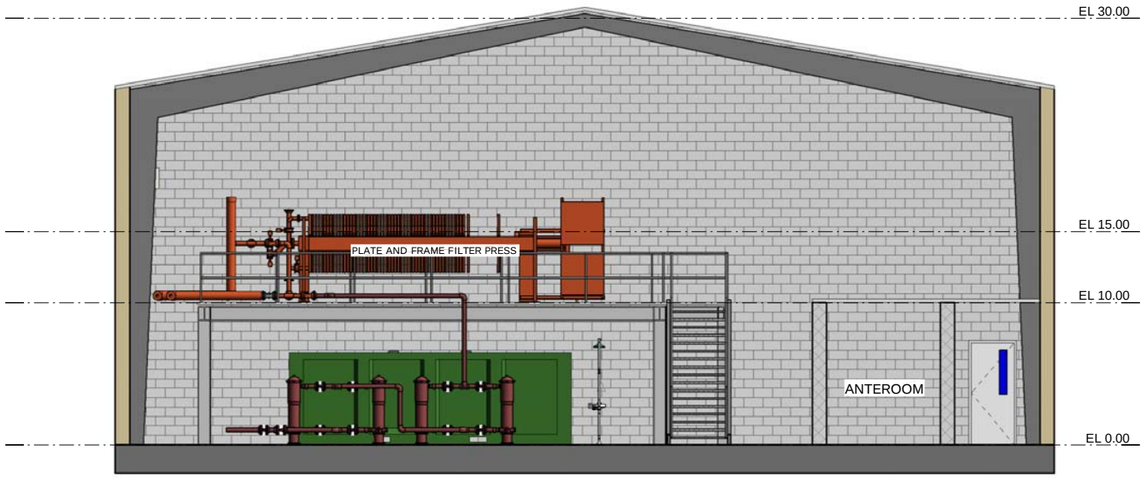


SECTION A
3/16" = 1'-0"
M-601



SECTION B
3/16" = 1'-0"
M-601



SECTION C
3/16" = 1'-0"
M-601

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DRAWING APPROVAL

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Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

BRINE TREATMENT BUILDING MECHANICAL SECTIONS

DATE:	OCTOBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	M-603

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LIGHTING:

X DENOTES FIXTURE TYPE (TYP.)
SEE SPECIFICATION 16500 FOR FIXTURE SCHEDULE
# DENOTES CIRCUIT NUMBER (TYP.)

RECTANGULAR FIXTURE

LEFT: CEILING MOUNTED FIXTURE
RIGHT: WALL MOUNTED FIXTURE

EMERGENCY WALL-MOUNTED FIXTURE:
LEFT: STANDARD
RIGHT: REMOTE-HEAD

LEFT: CEILING MOUNTED EXIT SIGN
RIGHT: WALL MOUNTED EXIT SIGN
SHADED PORTION DENOTES SIGN FACE

POLE-MOUNTED FIXTURE

PHOTOCELL

LEFT: CEILING MOUNTED OCCUPANCY SENSOR
RIGHT: WALL MOUNTED OCCUPANCY SENSOR
X DENOTES TYPE

RECEPTACLES:

X DENOTES RECEPTACLE TYPE (TYP.):
GFCI DENOTES GROUND FAULT CIRCUIT INTERRUPT
UPS DENOTES UNINTERRUPTIBLE POWER SUPPLY
WPCR DENOTES WEATHERPROOF CORROSION RESISTANT
# DENOTES CIRCUIT NUMBER (TYP.)

RECEPTACLES:
LEFT: SIMPLEX
MIDDLE: DUPLEX
RIGHT: QUADRUPLEX

MULTI-OUTLET RECEPTACLE:
LEFT: SIMPLEX
RIGHT: DUPLEX

OTHER RECEPTACLES:
LEFT: 240 VOLT
RIGHT: SPECIAL PURPOSE

HVAC AND FIRE ALARM

FIRE ALARM CONTROL PANEL

FIRE ALARM ANNUNCIATOR PANEL

FIRE ALARM PULL STATION

FIRE ALARM INDICATOR:
X DENOTES ALERT TYPE (TYP.):
A DENOTES AUDIBLE
V DENOTES VISIBLE (# DENOTES STROBE INTENSITY)

FIRE ALARM INDICATOR MOUNTED ABOVE A FIRE ALARM PULL STATION

DUCT DETECTOR

SMOKE DETECTOR:
X DENOTES TYPE:
Z DENOTES IONIZATION
P DENOTES PHOTOELECTRIC
T DENOTES THERMAL

HEAT DETECTOR

THERMOSTAT

AMBIENT TEMPERATURE TRANSMITTER

SWITCHES

WALL SWITCH:
X DENOTES TYPE:
NO SUBSCRIPT DENOTES SINGLE-POLE SWITCH
3 DENOTES 3-WAY SWITCH
4 DENOTES 4-WAY SWITCH
M DENOTES MANUAL MOTOR STARTER
# DENOTES CIRCUIT NUMBER
WPCR DENOTES WEATHERPROOF CORROSION RESISTANT

COMBINATION MOTOR STARTER

DISCONNECT SWITCH

LOCAL CONTROL STATION

ELEMENTARY CONTROL SCHEMATICS

3-POSITION SELECTOR SWITCH:
HOA DENOTES HAND/OFF/AUTO
LOR DENOTES LOCAL/OFF/REMOTE
FOR DENOTES FORWARD/OFF/REVERSE

PUSHBUTTON SWITCHES:
LEFT: N.O.
RIGHT: N.C.
TEXT DENOTES LEGEND PLATE

EMERGENCY STOP MUSHROOM HEAD PUSHBUTTON SWITCH (N.C.):
TEXT DENOTES LEGEND PLATE

PUSHBUTTON SWITCH N.C. WITH LOCK-OUT:
TEXT DENOTES LEGEND PLATE

SELECTOR SWITCH:
LEFT: STANDARD
RIGHT: SPRING-RETURN
TEXT DENOTES LEGEND PLATE

THERMAL OVERLOAD RELAY

	NO	NC
DISCONNECT SWITCHES		
CONTACTS	X	X
TORQUE SWITCH	-	TS
LIMIT SWITCHES	TS	TS

NOTATION LEGEND:
NO/NC: NORMALLY OPEN/CLOSED
RO/RC: RISE-TO-OPEN/CLOSE
FO/FC: FALL-TO-OPEN/CLOSE
TO/TC: TIME-OPEN/CLOSE

CONTACTS:
TEXT DENOTES COIL ID

SWITCHES:
TEXT DENOTES TAG NUMBER

	NORC	NOFC	NCRO	NCFO
TEMPERATURE SWITCHES/ THERMOSTATS	TS	-	TS	-
PRESSURE SWITCHES	TS	TS	TS	TS
LEVEL SWITCHES	TS	TS	TS	TS
FLOW SWITCHES	TS	TS	TS	TS

	NOTC	NOTO	NCTO	NCTC
TIME DELAY SWITCHES	TS	TS	TS	TS

INDICATOR LIGHT:
LEFT: STANDARD/RIGHT: PUSH-TO-TEST
X DENOTES COLOR

RUN TIME METER

SOLENOID VALVE

MOTOR PROTECTION RELAY

CONTROL POWER TRANSFORMER

MECHANICAL INTERLOCK CONNECTION

MOTOR SPACE HEATER

COIL:
X DENOTES TYPE:
M DENOTES MOTOR STARTER
CR DENOTES CONTROL RELAY
TD DENOTES TIME DELAY RELAY
PR DENOTES INTERPOSING PILOT RELAY
LC DENOTES LIGHTING CONTACTOR
Y DENOTES REFERENCE LINE NUMBER

EQUIPMENT/DEVICE LOCATION SYMBOLS

LOCATED IN MCC

LOCATED IN STAND-ALONE MOTOR STARTER/CONTROLLER

LOCATED IN FIELD

LOCATED AT PANEL:
X DENOTES PANEL ID:
L DENOTES LOCAL CONTROL STATION

SINGLE-LINE DIAGRAMS

XFMR
kVA
480-120/208V
3P/4W
DRY TRANS
TRANSFORMER

PROTECTIVE RELAY:
NUMBER DENOTES IEEE DEVICE FUNCTION

MOTOR AND TYPICAL ADDITIONAL DEVICES:
TSH: TEMPERATURE SWITCH
MSH: MOTOR SPACE HEATER
CF: COOLING FAN
TE: TEMPERATURE ELEMENT
ME: MOISTURE DETECTOR

INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
Y DENOTES INSTRUMENT NUMBER
SEE DRAWING I1 FOR INSTRUMENT ABBREVIATIONS

100A FUSE

100A 3P FUSED DISCONNECT SWITCH

30A 3P DISCONNECT SWITCH

30A 3P FUSED DISCONNECT SWITCH

LOW-VOLTAGE POWER CIRCUIT BREAKER:
LEFT: FIXED-MOUNT
RIGHT: DRAWOUT
E.O. DENOTES ELECTRICALLY OPERATED
LSIG DENOTES INSTALLED TRIP FUNCTIONS:
L DENOTES LONG-TIME
S DENOTES SHORT-TIME
I DENOTES INSTANTANEOUS
G DENOTES GROUND FAULT
Z DENOTES ZONE-SELECTIVE INTERLOCKING
CTR DENOTES BREAKER-SPECIFIC CT AND RATIOS

MEDIUM-VOLTAGE DRAWOUT POWER CIRCUIT BREAKER:
E.O. DENOTES ELECTRICALLY OPERATED
BATT. DENOTES BATTERY BACKUP POWER

LOW-VOLTAGE MOLDED CASE CIRCUIT BREAKER
LEFT: THERMAL-MAGNETIC TRIP UNIT
RIGHT: ELECTRONIC TRIP UNIT

MOTOR CIRCUIT PROTECTOR

GROUND

CT:
NUMBERS DENOTE CT WINDING RATIO AND CT QUANTITY

GFCT:
NUMBERS DENOTE GFCT WINDING RATIO AND GFCT QUANTITY

PT:
NUMBERS DENOTE PT WINDING VOLTAGES AND PT QUANTITY

DRAW-OUT ELEMENT

LEFT: PANELBOARD
RIGHT: COMBINATION POWER UNIT
X DENOTES PANEL ID

LIGHTNING ARRESTOR

SINGLE-LINE DIAGRAMS, CONT'D.

LEFT: RESISTOR
RIGHT: LINE REACTOR:
#% DENOTES IMPEDANCE

CAPACITOR

SHUNT TRIP

SURGE PROTECTIVE DEVICE

KIRK-KEY INTERLOCK

LEFT: FVNR STARTER:
X DENOTES NEMA SIZE
DP DENOTES DEFINITE PURPOSE CONTACTOR
RIGHT: FVR STARTER

LEFT: VFD WITH LINE REACTOR
MIDDLE: VFD WITH HARMONIC FILTER
RIGHT: VFD WITH LINE REACTOR AND FVNR BYPASS
X DENOTES NEMA SIZE

LEFT: RVSS STARTER
RIGHT: RVSS STARTER WITH FVNR BYPASS
X DENOTES NEMA SIZE

VFD WITH RVSS BYPASS

RVAT STARTER:
X DENOTES NEMA SIZE
#% DENOTES TAP SETTING

SINGLE-LINE DIAGRAMS, CONT'D.

GENERATOR

CONTACTOR-STYLE ATS OR MTS

CONTACTOR-STYLE ATS OR MTS WITH OFF POSITION

CONTACTOR-STYLE ATS OR MTS, SERVICE-ENTRANCE RATED

MCCB-STYLE ATS OR MTS

DRAWOUT CB-STYLE ATS OR MTS

MISC PLAN VIEW SYMBOLS

EQUIPMENT CONNECTION

GROUND RODS:
LEFT: BURIED
RIGHT: IN TESTWELL

DUCTBANK SECTION CUT IDENTIFIER:
DBXX DENOTES DUCTBANK ID
EXX DENOTES DRAWING NUMBER WHERE SECTION CUT IS LOCATED

DUCTBANK TAG:
X DENOTES DUCTBANK ID

CABLE TRAY TAG:
X DENOTES CABLE TRAY ID
Y DENOTES SCHEDULE REFERENCE

INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
# DENOTES INSTRUMENT NUMBER
SEE DRAWING I1 FOR INSTRUMENT ABBREVIATIONS

CONDUIT TAGS:
P DENOTES POWER
C DENOTES CONTROL
I DENOTES INSTRUMENTATION
XXXX DENOTES CONDUIT ID
XXX-XXX DENOTES CONDUIT ID

COMMUNICATIONS

TELEPHONE OR NETWORK DROP

PAGER RECEPTACLE

HORN/LIGHT DEVICE

PA UNIT

WIRING

CONDUIT HOME RUN

CONDUIT EXPOSED

CONCRETE ENCASED CONDUIT

CONDUIT CONCEALED

FLEXIBLE CONDUIT

CONCRETE ENCASED DUCTBANK

LEFT: CONDUIT RISE (TURN UP)
RIGHT: CONDUIT DROP (TURN DOWN)

BASIS OF DESIGN REPORT
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PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

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ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

GENERAL ELECTRICAL LEGEND AND SYMBOLS

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: E-001

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ABBREVIATIONS

AE	ANALYSIS ELEMENT
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
AIT	ANALYSIS INDICATING TRANSMITTER
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AF	AMPERE FRAME
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
BC	BYPASS CONTACTOR
BKR	BREAKER
(L/V)CP	(LOCAL/VENDOR) CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
DB	DUCTBANK
DSW	DISCONNECT SWITCH
EHH	ELECTRIC HAND HOLE
EMH	ELECTRIC MANHOLE
EO	ELECTRICALLY OPERATED
ETM	ELAPSED TIME METER
ETU	ELECTRONIC TRIP UNIT
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
FS	FLOW SWITCH
FSL	FLOW SWITCH LOW
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFCT	GROUND FAULT CURRENT TRANSFORMER
GNG	GO-NO GO
GND	GROUND
HOA	HAND-OFF-AUTO
HPU	HYDRAULIC POWER UNIT
IC	INPUT CONTACTOR
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
JB	JUNCTION BOX
LCS	LOCAL CONTROL STATION
LP	LIGHTING PANEL
LS	LEVEL SWITCH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW-LOW
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH-HIGH
LT	LEVEL TRANSMITTER
MFR	MULTI-FUNCTION RELAY
MH	MANHOLE
MOD	MOTOR OPERATED DAMPER
MOG	MOTOR OPERATED GATE
MOL	MOTOR OPERATED LOUVER
MOV	MOTOR OPERATED VALVE
MPR	MOTOR PROTECTION RELAY
MTD	MOUNTED
MTS	MANUAL TRANSFER SWITCH
MWTS	MOTOR WINDING TEMPERATURE SWITCH
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSN
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	OUTPUT CONTACTOR
OL	OVERLOAD

ABBREVIATIONS, CONT.

PB	PULLBOX
PC	PHOTOCELL
PCC	POINT OF COMMON COUPLING
PE	PRESSURE ELEMENT
PIT	PRESSURE INDICATING TRANSMITTER
PLC	PROGRAMMABLE LOGIC CONTROLLER
PP	POWER PANEL
PST	PHASE SHIFTING TRANSFORMER
PT	POTENTIAL TRANSFORMER
PTT	PUSH TO TEST
RCS	REMOTE CONTROL STATION
RECP	RECEPTACLE
RIO	REMOTE I/O
RM	ROOM
RTD	RESISTANCE THERMAL DEVICE
RTU	REMOTE TELEMETRY UNIT
RVAT	REDUCED VOLTAGE AUTO TRANSFORMER
RVSS	REDUCED VOLTAGE SOLID STATE
SA	SUPPLY AIR
S.E.	SERVICE ENTRANCE
SP. C.	SPARE CONDUIT
SPD	SURGE PROTECTIVE DEVICE
SST	STAINLESS STEEL
TB	TEST BLOCK
TC	TIMED CLOSE
TO	TIMED OPEN
TSH	TWISTED SHIELDED
TX	TRANSFORMER
TYP	TYPICAL
UPS	UNINTERRUPTIBLE POWER SUPPLY
VFD	VARIABLE FREQUENCY DRIVE
WPCR	WEATHER PROOF CORROSION RESISTANT
WT	WALK THROUGH
XFMR	TRANSFORMER

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DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

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CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

GENERAL ELECTRICAL ABBREVIATIONS AND GENERAL NOTES

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER:
E-002

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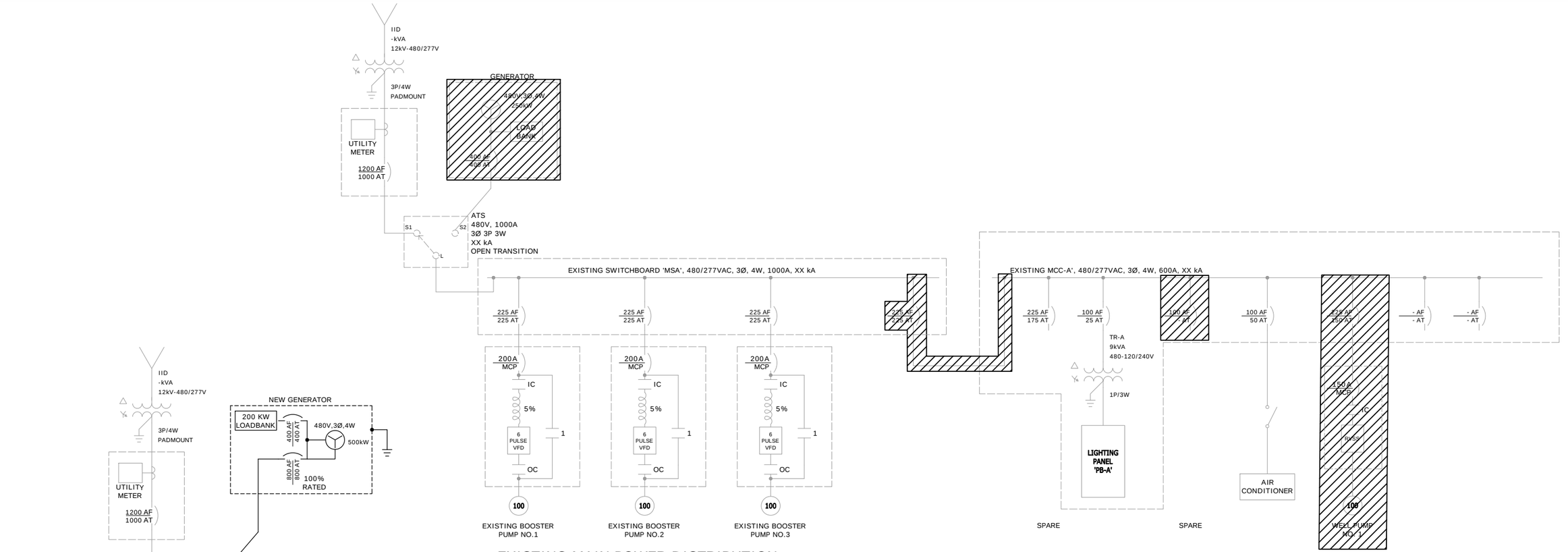
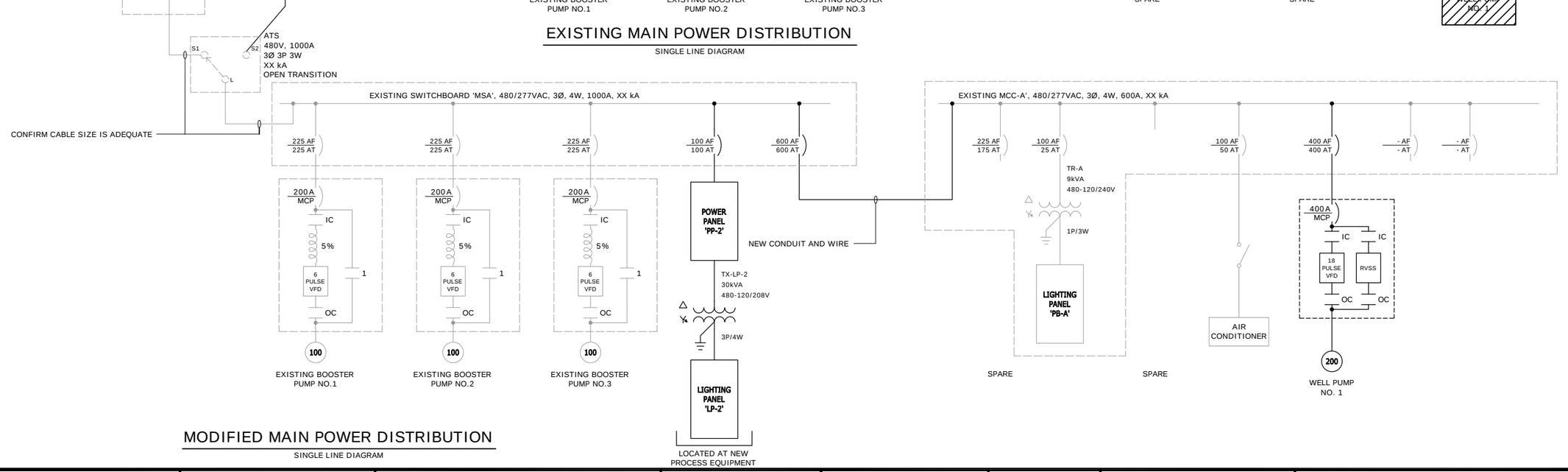


EXISTING MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM



MODIFIED MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 1/2" 1")

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: PROJECT ENGINEER

Recommended: DIRECTOR OF ENGINEERING

Date:

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

WELL SITE 12
ELECTRICAL
EXISTING AND MODIFIED
SINGLE LINE DIAGRAMS

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-121

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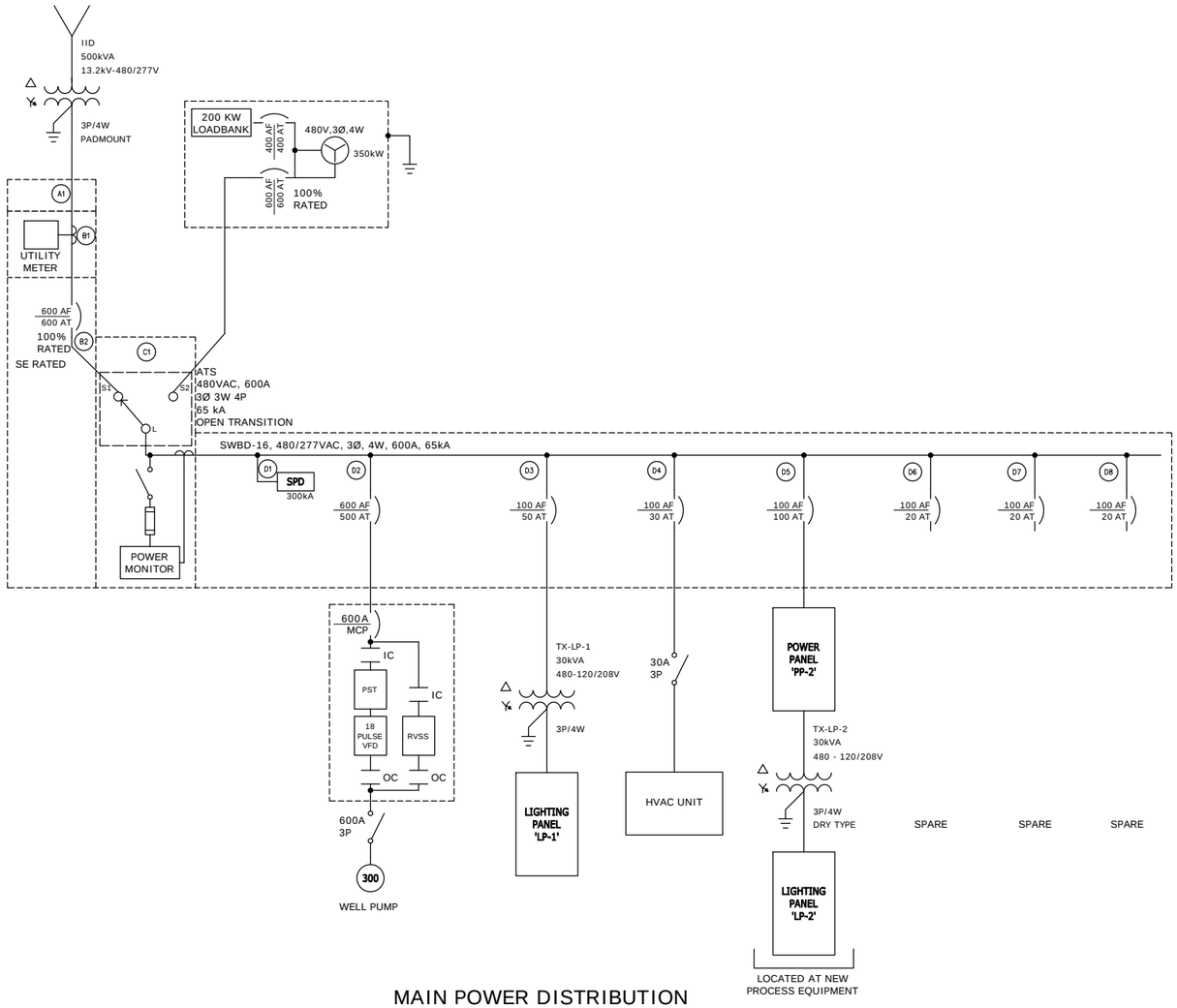
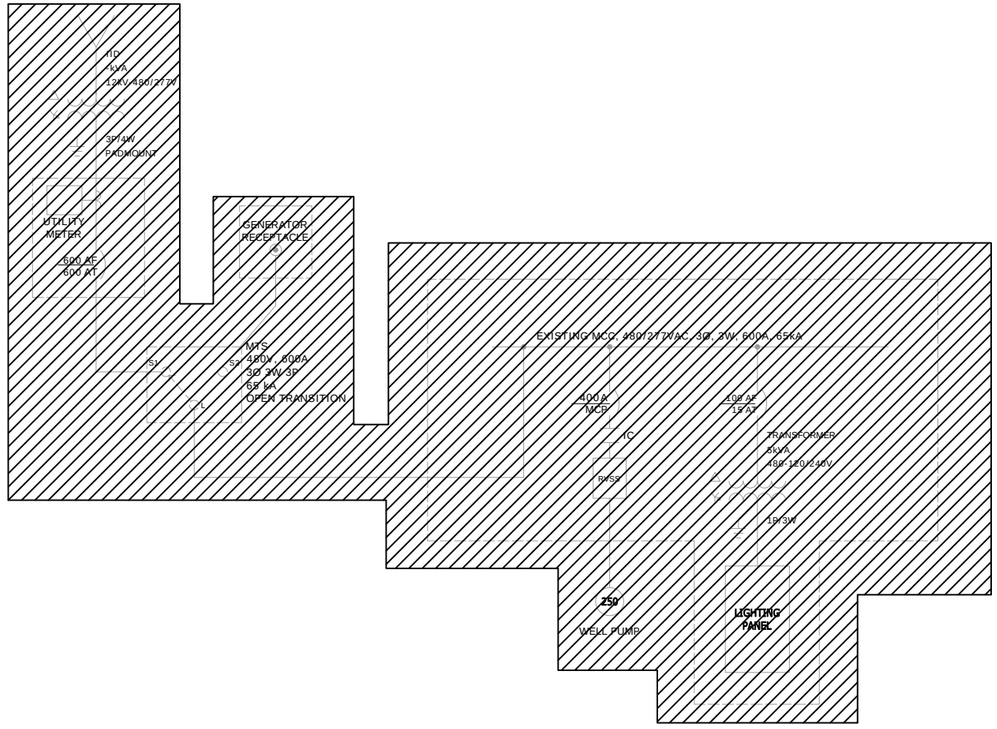


MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM



MAIN POWER DISTRIBUTION- DEMOLITION

SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: PROJECT ENGINEER

Recommended: DIRECTOR OF ENGINEERING

Date:

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 16
ELECTRICAL
DEMOLITION AND MODIFIED
SINGLE LINE DIAGRAMS

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: E-161

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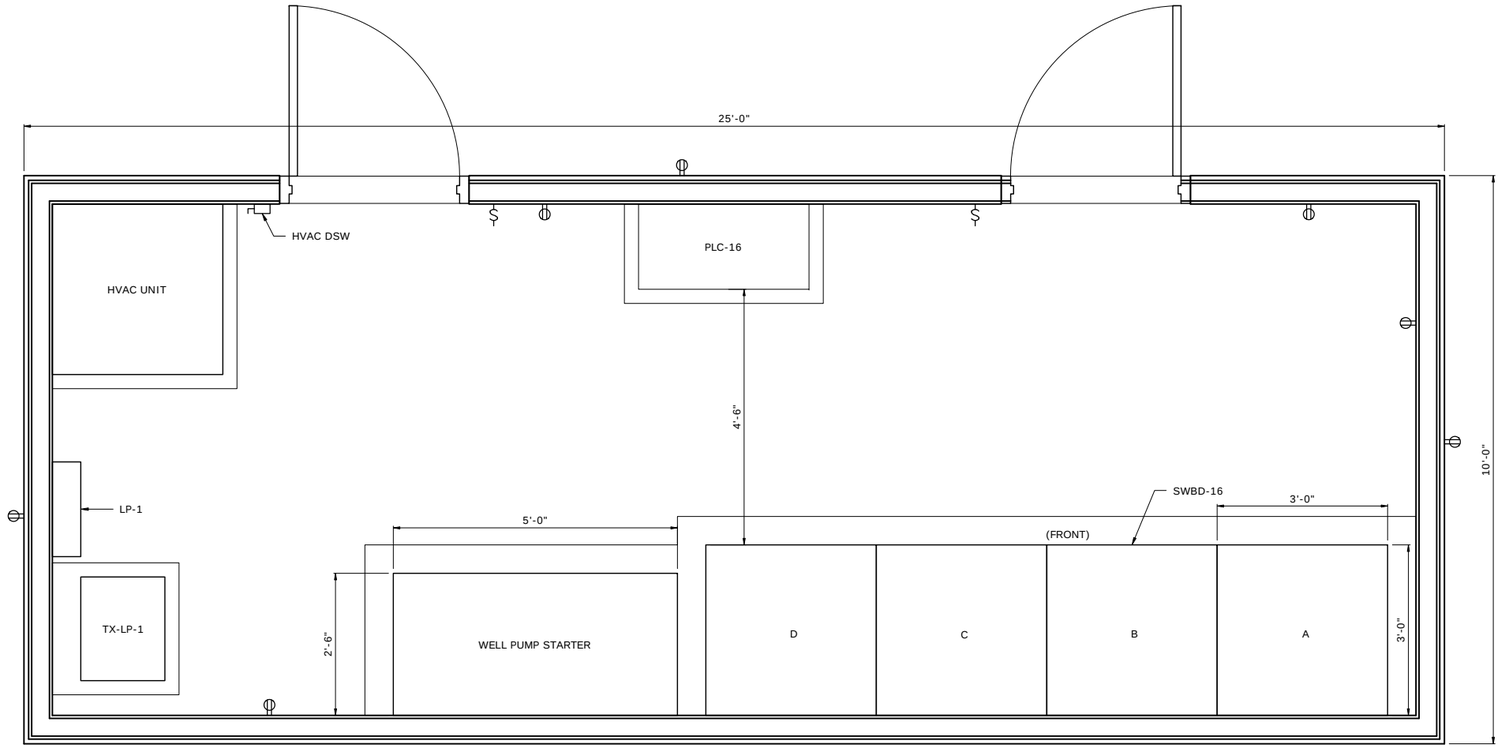
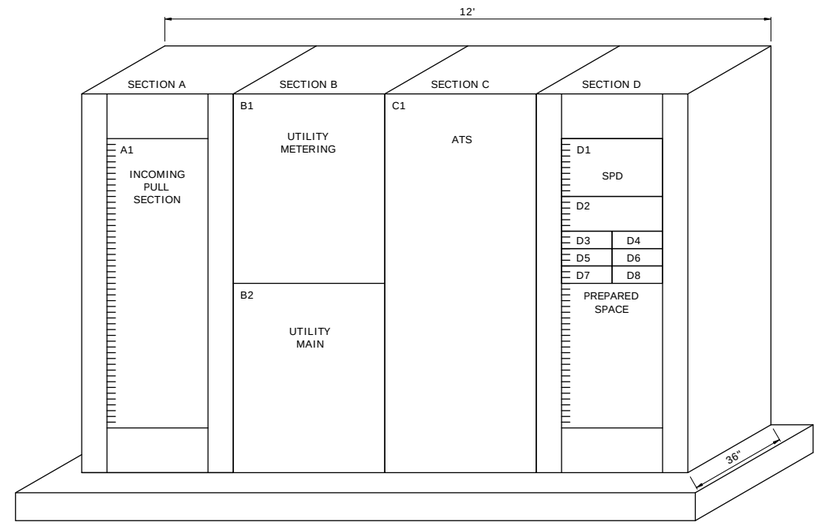


ELECTRICAL BUILDING - PLAN
3/4" = 1'-0"



SWBD-16
ELEVATION (NTS)

3/4"=1'-0"

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 16 ELECTRICAL SWBD ELEVATION AND ELECTRICAL BUILDING - PLAN

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-162

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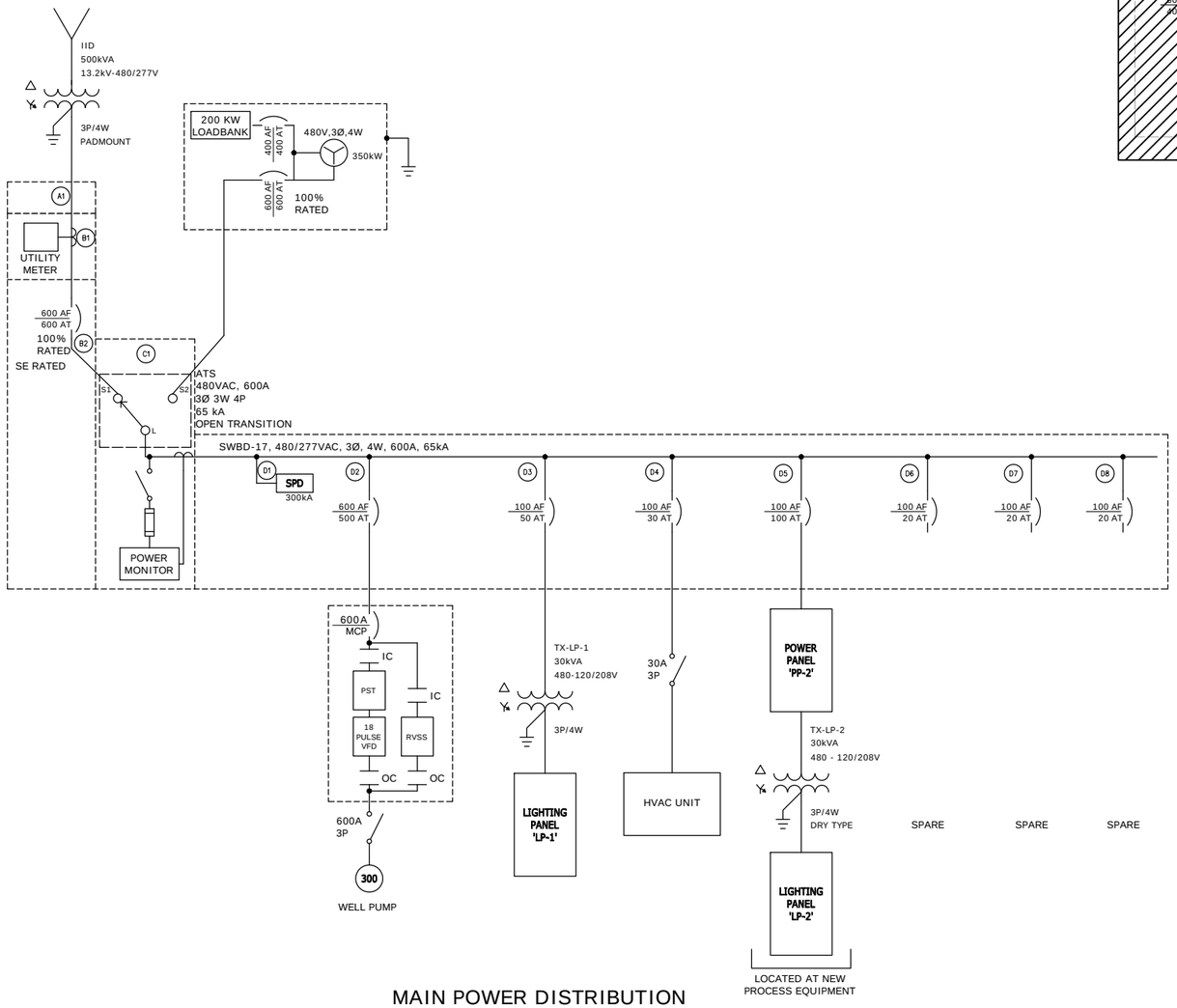
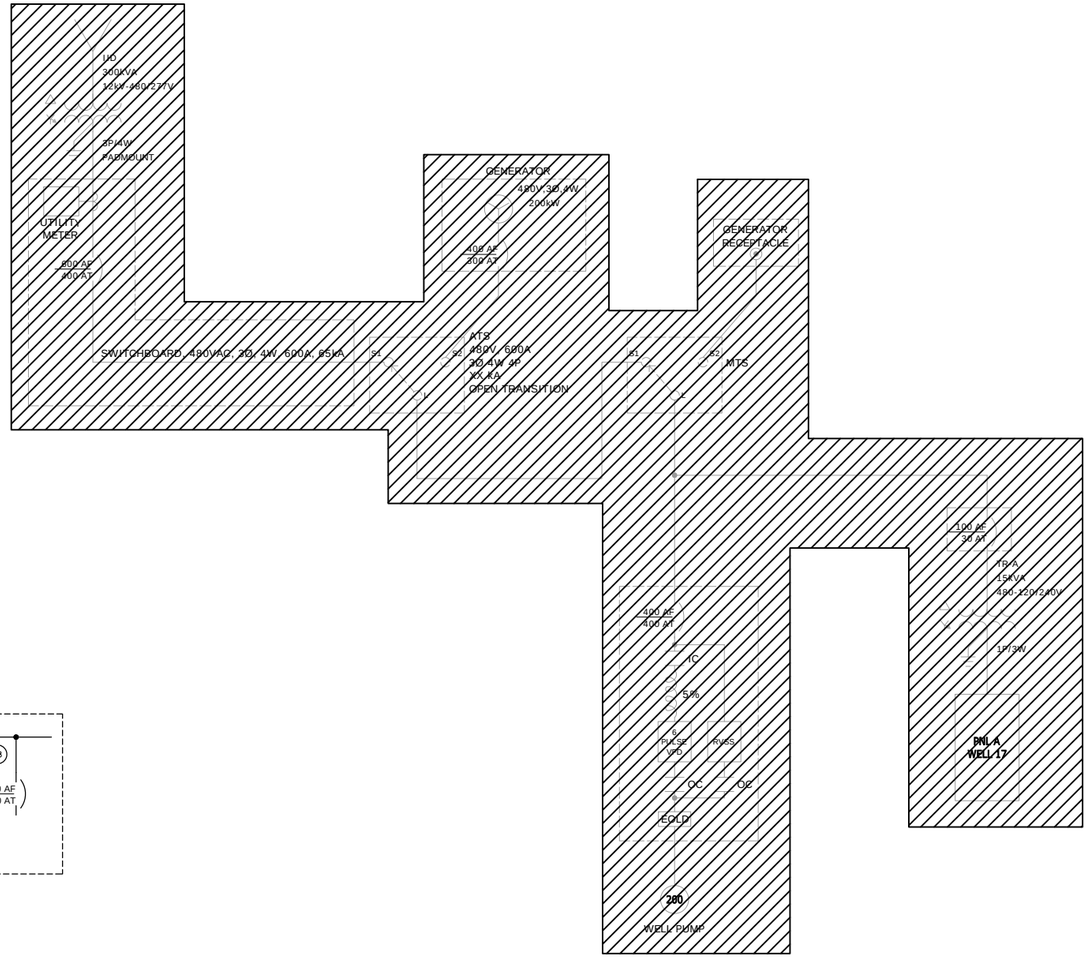


MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM



MAIN POWER DISTRIBUTION - DEMOLITION

SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 — 1/2" — 1")

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

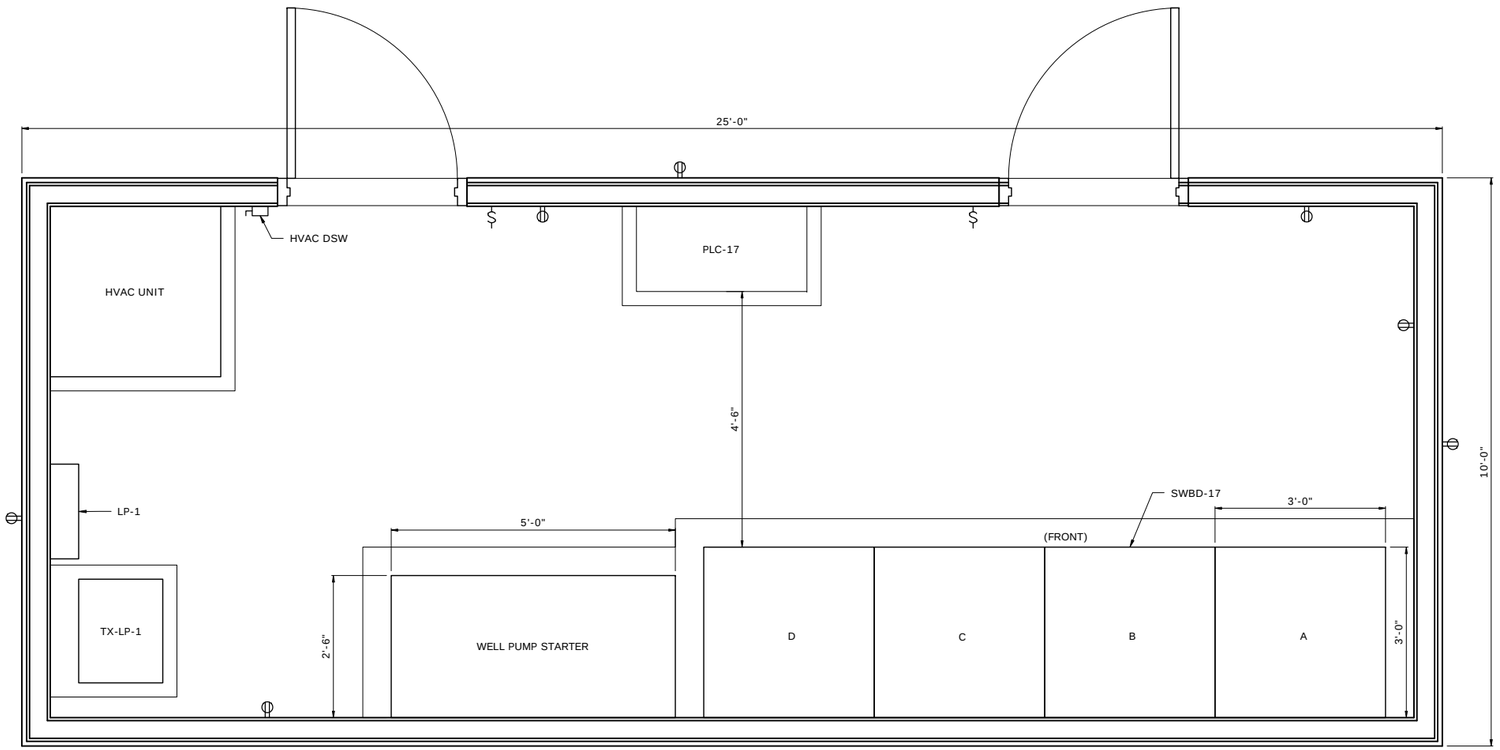
CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

WELL SITE 17
ELECTRICAL
DEMOLITION AND MODIFIED
SINGLE LINE DIAGRAMS

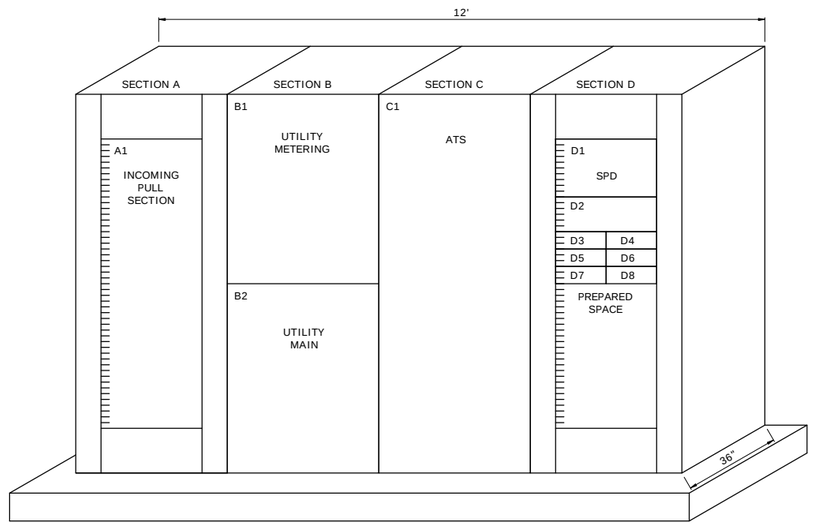
DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-171

File: \\172.32.2.10\PROJECTS\20050-RAL\20050-003\DRAWINGS\ELEC\E-171 Saved By PBOWLES Save Date: 2016/11/10 8:13 AM



ELECTRICAL BUILDING - PLAN

3/4" = 1'-0"



SWBD-17

ELEVATION (NTS)

3/4"=1'-0"

6" 0 1 2'

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

ELEC SEAL

Hazen

HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 17
ELECTRICAL
SWBD ELEVATION AND ELECTRICAL BUILDING - PLAN

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-172

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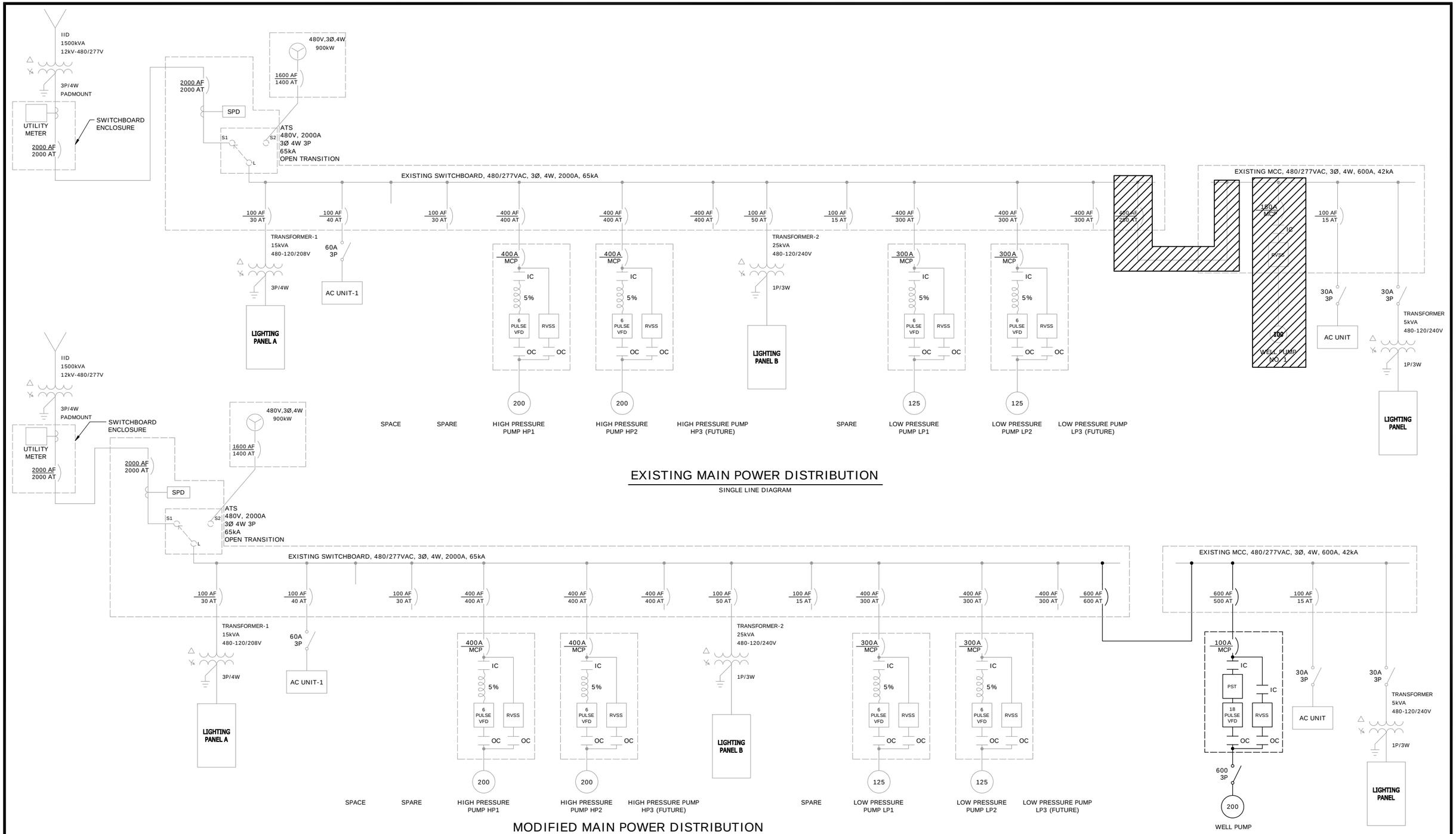

EXISTING MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM

MODIFIED MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 18
ELECTRICAL
EXISTING AND MODIFIED
SINGLE LINE DIAGRAMS

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-181

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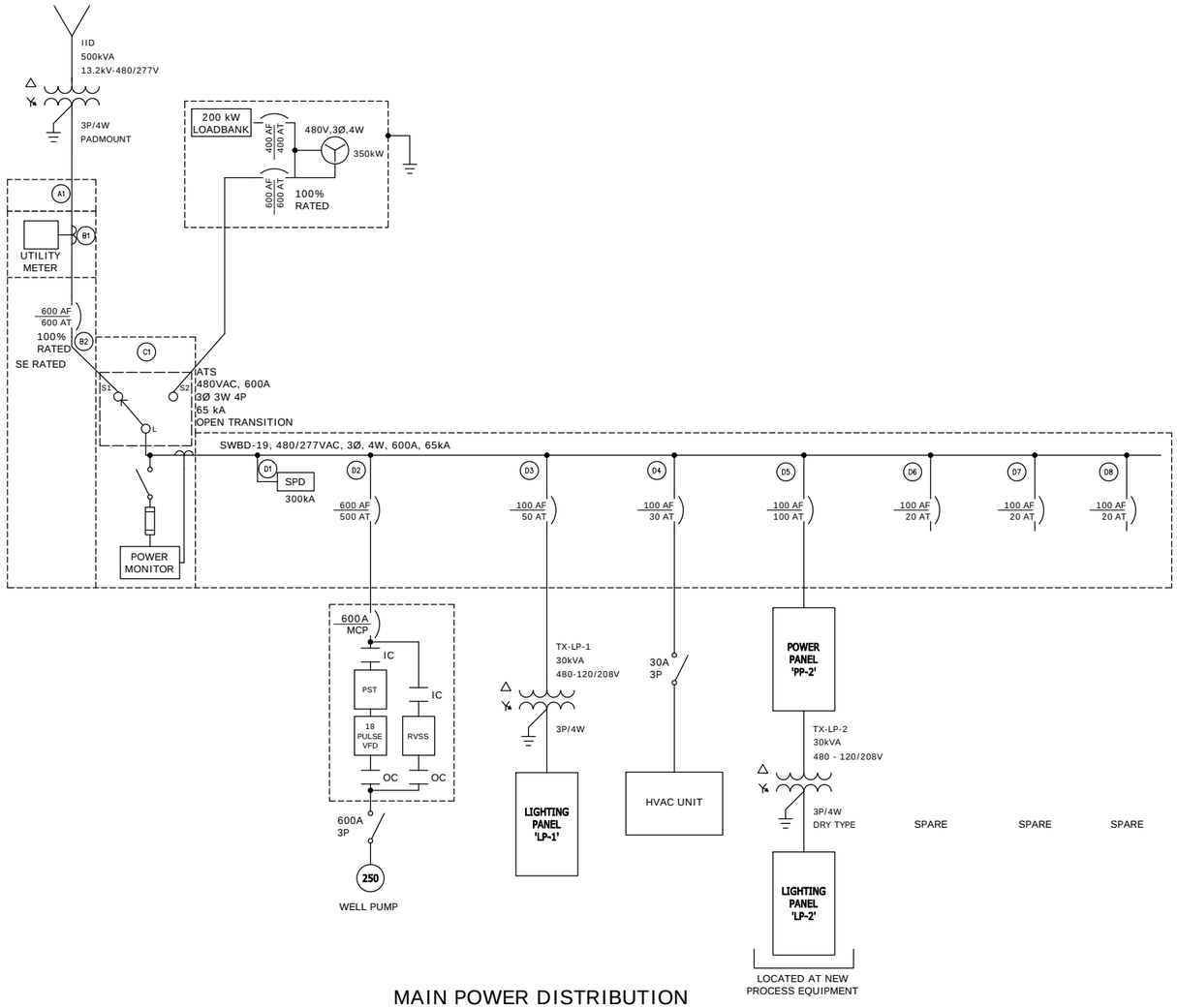
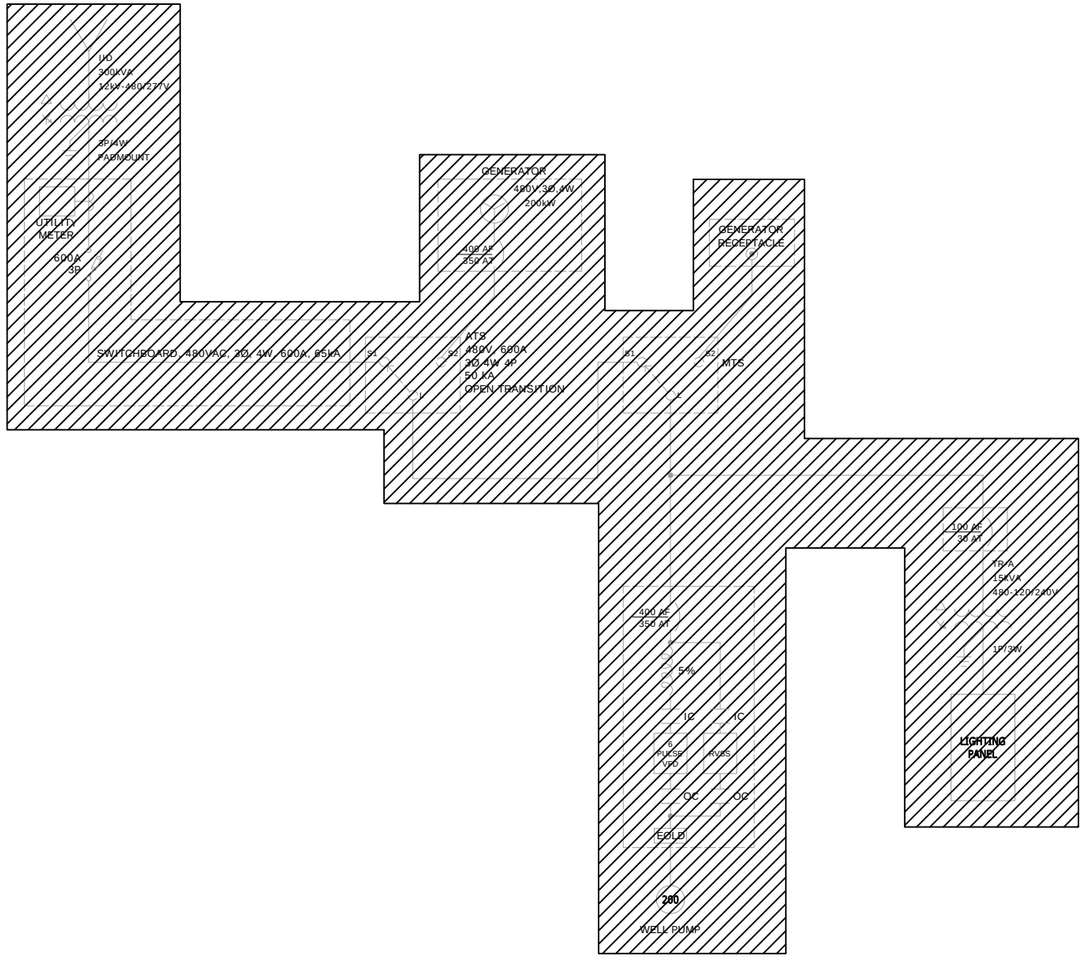


MAIN POWER DISTRIBUTION

SINGLE LINE DIAGRAM



MAIN POWER DISTRIBUTION - DEMOLITION

SINGLE LINE DIAGRAM

REV	ISSUED FOR	DATE	BY

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE (0 — 1/2" — 1")

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

WELL SITE 19
ELECTRICAL
DEMOLITION AND MODIFIED
SINGLE LINE DIAGRAMS

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-191

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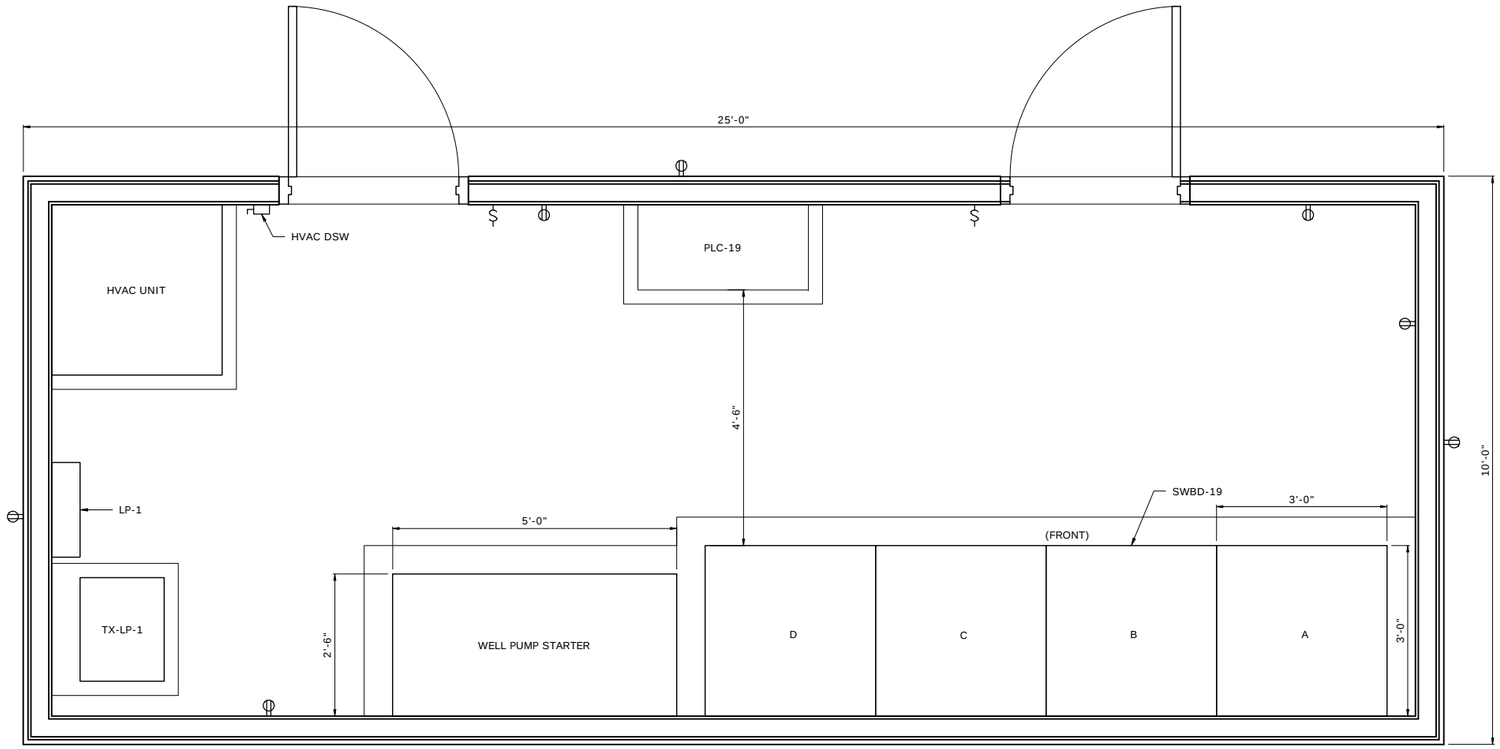
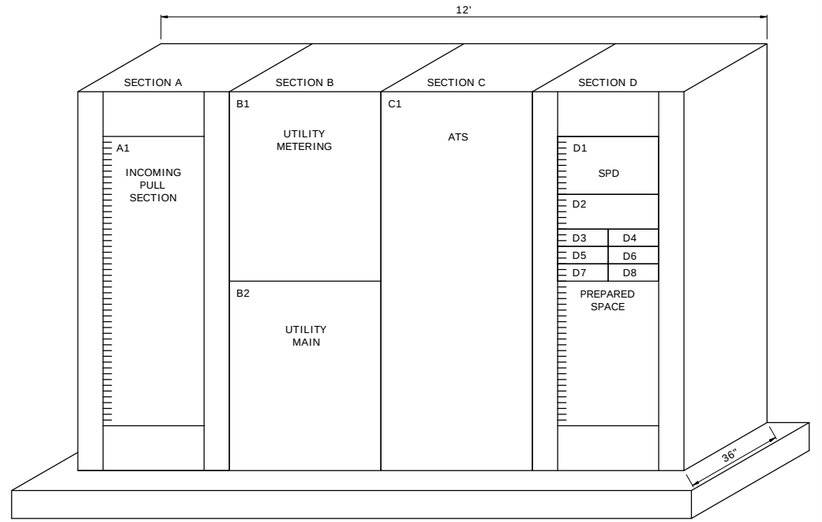


ELECTRICAL BUILDING - PLAN

3/4" = 1'-0"



SWBD-19

ELEVATION (NTS)

3/4"=1'-0"

6" 0 1 2'

REV	ISSUED FOR	DATE	BY

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

WELL SITE 19
ELECTRICAL
SWBD ELEVATION AND ELECTRICAL BUILDING - PLAN

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: E-192

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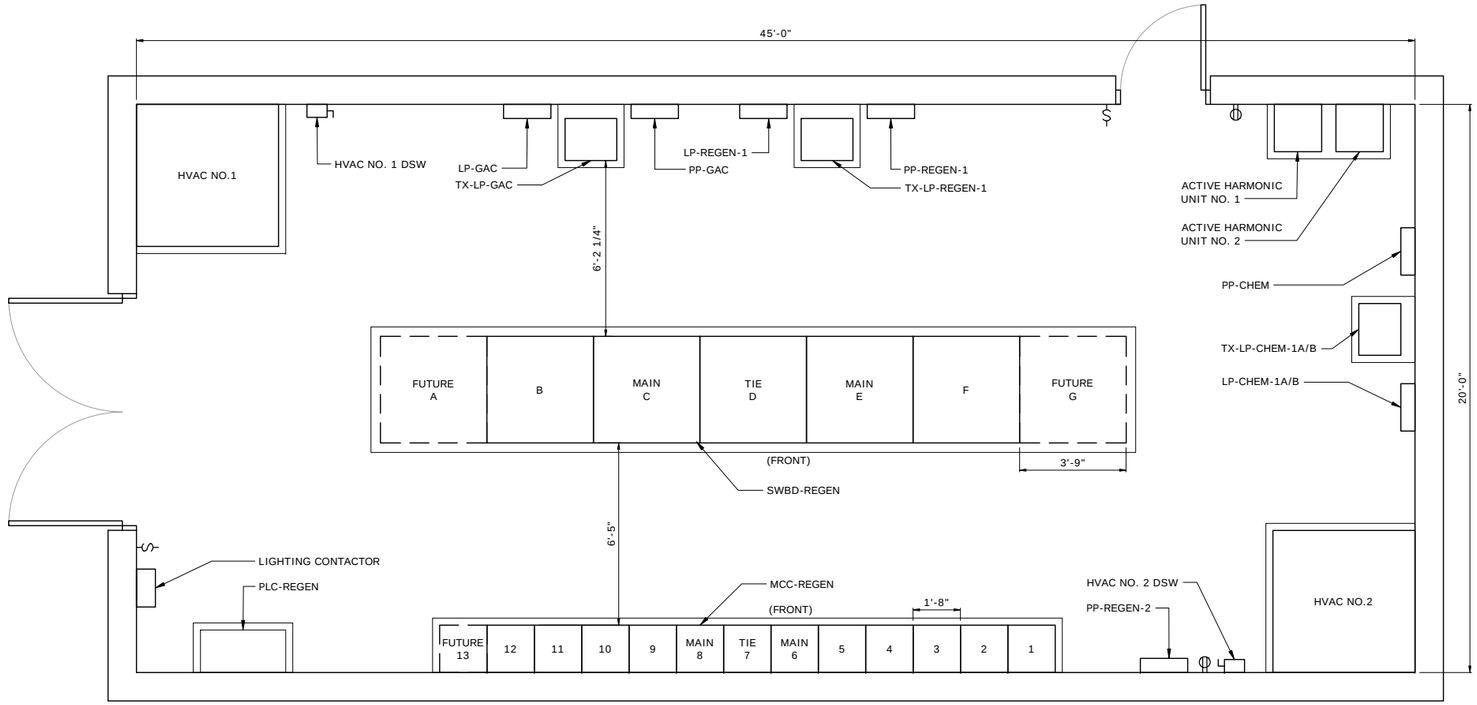

REGEN ELECTRICAL ROOM - PLAN

3/8" = 1'-0"

3/8"=1'-0" 12" 0 1 2 4'

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

ELEC SEAL

Hazen

HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY
ELECTRICAL
REGEN ELECTRICAL ROOM - PLAN

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-500

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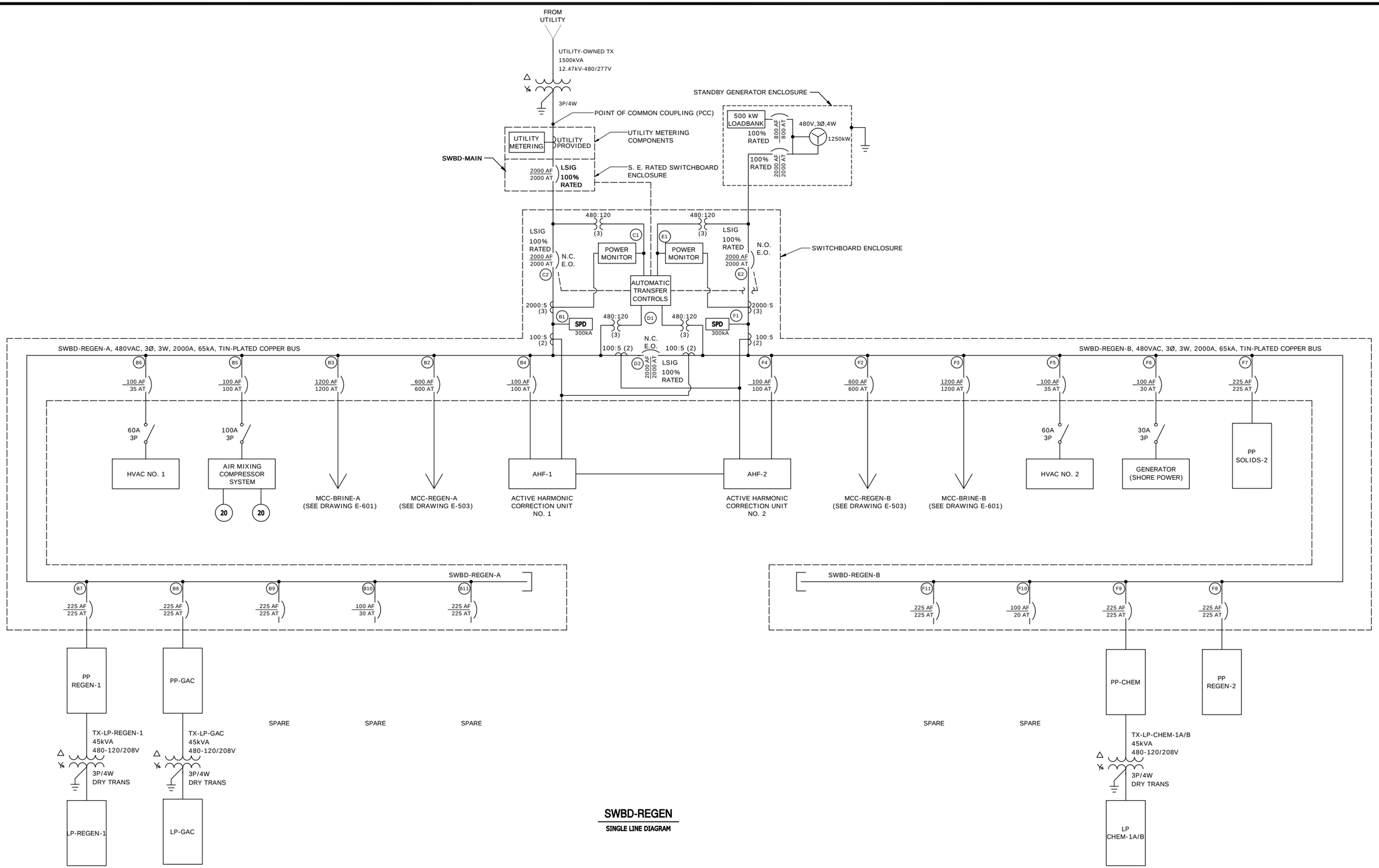


SWBD-REGEN
SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

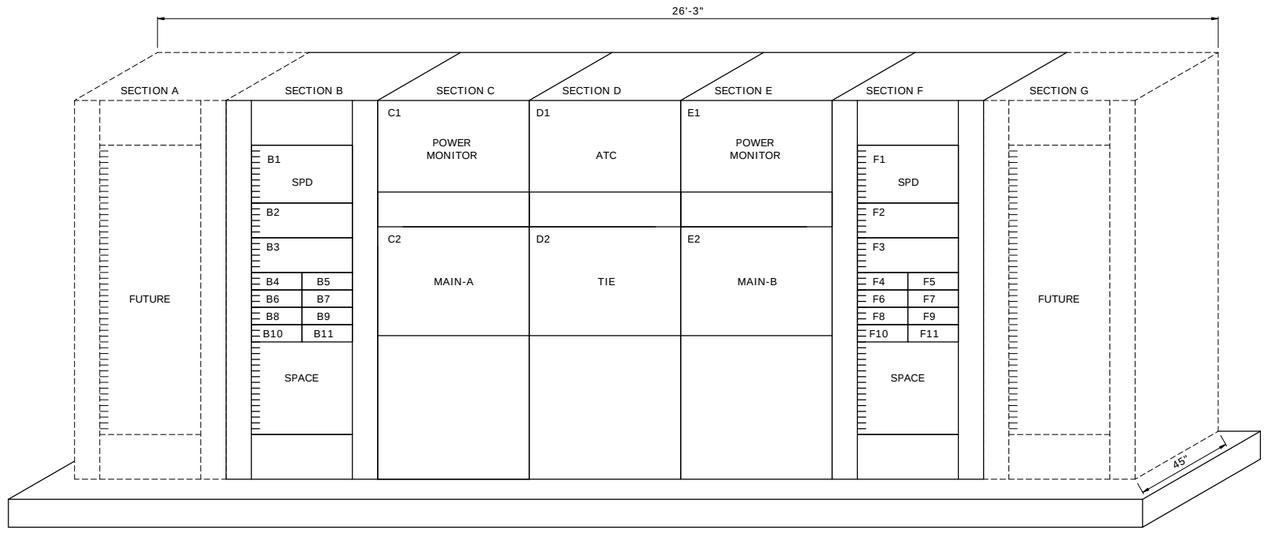
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY
ELECTRICAL
SWBD-REGEN SINGLE LINE DIAGRAM

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-501

File: \\172.30.2.10\PROJECTS\20050-RAL\20050-003\DRAWINGS\ELEC\E-501 Saved By: TRAHLAN Save Date: 2016/11/10 11:06 AM



SWBD-REGEN

ELEVATION (NTS)

REV	ISSUED FOR	DATE	BY

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

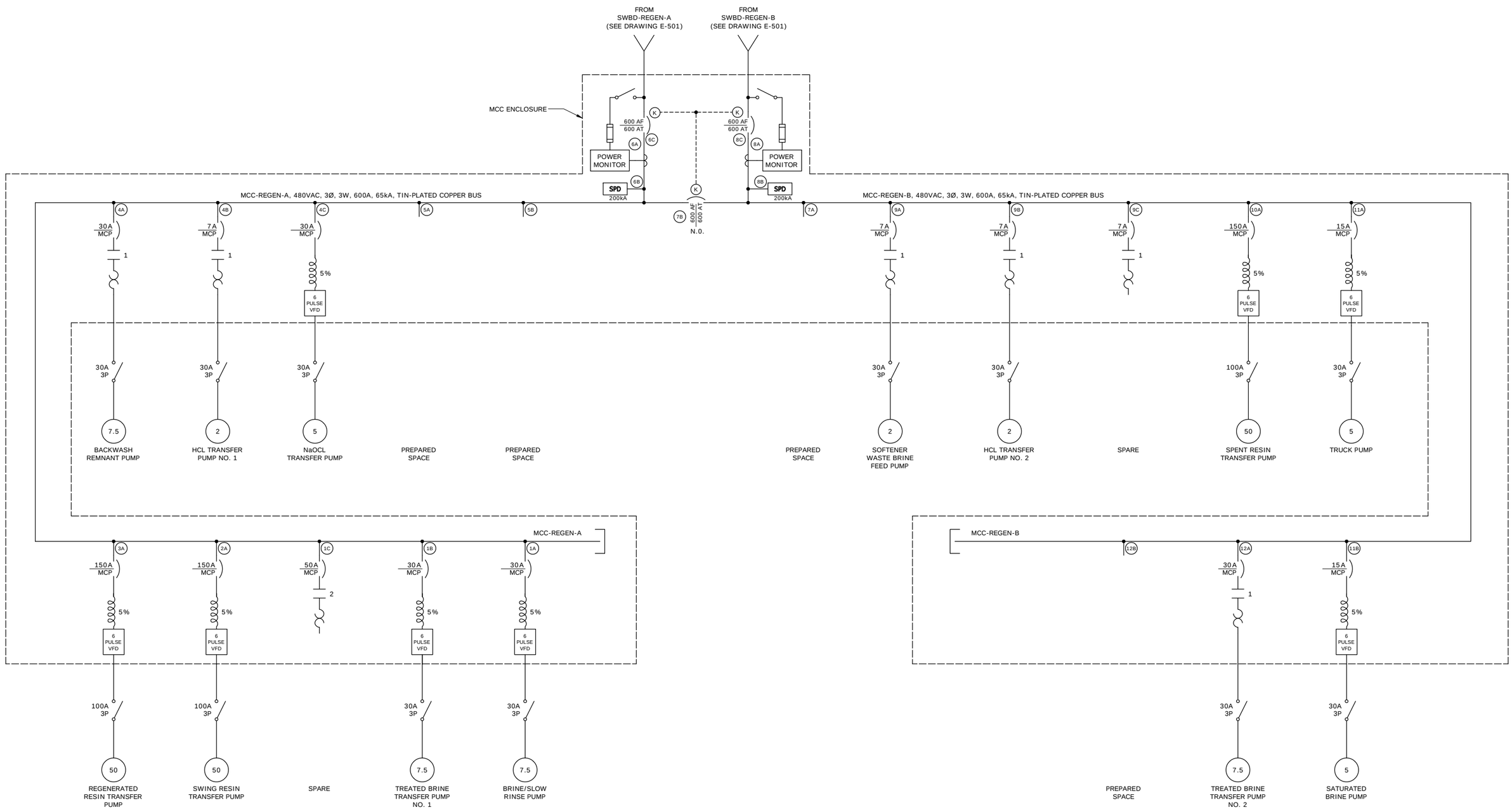
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY
ELECTRICAL
SWBD-REGEN ELEVATION

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-502

File: \\172.30.2.10\PROJECTS\20050-RAL\20050-003\DRAWINGS\ELEC\E-502 Saved By TRAHLAN Save Date: 2016/11/10 11:07 AM



MCC-REGEN

SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA DRAWING APPROVAL

Checked: PROJECT ENGINEER

Recommended: DIRECTOR OF ENGINEERING

Date:

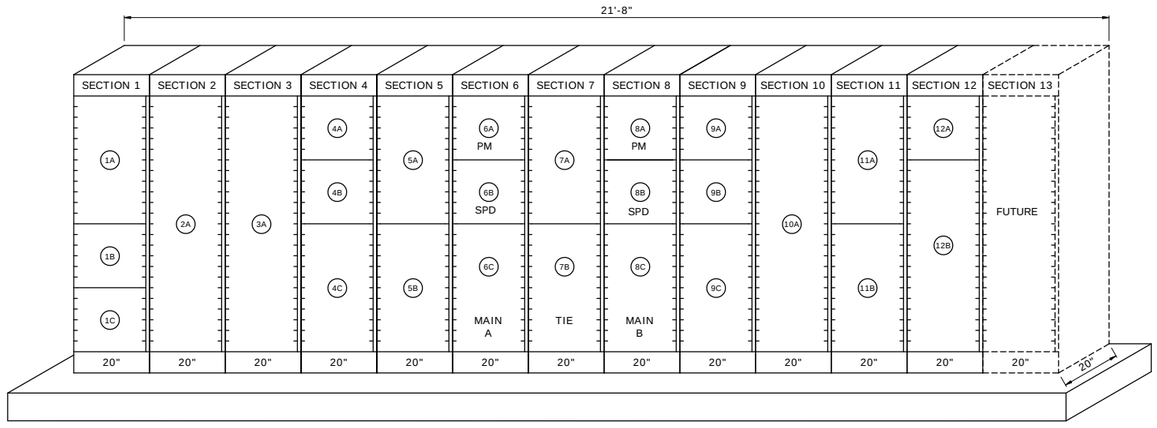
CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY
ELECTRICAL
MCC-REGEN SINGLE LINE DIAGRAM

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: E-503

File: \\172.30.2.10\PROJECTS\20050-RAL\20050-003\DRAWINGS\ELEC\E-503 Saved By: TRAHLAN Save Date: 2016/11/10 11:07 AM



MCC-REGEN

ELEVATION (NTS)

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

RESIN REGENERATION
FACILITY
ELECTRICAL
MCC-REGEN ELEVATION

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-504

File: \\172.30.2.10\PROJECTS\20050-RAL\20050-003\DRAWINGS\ELEC\E-504 Saved By: TRAHLAN Save Date: 2016/11/10 11:08 AM

NOTES:

1. FURNISH AND INSTALL 2#12, #12GND IN 3/4" C, UNLESS OTHERWISE NOTED.

480 VOLTS
3 PHASE, 3 WIRE

PP-FWS
MAIN BREAKER
225A 3P

TYPE: NEMA 1
MOUNT: SURFACE

MODS	DESCRIPTION	WIRE	TRIP	POLE	No.	VOLT-AMPERES A	VOLT-AMPERES B	VOLT-AMPERES C	No.	VOLT-AMPERES A	VOLT-AMPERES B	VOLT-AMPERES C	No.	POLE	TRIP	WIRE	DESCRIPTION	MODS
-	MOV-1, MOV-2, MOV-3		20	3	1	1,500			2	1,500								
					3		1,500		4		1,500		3	20		MOV-16, MOV-17, MOV-18	-
					5			1,500	6			1,500						
-	MOV-4, MOV-5, MOV-6		20	3	7	1,500			8	1,000								
					9		1,500		10		1,000		3	20		MOV-19, MOV-20	-
					11			1,500	12			1,000						
-	MOV-7, MOV-8, MOV-9		20	3	13	1,500			14	1,500								
					15		1,500		16		1,500		3	20		MOV-21, MOV-222, MOV-23	-
					17			1,500	18			1,500						
-	MOV-10, MOV-11, MOV-12		20	3	19	1,500			20	1,000								
					21		1,500		22		1,000		3	20		MOV-24, MOV-25	-
					23			1,500	24			1,000						
-	MOV-13, MOV-14, MOV-15		20	3	25	1,500			26	-								
					27		1,500		28		-		3	20		SPARE	-
					29			1,500	30			-						
-	SPARE		20	3	31	-			32	-								
					33		-		34		-		3	20		SPARE	-
					35			-	36			-						
-	SPARE		20	3	37	-			38	15,000								
					39		-		40		15,000		3	70		TX-LP-FWS	-
					41			-	42			15,000						
			TOTAL			7,500	7,500	7,500		20,000	20,000	20,000	TOTAL					
						PHASE TOTAL				TOTAL LOAD (VA)								
						27,500	27,500	27,500		82,500								
										TOTAL LOAD (A)								
										99								

MODIFICATION (MODS) LEGEND:
GFCI - GROUND FAULT CIRCUIT INTERRUPTER
LOD - LOCK-ON DEVICE
LFD - LOCK-OFF DEVICE

NOTES:
65K AIC
100kA SPD

208/120 VOLTS
3 PHASE, 4 WIRE

LP-FWS
MAIN BREAKER
150A 3P

TYPE: NEMA 1
MOUNT: SURFACE

MODS	DESCRIPTION	WIRE	TRIP	POLE	No.	VOLT-AMPERES A	VOLT-AMPERES B	VOLT-AMPERES C	VOLT-AMPERES A	VOLT-AMPERES B	VOLT-AMPERES C	No.	POLE	TRIP	WIRE	DESCRIPTION	MODS
-	LTG-ELEC ROOM 1	SEE NOTE 1	20	1	1	500			900			2	1	20	SEE NOTE 1	RECP-ELEC ROOM 1	-
-	LTG-ELEC ROOM 2	SEE NOTE 1	20	1	3		500			900		4	1	20	SEE NOTE 1	RECP-ELEC ROOM 2	-
-	PLC-REGEN		20	1	5			1,000			500	6	1	20		HVAC-LCP-1	-
-	AIT-1		20	1	7	100			100			8	1	20		FIT-3	-
-	FIT-1		20	1	9		100			500		10	1	20		MOV-26	-
-	AIT-2		20	1	11			1,300			100	12	1	20		AIT-3	-
-	FIT-2		20	1	13	100			100			14	1	20		FIT-4	-
-	VCP-AIRMX-1		20	1	15		500			100		16	1	20		AIT-4	-
-	AIRMX-1 No. 1		20	1	17			500			100	18	1	20		FIT-5	-
-	AIRMX-1 No. 2		20	1	19	500			500			20	1	20		VCP-AIRMX-2	-
-	MOV-28, MOV-29		20	1	21		1,000			500		22	1	20		AIRMX-2 No. 1	-
-	MOV-30		20	1	23			500			500	24	1	20		AIRMX-2 No. 2	-
-	MOV-31		20	1	25	500			500			26	1	20		AIRMX-2 No. 3	-
-	SPARE		20	1	27		-			500		28	1	20		AIRMX-2 No. 4	-
-	SPARE		20	1	29			-			500	30	1	20		AIRMX-2 No. 5	-
-	SPARE		20	1	31	-			500			32	1	20		MOV-27	-
-	SPARE		20	1	33		-			-		34	1	20		SPARE	-
-	SPARE		20	1	35			-			-	36	1	20		SPARE	-
-	SPARE		20	1	37	-			-			38	1	20		SPARE	-
-	SPARE		20	1	39		-			-		40	1	20		SPARE	-
-	SPARE		20	1	41			-			-	42	1	20		SPARE	-
			TOTAL			1,700	2,100	3,300	2,600	2,500	1,700	TOTAL					
						PHASE TOTAL			TOTAL LOAD (VA)								
						4,300	4,600	5,000	13,900								
									TOTAL LOAD (A)								
									39								

MODIFICATION (MODS) LEGEND:
GFCI - GROUND FAULT CIRCUIT INTERRUPTER
LOD - LOCK-ON DEVICE
LFD - LOCK-OFF DEVICE

NOTES:
22K AIC
100kA SPD

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
DESIGNED BY: B. PICKETT
DRAWN BY: T. RAHLAN
CHECKED BY: C. THUNHORST
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

ELEC SEAL

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

RESIN REGENERATION FACILITY ELECTRICAL PANEL SCHEDULES

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: E-505

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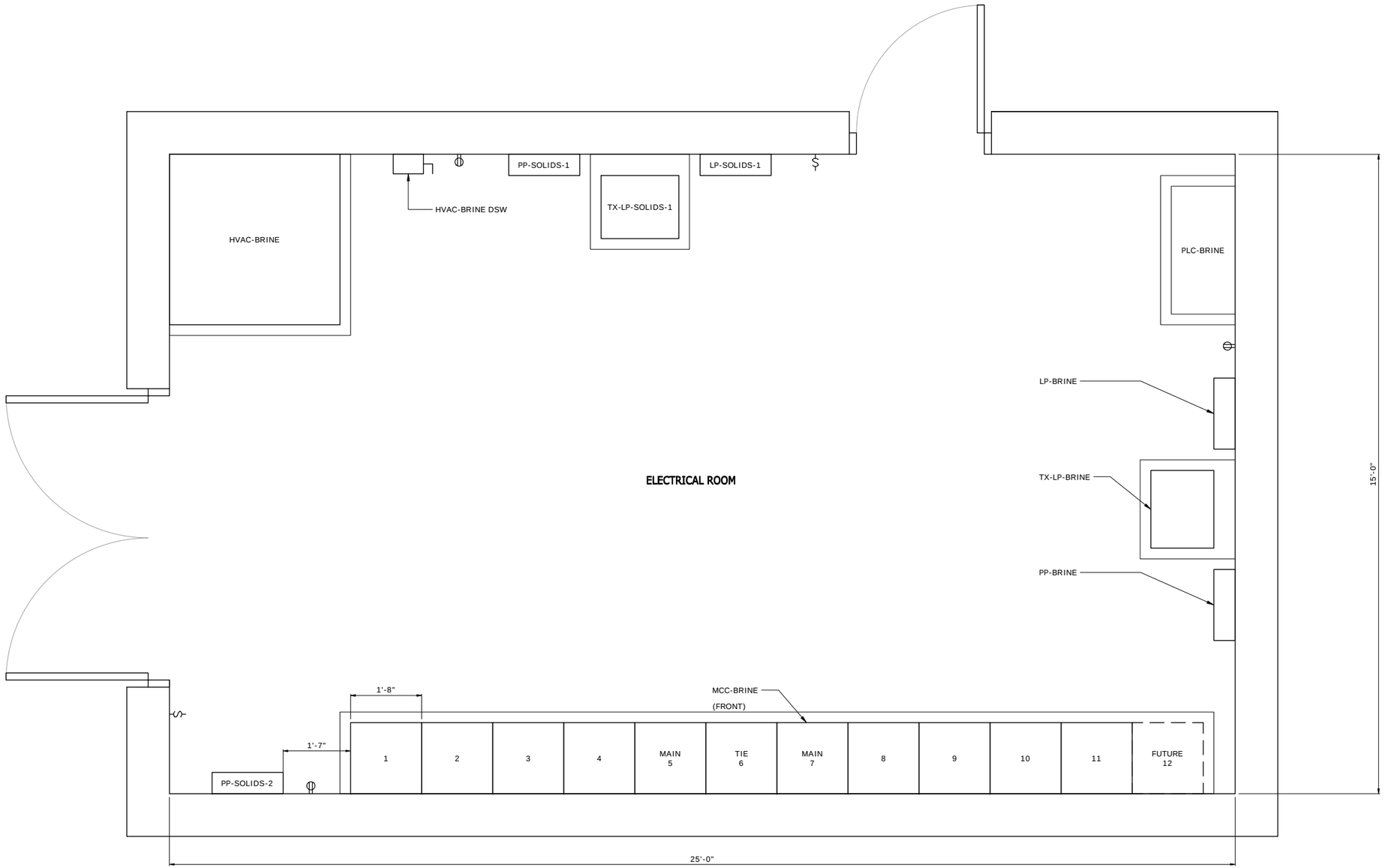

BRINE ELECTRICAL ROOM - PLAN

3/4" = 1'-0"

3/4"=1'-0" 6" 0 1 2'

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
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36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: PROJECT ENGINEER

Recommended: DIRECTOR OF ENGINEERING

Date:

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

BRINE TREATMENT
BUILDING
ELECTRICAL
BRINE ELECTRICAL ROOM
- PLAN

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-600

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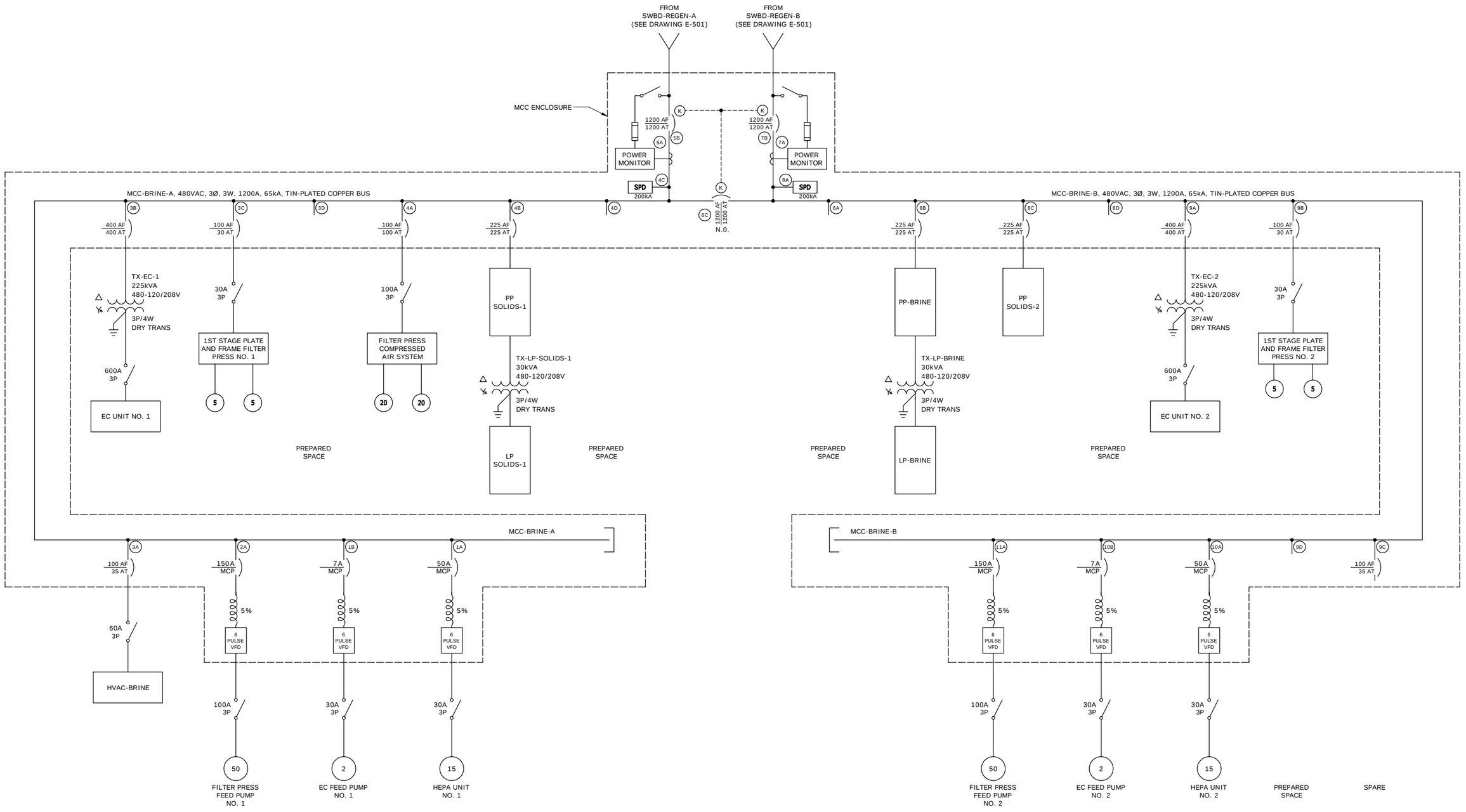

MCC-BRINE

SINGLE LINE DIAGRAM

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST

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HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

BRINE TREATMENT BUILDING
ELECTRICAL
MCC-BRINE SINGLE LINE DIAGRAM

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: E-601

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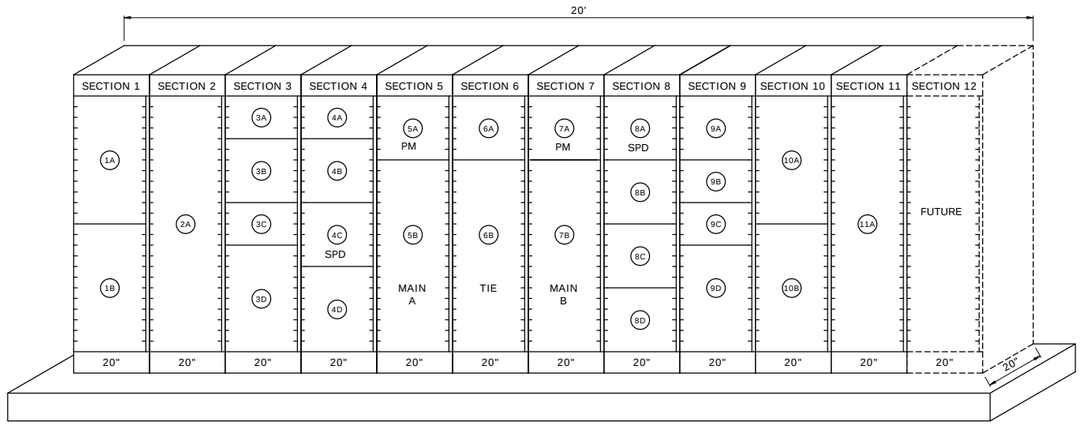

MCC-BRINE

ELEVATION (NTS)

BASIS OF DESIGN REPORT DO NOT USE FOR CONSTRUCTION			
REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	B. PICKETT
DRAWN BY:	T. RAHLAN
CHECKED BY:	C. THUNHORST
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HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

BRINE TREATMENT BUILDING
ELECTRICAL
MCC-BRINE ELEVATION

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	E-602

File: \\172.30.2.10\PROJECTS\20050-HAL\20050-003\DRAWINGS\ELEC\E-602 Saved By: TRAHLAN Save Date: 2016/11/10 11:10 AM

INSTRUMENT AND FUNCTION SYMBOLS

	PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNT	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	NORMALLY INACCESSIBLE OR BEHIND THE PANEL DEVICES OR FUNCTIONS
DISCRETE INSTRUMENTS	XXX 000	XXX 000	XXX 000	XXX 000
SHARED DISPLAY, SHARED CONTROL (OIT, HMI)	XXX 000		XXX 000	XXX 000
PROGRAMMABLE LOGIC CONTROL	XXX 000		XXX 000	XXX 000
COMPUTER FUNCTION	XXX 000		XXX 000	XXX 000

X — SUFFIX (X) TO DIFFERENTIATE BETWEEN INSTRUMENTS AND FUNCTIONS THAT WOULD OTHERWISE HAVE THE SAME IDENTIFICATION.

SINGLE INSTRUMENT OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS OR SHARING A COMMON HOUSING

(ZZZ) — DESIGNATIONS OF CONTROL FUNCTIONS (ZZZ) ASSOCIATED WITH INSTRUMENT OR OTHER COMPONENTS.

AHC	–	AUTO/HOLD/CLOSE	00	–	ON / OFF
AM	–	AUTO/MANUAL	OC	–	OPEN/CLOSE
CALC	–	CALCULATION	OOR	–	ON/OFF/REMOTE
DEV	–	DEVIATION	OSC	–	OPEN/STOP/CLOSED
ETM	–	RUN TIME HOURS	POT	–	POTENTIOMETER
FTC	–	FAIL TO CLOSE	RL	–	RAISE/LOWER
FTO	–	FAIL TO OPEN	RS	–	RUN/STOP
FTM	–	FAIL TO MOVE	RSL	–	RAISE/STOP/LOWER
FTS	–	FAIL TO START	SD	–	SHUTDOWN
HOA	–	HAND/OFF/AUTO	SEL	–	SELECT
HOR	–	HAND/OFF/REMOTE	SP	–	SET POINT
LOS	–	LOCKOUT STOP	SR	–	START/RESET
LR	–	LOCAL/REMOTE	SS	–	STOP/START
LOR	–	LOCAL/OFF/REMOTE	REM	–	REMOTE

* — INSTRUMENT WITH COMPUTING OR CONVERTING FUNCTION

ABCD 12345 — CONTROL SYSTEM COMPUTING FUNCTION

CONVERT — E – VOLTAGE, I – CURRENT, P – PNEUMATIC, A – ANALOG, B – BINARY, H – HYDRAULIC, O – ELECTROMAGNETIC, SONIC, R – RESISTANCE (ELECT.), D – DIGITAL

COMPUTE

Σ	SUMMING	P	PROPORTIONAL	△	DIFFERENCE
–	SUBTRACTOR	R	DERIVATIVE	>	HIGH SELECTING
X	MULTIPLYING	Σ/n	AVERAGING	<	LOW SELECTING
÷	DIVIDING	I:I	RATIO	◿	INTEGRAL
√	ROOT EXTRACTION	PID	PID	#	COMPLEX FUNCTION

= 1, 2, 3, etc. REFER TO NOTE ON SAME SHEET FOR BRIEF DESCRIPTION

* — ELECTRICAL CONTROL INTERLOCK

\# — COMPLEX INTERLOCK # = 1, 2, 3, etc. REFER TO NOTE ON SAME SHEET FOR BRIEF DESCRIPTION

AND — AND LOGIC

OR — OR LOGIC

* ASTERISK IDENTIFIES FIELD INSTRUMENTS FURNISHED BY EQUIPMENT SUPPLIER

VALVE SYMBOLS

GATE VALVE | PLUG VALVE | GLOBE VALVE | BALL VALVE

BALL VALVE (3 WAY) | PINCH VALVE | NEEDLE VALVE | DIAPHRAGM VALVE

BUTTERFLY VALVE | SWING CHECK VALVE | BALL CHECK VALVE | THROUGH PLUG VALVE

ANGLE VALVE | ROTARY VALVE | AIR RELEASE VALVE (ARV) | COMBINATION AIR VALVE (CAV) & WELL SERVICE AIR VALVE (WSAV)

PRESSURE RELIEF VALVE (PRV) | VACUUM RELIEF VALVE (VRV) | PRESSURE-REDUCING REGULATOR (PRRV) | BACKPRESSURE REGULATOR (PSV)

COMBINATION VACUUM AND PRESSURE RELIEF VALVE (CVPRV) | SLUICE GATE | SLIDE/WEIR GATE | STOP LOGS

PUMP CONTROL VALVE | DAMPER | TELESCOPING VALVE

WAFER-TYPE CHECK VALVE | BACKFLOW PREVENTOR | KNIFE GATE | STRAINER

FLOW METERS

MAGNETIC FLOWMETER | VORTEX SENSOR | PADDLE WHEEL | FLUME

SONIC FLOW METER "DOPPLER" OR "TRANSIT TIME" TEXT MAY BE ADDED | ORIFICE PLATE (MOUNTED IN FLANGE UNION) | SINGLE PORT PITOT TUBE | WEIR

VARIABLE AREA INDICATING ROTAMETER(R) | POSITIVE-DISPLACEMENT TYPE | VENTURI/INSERT TYPE FLOW TUBE | TURBINE-OR PROPELLER TYPE

VALVE/GATE ACTUATORS

SOLENOID | ROTARY MOTOR | VALVE ACTUATOR ELECTRO- PNEUMATIC CONVERTER | ELECTROHYDRAULIC

PNEUMATIC | HAND WHEEL

ANALYTICAL

XXXX 41:AIT 000 — ANALYSIS INDICATING TRANSMITTER

XXXX = ALK - ALKALINITY

CH4	-	METHANE CONCENTRATION
CL2	-	CHLORINE CONCENTRATION
COMB	-	COMBUSTIBLE GAS
CON	-	CONDUCTIVITY
DO	-	DISSOLVED OXYGEN
IR	-	INFRARED
H2S	-	HYDROGEN SULFIDE
LEL	-	LOWER EXPLOSIVE LIMIT
MEOH	-	METHANOL VAPOR CONCENTRATION
O2	-	OXYGEN CONCENTRATION
O3	-	OZONE
ORP	-	OXIDATION/REDUCTION POTENTIAL
PETRO	-	PETROLEUM VAPOR
PH	-	HYDROGEN ION CONCENTRATION
SO2	-	SULFUR DIOXIDE
TH	-	TOTAL HARDNESS
TSS	-	TOTAL SUSPENDED SOLIDS
TURB	-	TURBIDITY
UV	-	ULTRAVIOLET

PUMP AND COMPRESSOR SYMBOLS

CENTRIFUGAL PUMP | MAGNETIC DRIVE PUMP | PROGRESSIVE CAVITY PUMP | CENTRIFUGAL WET PIT (OR DRY-PIT SUBMERSIBLE) PUMP | COMPRESSOR (CENTRIFUGAL), OR TURBINE

CHOPPER PUMP | PISTON PUMP | GEAR PUMP | COMPRESSOR (PISTON)

ROTARY LOBE PUMP OR BLOWER (POSITIVE DISPLACEMENT) | VERTICAL TURBINE PUMP | INLINE GRINDER | BLOWER (CENTRIFUGAL)

CHEMICAL FEED PUMP | SCREW CENTRIFUGAL PUMP | HOSE PUMP

MISCELLANEOUS SYMBOLS

DIAPHRAGM SEAL | BLIND FLANGE | FILTER | MIXER | VENTILATION FAN | ROTARY FEEDER

ELECTRIC MOTOR | DRAIN | VENT TO ATMOSPHERE | AIR GAP | CONCENTRIC REDUCER | ECCENTRIC REDUCER | PRESSURE TRANSMITTER WITH FLUSH-MOUNTED FLANGE SEAL

COMPRESSED AIR CYLINDER | ANNULAR DIAPHRAGM SEAL | SIGHT GLASS | HORN | HORN/ STROBE LIGHT | EXPANSION TANK | RUPTURE DISK

CALIBRATION CYLINDER | PULSATION DAMPENER | INJECTOR OR EDUCTOR | FLEXIBLE HOSE | QUICK CONNECT | ULTRASONIC LEVEL OR FLOW SENSOR | SUBMERSIBLE LEVEL (PRESSURE) SENSOR

AIR FILTER | WETWELL/ CLEARWELL | WELL | LIQUID LEVEL | RADAR LEVEL SENSOR | BASKET STRAINER

STATIC MIXER

EQUIPMENT TAG NUMBERS

TTTT-NNN
- EQUIPMENT NUMBER
- EQUIPMENT TYPE

PIPE TAG NUMBERS

NN"-TTT-TTT
- PIPE MATERIAL
- SERVICE
- SIZE

INSTRUMENT LOOP NUMBERS

NNNN
- LOOP NUMBER (4 DIGITS PLUS SUFFIX AS NEEDED)

PANEL NUMBERS

TTT-TTT-NNN
- PANEL NUMBER (SAME AS NUMBER OF ASSOCIATED EQUIPMENT)
- EQUIPMENT TYPE (SAME AS TYPE OF ASSOCIATED EQUIPMENT)
- FCP (VENDOR-FURNISHED), LCP (PROVIDED UNDER DIV 16 OR 17)

NOTES

1. SYMBOLS AND NOMENCLATURE ARE BASED ON ISA STANDARDS S5.1, S5.2, S5.4
2. SEE ASSOCIATED ELECTRICAL AND MECHANICAL SYMBOL SHEETS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
3. POWER SUPPLIES FOR LOOPS OR SYSTEMS SHALL BE FURNISHED BY THE INSTRUMENTATION SUPPLIER TO MEET THE PARTICULAR CHARACTERISTICS (E.G. VOLTAGE AND CURRENT REQUIREMENTS) OF COMPONENTS IN EACH LOOP OR SYSTEM
4. X(S) REQUIRED FOR ALL EQUIPMENT TYPES LESS THAN FOUR CHARACTERS.

INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER: MEASURED OR INITIATING VARIABLE	FIRST LETTER: MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING LETTERS: OUTPUT FUNCTION	SUCCEEDING LETTERS: MODIFIER
A	ANALYSIS		ALARM OR PLC/DCS DISCRETE INPUT		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	BYPASS
C	CONDUCTIVITY (ELECTRICAL)			CONTROLLER	CLOSE, CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			DRIVE (VFD)
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW	RATIO			
G	USER'S CHOICE				
H	HAND SWITCH (SELECTOR SWITCH)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE OR PLC/DCS ANALOG INPUT		
J	POWER	SCAN			
K	TIME OR TIME-SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTERMEDIATE
N	USER'S CHOICE		NOTIFY OR PLC/DCS DISCRETE INPUT	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY		INTEGRATE OR TOTALIZE		
R	RADIATION	REMOTE CONTROL	RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER OR LOUVER	
W	WEIGHT, TORQUE, OR FORCE		WELL		
X	PLC COMMAND		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE			COMPUTE, CONVERT, RELAY	
Z	POSITION, DIMENSION, DIRECTION			DRIVE, ACTUATOR OR UNCLASSIFIED FINAL CONTROL ELEMENT	

LINE SYMBOLS AND LEGEND

- MAJOR PROCESS PIPES OR CHANNELS, NEW
- SECONDARY PROCESS OR MECHANICAL CONNECTION, NEW
- MAJOR PROCESS PIPES, SECONDARY PROCESS OR CHANNELS, EXISTING
- MAJOR PROCESS PIPES, SECONDARY PROCESS OR CHANNELS, FUTURE
- DOUBLE CONTAINED PIPE
- DEMO
- PROCESS/SIGNALS NOT CONNECTED (CROSSING)
- PROCESS/SIGNALS CONNECTED
- AIR SUPPLY OR SIGNAL
- ELECTRICAL SIGNAL
- DATA LINK OR INTERNAL SOFTWARE LINK
- C6 — ETHERNET VIA CATEGORY 6 CABLE
- FO — FIBER OPTIC CABLE
- RADIO LINK

REFER TO COMMUNICATION CABLE LEGEND ON THE NETWORK ARCHITECTURE DRAWING FOR ADDITIONAL LINE TYPES FOR SIGNAL CABLES

- DISCRETE ELECTRICAL SIGNAL (INPUTS) WITH INTERPOSING RELAYS (OUTPUTS)
- ANALOG ELECTRICAL SIGNAL WITH LIGHTNING SURGE ARRESTOR (INPUTS AND OUTPUTS)
- "DISCRETE" DIGITAL SIGNALS, INPUTS AND OUTPUTS.
- "DISCRETE" ANALOG SIGNALS, INPUTS AND OUTPUTS.

DWG NO / DWG NO — TIE-IN CONTINUED ELSEWHERE AS INDICATED

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
DESIGNED BY:
DRAWN BY: C. KOLESA
CHECKED BY:
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE — 0 1/2" 1"

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

CITY OF COACHELLA
HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

ENTER DISCIPLINE HERE
General
INSTRUMENTATION SYMBOLS AND LEGEND

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: I-001

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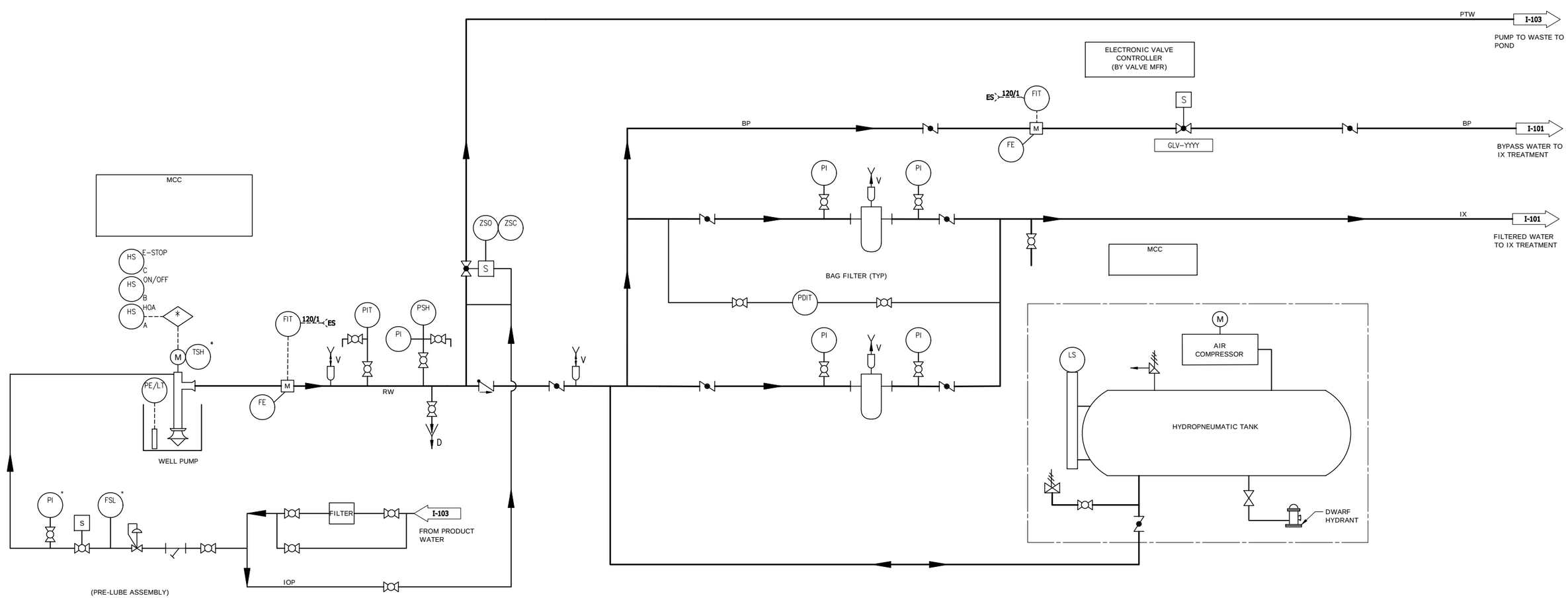

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REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
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PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

CITY OF COACHELLA

HEXAVALENT CHROMIUM TREATMENT FACILITIES PROJECT

ENTER DISCIPLINE HERE

SBA 100 Series
INSTRUMENTATION
PRETREATMENT

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: I-100

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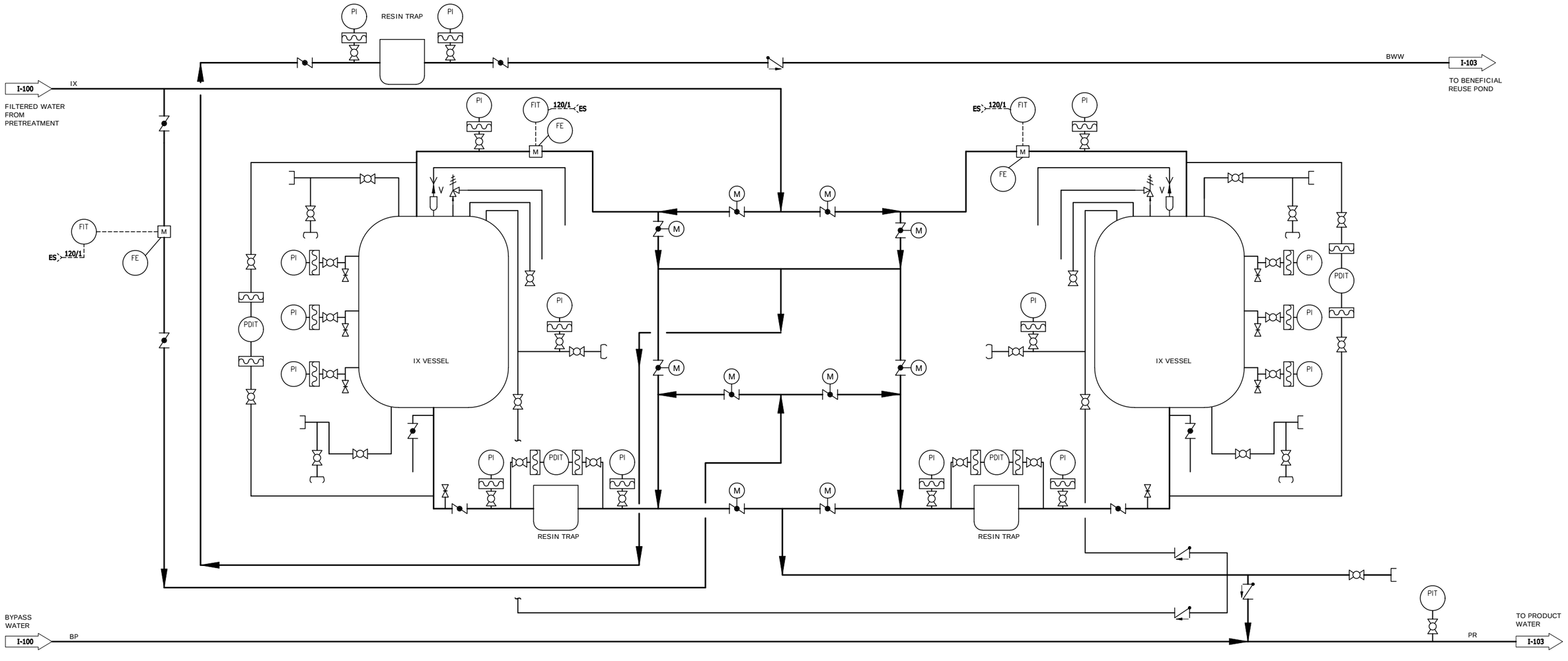

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DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	
DRAWN BY:	C. KOLESA
CHECKED BY:	

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

ENTER DISCIPLINE HERE

SBA 100 Series
INSTRUMENTATION
IX AREA

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	I-101

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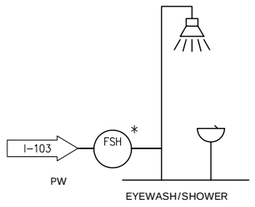

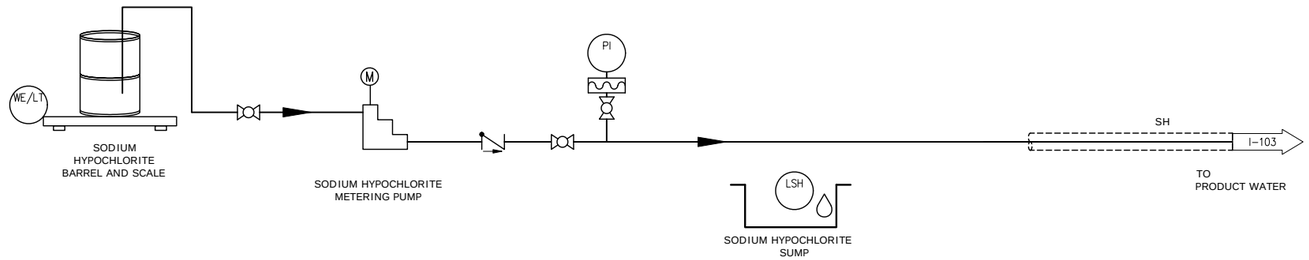

BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER: J. RHOADES
DESIGNED BY:
DRAWN BY: C. KOLESA
CHECKED BY:
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

Hazen
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36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL
Checked: PROJECT ENGINEER
Recommended: DIRECTOR OF ENGINEERING
Date:

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

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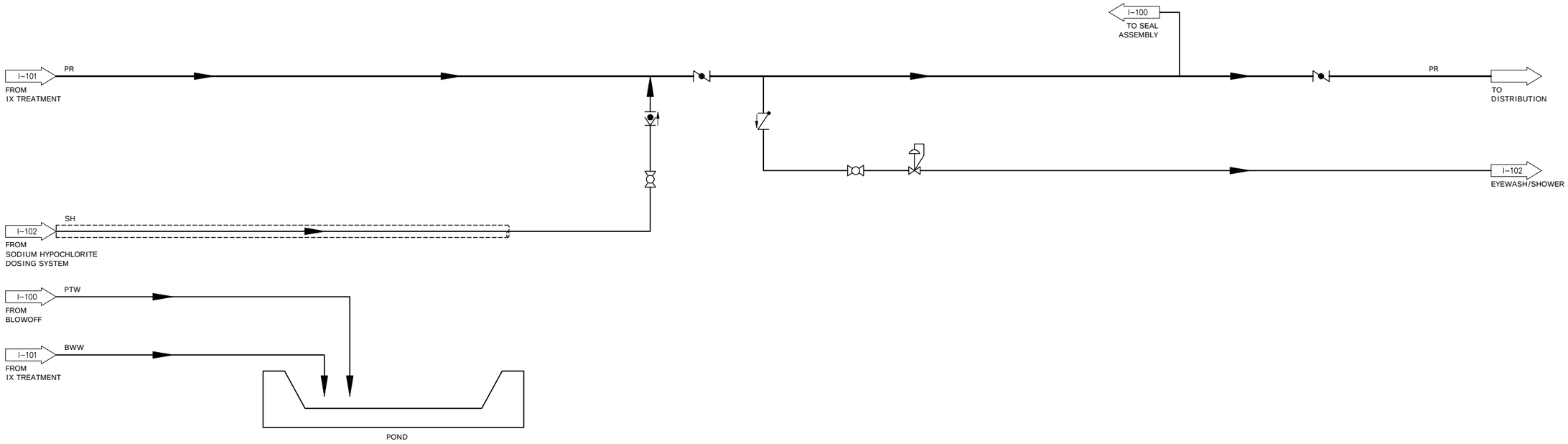
SBA 100 Series
INSTRUMENTATION
SODIUM HYPOCHLORITE DOSING
SYSTEM

DATE: NOVEMBER 2016
HAZEN NO.: 20050-003
CONTRACT NO.: 1
DRAWING NUMBER: I-102

File: G:\20050-PAL\20050-003\DRAWINGS\INST\I-102 SODIUM HYPOCHLORITE DOSING SYSTEM Saved By: CKOLESA Save Date: 2016/10/25 11:18 AM



BASIS OF DESIGN REPORT
DO NOT USE FOR CONSTRUCTION

REV	ISSUED FOR	DATE	BY

PROJECT MANAGER:	J. RHOADES
DESIGNED BY:	
DRAWN BY:	C. KOLESA
CHECKED BY:	

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

Hazen
HAZEN AND SAWYER
36923 COOK STREET, SUITE 101
PALM DESERT, CALIFORNIA, 92211

CITY OF COACHELLA
DRAWING APPROVAL

Checked: _____ PROJECT ENGINEER

Recommended: _____ DIRECTOR OF ENGINEERING

Date: _____

CITY OF COACHELLA

HEXAVALENT
CHROMIUM TREATMENT
FACILITIES PROJECT

ENTER DISCIPLINE HERE

SBA 100 Series
INSTRUMENTATION
PRODUCT WATER

DATE:	NOVEMBER 2016
HAZEN NO.:	20050-003
CONTRACT NO.:	1
DRAWING NUMBER:	I-103

File: G:\20050-RAL\20050-003\DRAWINGS\INSTL\I-103 PRODUCT WATER Saved By JCKOLESA Save Date: 2016/10/25 11:18 AM

Appendix B: Geotechnical Report

Geotechnical Report to be provided when available.

Appendix C: Site Survey

Site survey files to be provided electronically when available.

Appendix D: Supporting Electrical Documents

Coachella Water Authority Resin Regeneration Facility
Electrical Load List

Facility / Load	Description	Starter	Existing Plant Loads							Proposed Plant Upgrades						
			Connected Load				Demand	Operating Load		Connected Load				Demand	Operating Load	
			HP	KW	KVA	FLA	Factor	FLA	KW	HP	KW	KVA	FLA	Factor	FLA	KW
REGEN FACILITY																
SWBD-REGEN																
(NEW)	SWBD-REGEN-A (SEE BELOW)												844.4		675.5	477.4
2000A Bus	SWBD-REGEN-B (SEE BELOW)												722.3		577.9	408.4
	Subtotal					**0**		**0**	**0**				**1567**		**1253**	**886**
SWBD-REGEN-A																
(NEW)	AIR MIXING COMPRESSOR SYSTEM	BKR								40			52.0	0.8	41.6	29.4
2000A Bus	POWERPANEL 'PP-REGEN-1'	BKR														
2000A Main Breaker	LIGHTING PANEL 'LP-REGEN-1' TRANSFORMER	BKR										45	54.1	0.8	43.3	30.6
	ELECTRICAL ROOM HVAC	BKR											24.0	0.8	19.2	13.6
	POWERPANEL 'PP-GAC'	BKR														
	LIGHTING PANEL 'LP-GAC' TRANSFORMER	BKR										45	54.1	0.8	43.3	30.6
	MCC-REGEN-A (SEE BELOW)	BKR											174.0		139.2	98.4
	MCC-BRINE-A (SEE BELOW)	BKR											486.1		388.9	274.8
	Subtotal					**0**		**0**	**0**				**844**		**676**	**477**
SWBD-REGEN-B																
(NEW)	GENERATOR (SHORE POWER)	BKR										30	36.1	0.8	28.9	20.4
2000A Bus	POWERPANEL 'PP-CHEM'	BKR														
2000A Main Breaker	LIGHTING PANEL 'LP-CHEM-1A/B' TRANSFORMER	BKR										45	54.1	0.8	43.3	30.6
	POWERPANEL 'PP-REGEN-2'	BKR														
	ELECTRICAL ROOM HVAC	BKR											24.0	0.8	19.2	13.6
	MCC-REGEN-B (SEE BELOW)	BKR											174.0		139.2	98.4
	MCC-BRINE-B (SEE BELOW)	BKR											434.1		347.3	245.4
	Subtotal					**0**		**0**	**0**				**722**		**578**	**408**
MCC-REGEN-A																
(NEW)	TREATED BRINE TRANSFER PUMP NO. 1	FVNR								7.5			11.0	0.8	8.8	6.2
600A Bus	HCL TRANSFER PUMP NO.1	FVNR								2			3.4	0.8	2.7	1.9
600A Main Breaker	BACKWASH REMNANT PUMP	FVNR								7.5			11.0	0.8	8.8	6.2
	REGENERATED RESIN TRANSFER PUMP	VFD								50			65.0	0.8	52.0	36.7
	SWING RESIN TRANSFER PUMP	VFD								50			65.0	0.8	52.0	36.7
	NaOCL TRANSFER PUMP	VFD								5			7.6	0.8	6.1	4.3
	BRINE/SLOW RINSE PUMP	VFD								7.5			11.0	0.8	8.8	6.2
	Subtotal					**0**		**0**	**0**				**174**		**139**	**98**
MCC-REGEN-B																
(NEW)	TREATED BRINE TRANSFER PUMP NO. 2	FVNR								7.5			11.0	0.8	8.8	6.2
600A Bus	HCL TRANSFER PUMP NO.2	FVNR								2			3.4	0.8	2.7	1.9
600A Main Breaker	SOFTENER WASTE BRINE FEED PUMP	FVNR								2			3.4	0.8	2.7	1.9
	SPENT RESIN TRANSFER PUMP	VFD								50			65.0	0.8	52.0	36.7
	SATURATED BRINE PUMP	VFD								5			7.6	0.8	6.1	4.3
	TRUCK PUMP	VFD								5			7.6	0.8	6.1	4.3
	Subtotal					**0**		**0**	**0**				**98**		**78**	**55**
MCC-BRINE-A																
(NEW)	EC FEED PUMP NO. 1	VFD								2			3.4	0.8	2.7	1.9
1200A Bus	FILTER PRESS FEED PUMP NO. 1	VFD								50			65.0	0.8	52.0	36.7
1200A Main Breaker	HEPA UNIT NO.1	VFD								15			21.0	0.8	16.8	11.9
	FILTER PRESS COMPRESSED AIR SYSTEM	BKR								40			52.0	0.8	41.6	29.4
	1ST STAGE PLATE AND FRAME FILTER PRESS NO. 1	BKR								10			14.0	0.8	11.2	7.9
	POWERPANEL 'PP-SOLIDS-1'	BKR														
	LIGHTING PANEL 'LP-SOLIDS-1' TRANSFORMER	BKR										30	36.1	0.8	28.9	20.4
	EC UNIT NO. 1 TRANSFORMER	BKR										225	270.6	0.8	216.5	153.0
	ELECTRICAL ROOM HVAC	BKR											24.0	0.8	19.2	13.6
	Subtotal					**0**		**0**	**0**				**486**		**389**	**275**
MCC-BRINE-B																
(NEW)	FILTER PRESS FEED PUMP NO. 2	VFD								50			65.0	0.8	52.0	36.7
1200A Bus	EC FEED PUMP NO. 2	VFD								2			3.4	0.8	2.7	1.9
1200A Main Breaker	HEPA UNIT NO.2	VFD								15			21.0	0.8	16.8	11.9
	POWERPANEL 'PP-SOLIDS-2'	BKR														
	EC UNIT NO. 2 TRANSFORMER	BKR										225	270.6	0.8	216.5	153.0
	ELECTRICAL ROOM HVAC	BKR											24.0	0.8	19.2	13.6
	POWERPANEL 'PP-BRINE'	BKR														
	LIGHTING PANEL 'LP-BRINE' TRANSFORMER	BKR										30	36.1	0.8	28.9	20.4
	1ST STAGE PLATE AND FRAME FILTER PRESS NO. 2	BKR								10			14.0	0.8	11.2	7.9
	Subtotal					**0**		**0**	**0**				**434**		**347**	**245**

Coachella Water Authority Well 12
Electrical Load List

Facility / Load	Description	Starter	Existing Site Loads							Proposed Site Upgrades						
			Connected Load				Demand	Operating Load		Connected Load				Demand	Operating Load	
			HP	KW	KVA	FLA	Factor	FLA	KW	HP	KW	KVA	FLA	Factor	FLA	KW
EXISTING SITE																
(EXISTING)	SWBD (SEE BELOW)					507		340	240				717		515	364
WELL SITE																
	Existing Site Totals					**507**		**340**	**240**				**717**		**515**	**364**
SWBD																
(EXISTING)	BOOSTER PUMP NO.1	VFD	100			124.0	0.9	111.6	78.9	100			124.0	0.9	111.6	78.9
1000A Bus	BOOSTER PUMP NO.2	VFD	100			124.0	0.9	111.6	78.9	100			124.0	0.9	111.6	78.9
1000A Main	BOOSTER PUMP NO.3	VFD	100			124.0	0	0.0	0.0	100			124.0	0	0.0	0.0
	LIGHTING PANEL TRANSFORMER	BKR			9	10.8	0.5	5.4	3.8			9	10.8	0.5	5.4	3.8
	MCC (SEE BELOW)	BKR				124.0		111.6	78.9				240.0		216.0	152.6
	Cr6 TREATMENT (SEE BELOW)												94.3		70.4	49.8
	Subtotal					**507**		**340**	**240**				**717**		**515**	**364**
MCC																
(EXISTING)	WELL PUMP	RVSS?	100			124.0	0.9	111.6	78.9	200			240.0	0.9	216.0	152.6
600A Bus	TRANSFORMER	BKR														
MLO																
	Subtotal					**124**		**112**	**79**				**240**		**216**	**153**
Cr6 TREATMENT																
(NEW)	POWERPANEL	BKR														
100A Bus	CALCIUM HYPOCHLORITE PUMP									1			2.1	0.9	1.9	1.3
100A Main	CHLORINE DOSING PUMP									1			2.1	0.9	1.9	1.3
	MOV'S									10			14.0	0.9	12.6	8.9
	TRAILER PUMP RECEPTACLE									30			40.0	0.9	36.0	25.4
	LIGHTING PANEL TRANSFORMER											30	36.1	0.5	18.0	12.8
	Subtotal												**94**		**70**	**50**

Coachella Water Authority Well 16
Electrical Load List

Facility / Load	Description	Starter	Existing Site Loads							Proposed Site Upgrades						
			Connected Load				Demand	Operating Load		Connected Load				Demand	Operating Load	
			HP	KW	KVA	FLA	Factor	FLA	KW	HP	KW	KVA	FLA	Factor	FLA	KW
EXISTING SITE																
(EXISTING)																
	SWBD (SEE BELOW)					308		275	194				506		427	302
WELL SITE																
	Existing Site Totals					**308**		**275**	**194**				**506**		**427**	**302**
SWBD																
(NEW)	WELL PUMP	RVSS	250			302.0	0.9	271.8	192.1	300			361.0	0.9	324.9	229.6
600A Bus	LIGHTING PANEL TRANSFORMER	BKR			5	6.0	0.5	3.0	2.1			30	36.1	0.5	18.0	12.8
600A Main	HVAC UNIT												15.0	0.9	13.5	9.5
	Cr6 TREATMENT (SEE BELOW)												94.3		70.4	49.8
	Subtotal					**308**		**275**	**194**				**506**		**427**	**302**
Cr6 TREATMENT																
(NEW)	POWERPANEL	BKR														
100A Bus	CALCIUM HYPOCHLORITE PUMP									1			2.1	0.9	1.9	1.3
100A Main	CHLORINE DOSING PUMP									1			2.1	0.9	1.9	1.3
	MOV'S									10			14.0	0.9	12.6	8.9
	TRAILER PUMP RECEPTACLE									30			40.0	0.9	36.0	25.4
	LIGHTING PANEL TRANSFORMER											30	36.1	0.5	18.0	12.8
	Subtotal												**94**		**70**	**50**

Coachella Water Authority Well 17
Electrical Load List

Facility / Load	Description	Starter	Existing Site Loads							Proposed Site Upgrades						
			Connected Load				Demand	Operating Load		Connected Load				Demand	Operating Load	
			HP	KW	KVA	FLA	Factor	FLA	KW	HP	KW	KVA	FLA	Factor	FLA	KW
EXISTING SITE																
(EXISTING)																
	SWBD (SEE BELOW)					258		225	159				506		427	302
WELL SITE																
	Existing Site Totals					**258**		**225**	**159**				**506**		**427**	**302**
SWBD																
(NEW)	WELL PUMP	VFD/RVSS	200			240.0	0.9	216.0	152.6	300			361.0	0.9	324.9	229.6
600A Bus	LIGHTING PANEL TRANSFORMER	BKR			15	18.0	0.5	9.0	6.4			30	36.1	0.5	18.0	12.8
400AT Main	HVAC UNIT					0.0	0.9	0.0	0.0				15.0	0.9	13.5	9.5
	Cr6 TREATMENT (SEE BELOW)												94.3		70.4	49.8
	Subtotal					**258**		**225**	**159**				**506**		**427**	**302**
Cr6 TREATMENT																
(NEW)	POWERPANEL	BKR														
100A Bus	CALCIUM HYPOCHLORITE PUMP									1			2.1	0.9	1.9	1.3
100A Main	CHLORINE DOSING PUMP									1			2.1	0.9	1.9	1.3
	MOV'S									10			14.0	0.9	12.6	8.9
	TRAILER PUMP RECEPTACLE									30			40.0	0.9	36.0	25.4
	LIGHTING PANEL TRANSFORMER											30	36.1	0.5	18.0	12.8
	Subtotal												**94**		**70**	**50**

Coachella Water Authority Well 18
Electrical Load List

Facility / Load	Description	Starter	Existing Site Loads							Proposed Site Upgrades						
			Connected Load				Demand	Operating Load		Connected Load				Demand	Operating Load	
			HP	KW	KVA	FLA	Factor	FLA	KW	HP	KW	KVA	FLA	Factor	FLA	KW
EXISTING SITE																
(EXISTING)	SWBD (SEE BELOW)					1011		888	628				1221		1063	751
WELL SITE																
	Existing Site Totals					**1011**		**888**	**628**				**1221**		**1063**	**751**
SWBD																
(EXISTING)	HP BOOSTER PUMP HP1		200			240.0	0.9	216.0	152.6	200			240.0	0.9	216.0	152.6
2000A Bus	LP BOOSTER PUMP LP1		125			156.0	0.9	140.4	99.2	125			156.0	0.9	140.4	99.2
2000A Main	LP BOOSTER PUMP LP2		125			156.0	0.9	140.4	99.2	125			156.0	0.9	140.4	99.2
	HP BOOSTER PUMP HP2		200			240.0	0.9	216.0	152.6	200			240.0	0.9	216.0	152.6
	LIGHTING PANEL TRANSFORMER	BKR			15	18.0	0.5	9.0	6.4			15	18.0	0.5	9.0	6.4
	LIGHTING PANEL TRANSFORMER	BKR			25	30.1	0.5	15.0	10.6			25	30.1	0.5	15.0	10.6
	HVAC UNIT					30.6	0.9	27.5	19.5				30.6	0.9	27.5	19.5
	MCC (SEE BELOW)					140.3		123.9	87.5				256.3		228.3	161.3
	Cr6 TREATMENT (SEE BELOW)												94.3		70.4	49.8
	Subtotal					**1011**		**888**	**628**				**1221**		**1063**	**751**
MCC																
(EXISTING)	WELL PUMP	RVSS	100			124.0	0.9	111.6	78.9	200			240.0	0.9	216.0	152.6
600A Bus	TRANSFORMER				5	6.0	0.5	3.0	2.1			5	6.0	0.5	3.0	2.1
600A Main	HVAC UNIT					10.3	0.9	9.3	6.6				10.3	0.9	9.3	6.6
	Subtotal					**140**		**124**	**88**				**256**		**228**	**161**
Cr6 TREATMENT																
(NEW)	POWERPANEL	BKR														
100A Bus	CALCIUM HYPOCHLORITE PUMP									1			2.1	0.9	1.9	1.3
100A Main	CHLORINE DOSING PUMP									1			2.1	0.9	1.9	1.3
	MOV'S									10			14.0	0.9	12.6	8.9
	TRAILER PUMP RECEPTACLE									30			40.0	0.9	36.0	25.4
	LIGHTING PANEL TRANSFORMER											30	36.1	0.5	18.0	12.8
	Subtotal												**94**		**70**	**50**

Coachella Water Authority Well 19
Electrical Load List

Facility / Load	Description	Starter	Existing Site Loads							Proposed Site Upgrades						
			Connected Load				Demand	Operating Load		Connected Load				Demand	Operating Load	
			HP	KW	KVA	FLA	Factor	FLA	KW	HP	KW	KVA	FLA	Factor	FLA	KW
EXISTING SITE																
(EXISTING)																
	SWBD (SEE BELOW)					258		225	159				447		374	264
WELL SITE																
	Existing Site Totals					**258**		**225**	**159**				**447**		**374**	**264**
SWBD																
(NEW)	WELL PUMP	VFD/RVSS	200			240.0	0.9	216.0	152.6	250			302.0	0.9	271.8	192.1
600A Bus	LIGHTING PANEL TRANSFORMER	BKR			15	18.0	0.5	9.0	6.4			30	36.1	0.5	18.0	12.8
600A Main	HVAC UNIT												15.0	0.9	13.5	9.5
	Cr6 TREATMENT (SEE BELOW)												94.3		70.4	49.8
	Subtotal					**258**		**225**	**159**				**447**		**374**	**264**
Cr6 TREATMENT																
(NEW)	POWERPANEL	BKR														
100A Bus	CALCIUM HYPOCHLORITE PUMP									1			2.1	0.9	1.9	1.3
100A Main	CHLORINE DOSING PUMP									1			2.1	0.9	1.9	1.3
	MOV'S									10			14.0	0.9	12.6	8.9
	TRAILER PUMP RECEPTACLE									30			40.0	0.9	36.0	25.4
	LIGHTING PANEL TRANSFORMER											30	36.1	0.5	18.0	12.8
	Subtotal												**94**		**70**	**50**

Appendix E: CVWD Regional Chromium Meeting

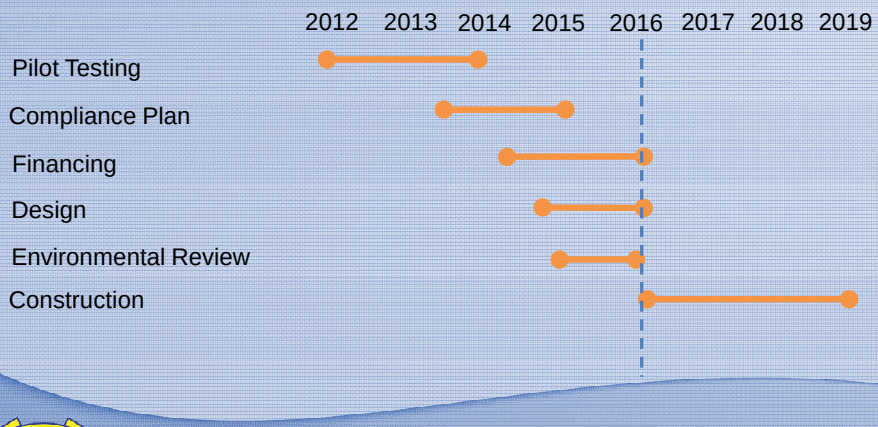
Regional Chromium-6 Compliance and Other Drinking Water Standards

August 18, 2016
11:30 a.m. to 1 p.m.
CVWD Training Room

Agenda

- Agency Chromium-6 Compliance Plan Updates
- Chromium-6 Compliance Discussion
- Other Drinking Water Standards

CVWD Cr6 Project Timeline



3

CVWD Cr6 Facilities

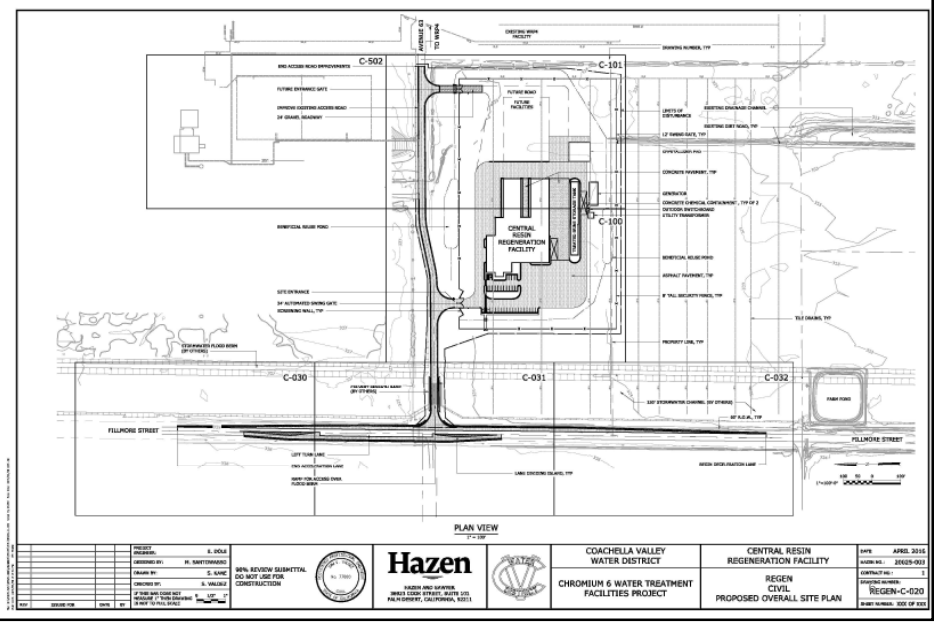
- 4 WBA Transfer Wells
- 1 WBA Central Treatment Site
- 20 SBA Treatment Sites
- 1 Central Resin Regeneration Facility
- 8 miles pipeline

CRRF Site Location

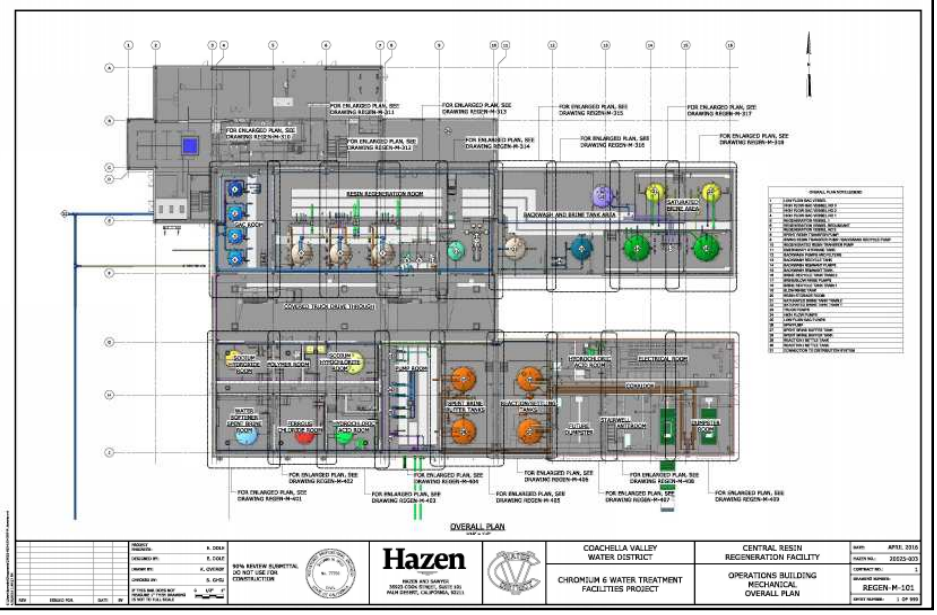
- Land owned by CVWD
- Adjacent to existing Water Reclamation Plant (WRP4)
- Proximity to utilities and major highway corridor

5

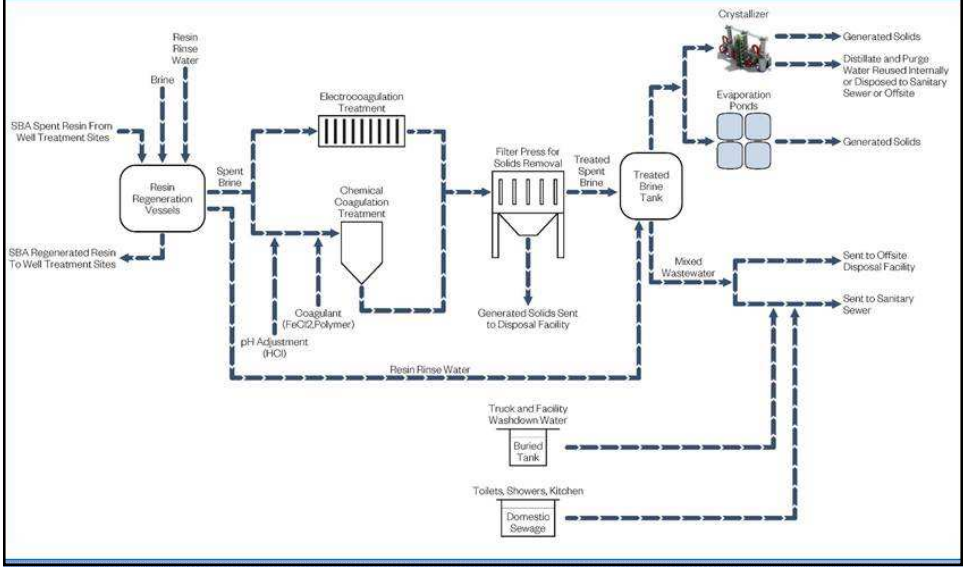
CRRF Site Plan



CRRF Building Plan



CRRF Process



CRRF Building Rendering

Typical SBA Well Treatment Site

Resin Transfer and Regeneration - Procedures

SBA TREATMENT SITE

TRAVEL

RESIN REGENERATION FACILITY

RESIN TRANSFER (2HR PER TRANSFER):

1. 1st vessel in resin transfer mode (2nd vessel remain in service)
2. Resin transfer to truck (pick up)
3. Resin transfer to vessel (return)
4. Backwash
5. 1st vessel back in service
6. Transfer 2nd vessel (if needed)

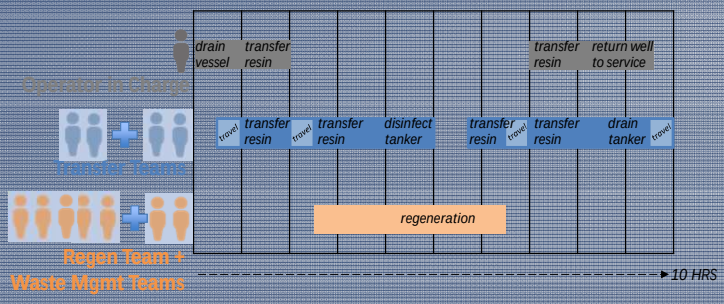
TRAVEL ROUNDTRIP (2HR):

Up to 60 miles each way

RESIN REGENERATION (4HR)

1. Resin transfer truck to regen
2. Backwash
3. Resin makeup
4. Brine regeneration
5. Slow rinse
6. Fast rinse
7. Trailer disinfection
8. Resin transfer to tanker

Resin Transfer and Regeneration - Time and Labor



CRRF Construction Costs

	Cost (x1000)	% of Total
Site Work	$3,676	5.9%
Yard Pipe	$1,455	2.3%
Concrete	$10,279	16.4%
Architectural	$9,849	15.7%
Metals	$4,227	6.8%
Process Equipment	$8,883	14.2%
Mechanical	$9,860	15.8%
Electrical/I&C	$10,447	16.7%
General Requirements	$3,895	6.2%
Total Construction (Direct)	$62,571	

*Trade packages (~75% of total cost) will be competitively bid by CMAR with cost savings back to owner

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CRRF Guaranteed Max Price (GMP)

	Cost (x1000)	% of Total
Construction Cost	$62,571	71.2%
Brine Crystallizer[A]	$8,500	9.7%
Resin transfer trucks (3)[A]	$0,933	1.1%
IID Power Allowance[A,B]	$1,500	1.7%
Other Allowances[B]	$1,222	1.4%
General Conditions and Contractor Fees	$8,753	10.0%
Contingency[B]	$4,434	5.0%
Total	$87,915	

[A]Direct cost to CVWD (i.e. no CMAR markup)
[B]Unused allowance and contingency will go back to owner

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O&M Cost Basis

- Chemicals
  - GAC
  - NaOH
  - Salt
  - Acid
  - Ferrous or Iron Blades
  - Caustic
  - NaOCl
- Solids and Liquids Disposal
  - Iron solids (LLRW)
  - Salt cake (Non-haz)
  - Liquid waste haul (Hazardous)
- Energy
  - Process equipment
  - Crystallizer
  - Building/HVAC
- Labor
  - CRRF Operations (7)
  - Resin transfer teams (4)
  - Crystallizer (1)
  - Trades/Maintenance (4)
  - Water Quality Monitoring and Analytical (1)
- Other
  - Misc parts
  - Transfer truck maintenance
  - Haz material generator fees
- Not Included
  - Initial resin
  - Resin replacement

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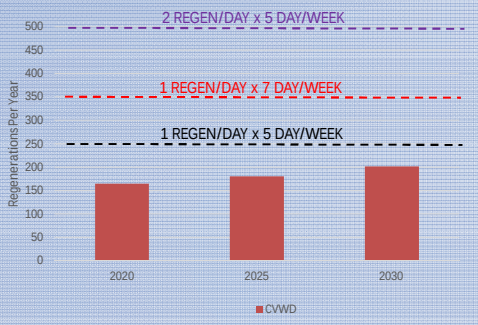
CRRF Capacity Utilization



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Waste Management Alternatives

Waste Management Mode	Annual O&M ($M)	Risk	Operations Priority
Sanitary Sewer	$3.2	Possible lower TDS limits in CVSC. Requires secondary option.	Primary
Crystallizer	$4.0	Mechanically complex	Secondary
Evaporation Ponds	$3.3	Pending legislation to allow permitting	Alternative
Hazardous Brine Hauling	$5.4	Dependent on 3rd party	Contingency

Estimated Costs per Regeneration[A,B]

Waste Management Mode	O&M ($k/regen)	Capital[C] ($k/regen)	Total ($k/regen)	Operation Priority
Sanitary Sewer	$12.9	$14.6[C]	$27.5	Primary
Crystallizer	$16.2	$14.6	$30.9	Secondary
Evaporation Ponds	$13.3	$13.8	$27.1	Alternative
Hazardous Brine Hauling	$21.8	$14.6[C]	$36.4	Contingency

[A]250 regen/year capacity utilization
[B]30 year lifecycle, 1.5%
[C]Crystallizer included in capital. If evap ponds approved, costs will be reduced by $800/regen.

Additional Compliance Drivers

- Water quality objectives
- Evaporation pond legislation
- SBA Resin
- State grant opportunities
- Chromium-6 occurrence

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Other Agency Updates

- Indio Water Authority
- Mission Springs Water District
- Coachella Water Authority
- Myoma Dunes Water Company
- City of Banning
- Desert Water Agency

20

Hazen

Hazen and Sawyer
36-923 Cook Street • Suite 101 • Palm Desert, CA 92234

ATTACHMENT II

IN 2022 THE CITY THROUGH WORK PERFORMED VIA THE COACHELLA VALLEY WATER DISTRICT ANALYZED CR6 REDUCTION USING SNCL2 (0.5 MG/L DOSE AS SN) IN A CHLORINATED SYSTEM (0.5 MG/L AS FREE CL2).

Simulated Distribution System Bench Top Test Plan - CWA

CWA Well 17 (raw) - Test A

↓

Dose 0.8 mg/L $SnCl_2$ (0.5 mg/L as Sn) ← Test B

Dose 0.5 mg/L Cl_2 ← Test C'

Store 2.5 liter amber ← Test C

Day One

Day Three

Store 2.5 liter amber ← Test C

Day Seven

Store 2.5 liter amber ← Test C

Day Fourteen

Store 2.5 liter amber ← Test C

Day Twenty one

Store 2.5 liter amber ← Test C

Day Twenty eight

End of Study

Test A

- pH/EC
- Turbidity
- Total Cr/Cr6

Test B

- pH/EC
- Turbidity
- Total Cr/Cr6
- Sn
- Free Cl_2

Test C

- pH/EC
- Turbidity
- Total Cr/Cr6
- Sn
- Free Cl_2
- Check for settled solids (visual only)

Test C'

Same parameters as Test C performed one hour after Cl_2 dosing

Final Analytical Report

22071812

Customer: Chromium (VI) Studies

Coachella Valley Water District
Water Quality Laboratory
ELAP No. 1780

Route: Simulated Distribution System Bench Top Study

Report Date: 01-Sep-22

Lab Sample ID: 22071812-01
Sample Site: CWA Well 17 - raw (EDT)
Collection Date/Time: 7/19/2022 7:40 AM
Received Date/Time: 7/19/2022 8:48 AM

Sample Status: Approved
State Well Number:
Collector: CWA
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	19 µg/L		0.05	1.0	SH1509	7/19/2022
Turbidity	SM 2130 B	0.17 NTU		0.1	0.1	AR1441	7/20/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	7/20/2022
Chromium	SM 3113 B	21 µg/L		1	10	1016	7/20/2022
pH	SM 4500 H+	7.7 SU				AR1441	7/19/2022

P.O. Box 1058
Coachella, CA 92236

Lab Sample ID: 22071812-02
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 7/19/2022 4:15 AM
Received Date/Time: 7/19/2022 8:48 AM

Sample Status: Approved
State Well Number:
Collector: SH1509
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	1.0 µg/L		0.05	1.0	SH1509	7/19/2022
Turbidity	SM 2130 B	0.24 NTU		0.1	0.1	AR1441	7/20/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	7/20/2022
Chromium	SM 3113 B	21 µg/L		1	10	1016	7/20/2022
Tin	SM 3113 B	490 µg/L		10	20	JS1016	7/19/2022
pH	SM 4500 H+	7.8 SU				AR1441	7/19/2022
Chlorine Residual, Free	SM 4500-Cl G	0.48 mg/L		0.02	0.02	AR1441	7/19/2022
Chlorine Residual, Total	SM 4500-Cl G	NA		0.02	0.02	AR1441	7/19/2022

P.O. Box 1058
Coachella, CA 92236

Lab Sample ID: 22071812-03
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 7/19/2022 5:15 PM
Received Date/Time: 7/19/2022 8:48 AM

Sample Status: Approved
State Well Number:
Collector: SH1509
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	< 1.0 µg/L		0.05	1.0	SH1509	7/20/2022
Turbidity	SM 2130 B	0.26 NTU		0.1	0.1	AR1441	7/20/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	7/20/2022
Chromium	SM 3113 B	21 µg/L		1	10	1016	7/20/2022
Tin	SM 3113 B	470 µg/L		10	20	JS1016	7/19/2022
pH	SM 4500 H+	8.0 SU				SH1509	7/19/2022
Chlorine Residual, Free	SM 4500-Cl G	0.48 mg/L		0.02	0.02	JS1016	7/19/2022
Chlorine Residual, Total	SM 4500-Cl G	n/a mg/L		0.02	0.02	JS1016	7/19/2022

NA = not analyzed
MDL = Method Detection Limit
RL = Reporting limit

P = Present *A = Absent*
J2 = Reported value is estimated; Did not meet the required QC criteria
J3 = Reported value is biased high; LFB recovered above QC criteria
Q = Sample analysis is performed outside of the method specified Holding time.

P.O. Box 1058
Coachella, CA 92236

CHAIN OF CUSTODY

Laboratory:

Order No. 22071415 Customer Name: Chromium (VI) Studies Requires State Forms Turn Around Time: Standard Rush LIMs Entry

Project: Simulated Distribution System Bench Top Study Employee ID: Project #: 535

Collect Date/Time	Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total	Comments
7/19/22 0740	22071415-01 - CWA Well 17 - raw (EDT)	EC - Field, pH Field	None	10 L poly cube	1 2	W							

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
		CWA		1441		220719	848	21.3

Sample Matrix (SM): W=Water; S=Soil; Sl=Sludge **All samples are grab unless specified as a 24 Hour**

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

CHAIN OF CUSTODY

Laboratory:

Order No. 22071812 | Customer Name: Chromium (VI) Studies | Requires State Forms ☐ | Turn Around Time: Standard ☐ Rush ☐ | LIMs Entry

Project: Simulated Distribution System Bench Top Study | Employee ID: SH1509 | Project #: 535

Collect Date/Time		Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total		Comments
07/19/22	7:40 AM	22071812-01 - CWA Well 17 - raw (EDT)	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				289				Day 1 - Test A
07/19/22	7:40 AM	22071812-01 - CWA Well 17 - raw (EDT)	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				289				Day 1 - Test A
07/19/22	7:40 AM	22071812-01 - CWA Well 17 - raw (EDT)	EC	Iced; <4C	250 ml HDPE	1	W				289				Day 1 - Test A
07/19/22	7:40 AM	22071812-01 - CWA Well 17 - raw (EDT)	pH, Turb	Iced; <4C	1 L PE	1	W				289				Day 1 - Test A
7/19/2022	4:15 PM	22071812-02 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				292		0.48	NA	Day 1 - Test B
↓	↓	22071812-02 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				292		0.48	NA	Day 1 - Test B
		22071812-02 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W				292		0.48	NA	Day 1 - Test B
		22071812-02 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W				292		0.48	NA	Day 1 - Test B
		22071812-02 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	None	250 ml HDPE	1	W				292		0.48	NA	Day 1 - Test B
7/19/2022	5:15 PM	22071812-03 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				292		0.48	n/a	Day 1 - Test C'
↓	↓	22071812-03 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				292		0.48	n/a	Day 1 - Test C'
		22071812-03 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W				292		0.48	n/a	Day 1 - Test C'
		22071812-03 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W				292		0.48	n/a	Day 1 - Test C'
		22071812-03 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	None	250 ml HDPE	1	W				292		0.48	n/a	Day 1 - Test C'

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
	1509	CVWD		1508	CVWD	220719 ~~2208~~	~~6:40~~ 8:48	

Sample Matrix (SM): W=Water; S=Soil; Sl=Sludge

All samples are grab unless specified as a 24 Hour

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

Final Analytical Report

22072018

Customer: Chromium (VI) Studies

Coachella Valley Water District
Water Quality Laboratory
ELAP No. 1780

Route: Simulated Distribution System Bench Top Study

Report Date: 31-Aug-22

Lab Sample ID: 22072018-01
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 7/21/2022 9:00 AM
Received Date/Time: 7/21/2022 9:00 AM

Sample Status: Approved
State Well Number:
Collector: SH1509
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	2.5 µg/L		0.05	1.0	SH1509	7/21/2022
Turbidity	SM 2130 B	0.28 NTU		0.1	0.1	SH1509	7/22/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	SH1509	7/22/2022
Chromium	SM 3113 B	19 µg/L		1	10	Js1016	7/22/2022
Tin	SM 3113 B	430 µg/L		10	20	JS1016	7/21/2022
pH	SM 4500 H+	7.4 SU				JS1016	7/21/2022
Chlorine Residual, Free	SM 4500-Cl G	0.46 mg/L		0.02	0.02	JS1016	7/21/2022
Chlorine Residual, Total	SM 4500-Cl G	n/a mg/L		0.02	0.02	JS1016	7/21/2022

NA = not analyzed
MDL = Method Detection Limit
RL = Reporting limit

P = Present *A = Absent*
J2 = Reported value is estimated; Did not meet the required QC criteria
J3 = Reported value is biased high; LFB recovered above QC criteria
Q = Sample analysis is performed outside of the method specified Holding time.

P.O. Box 1058
Coachella, CA 92236

CHAIN OF CUSTODY

Laboratory:

Order No. 22072018 | Customer Name: Chromium (VI) Studies | Requires State Forms | Turn Around Time: Standard | Rush | LIMs Entry

Project: Simulated Distribution System Bench Top Study | Employee ID: SH1509 | Project #: 535

Collect Date/Time		Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total		Comments
7/21/2022	09:00	22072018-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				290		0.46	n/a	Day 3 - Test C
↓	↓	22072018-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				290		0.46	n/a	Day 3 - Test C
		22072018-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W				290		0.46	n/a	Day 3 - Test C
		22072018-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W				290		0.46	n/a	Day 3 - Test C
↓	↓	22072018-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	NaOH, pH > 12	250 ml HDPE	1	W				290		0.46	n/a	Day 3 - Test C

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
	1509	CUWD		1508	CUWD	220721	9:00	

Sample Matrix (SM): W=Water; S=Soil; SI=Sludge

All samples are grab unless specified as a 24 Hour

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

Final Analytical Report

22072511

Customer: Chromium (VI) Studies

Coachella Valley Water District
Water Quality Laboratory
ELAP No. 1780

Route: Simulated Distribution System Bench Top Study

Report Date: 02-Sep-22

Lab Sample ID: 22072511-01
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 7/25/2022 10:07 AM
Received Date/Time: 8/16/2022 10:07 AM

Sample Status: Approved
State Well Number:
Collector: SH1509
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	3.1 µg/L		0.05	1.0	JS1016	7/25/2022
Turbidity	SM 2130 B	0.45 NTU		0.1	0.1	AR1441	7/25/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	7/25/2022
Chromium	SM 3113 B	20 µg/L		1	10	JS1016	7/26/2022
Tin	SM 3113 B	510 µg/L		10	20	1016	7/25/2022
pH	SM 4500 H+	7.8 SU				AR1441	7/25/2022
Chlorine Residual, Free	SM 4500-Cl G	0.34 mg/L		0.02	0.02	AR1441	7/25/2022
Chlorine Residual, Total	SM 4500-Cl G	NA		0.02	0.02	AR1441	7/25/2022

NA = not analyzed
MDL = Method Detection Limit
RL = Reporting limit

P = Present *A = Absent*
J2 = Reported value is estimated; Did not meet the required QC criteria
J3 = Reported value is biased high; LFB recovered above QC criteria
Q = Sample analysis is performed outside of the method specified Holding time.

P.O. Box 1058
Coachella, CA 92236

CHAIN OF CUSTODY

Laboratory:

Order No. 22072511 | Customer Name: Chromium (VI) Studies | Requires State Forms ☐ | Turn Around Time: Standard ☐ Rush ☐ | LIMs Entry ☐

Project: Simulated Distribution System Bench Top Study | Employee ID: SH1509 | Project #: 535

Collect Date/Time		Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total		Comments
7/25/2022	10:07	22072511-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				292		0.34	NA	Day 7 - Test C
↓	↓	22072511-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				292		0.34	NA	Day 7 - Test C
		22072511-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W				292		0.34	NA	Day 7 - Test C
		22072511-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W				292		0.34	NA	Day 7 - Test C
		22072511-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	NaOH, pH > 12	250 ml HDPE	1	W				292		0.34	NA	Day 7 - Test C

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
	1509	CUWD		1508	CVWD	220816	10:07	

Sample Matrix (SM): W=Water; S=Soil; Sl=Sludge

All samples are grab unless specified as a 24 Hour

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

Final Analytical Report

22080118

Customer: Chromium (VI) Studies

Coachella Valley Water District
Water Quality Laboratory
ELAP No. 1780

Route: Simulated Distribution System Bench Top Study

Report Date: 02-Sep-22

Lab Sample ID: 22080118-01
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 8/1/2022 10:08 AM
Received Date/Time: 8/15/2022 3:20 PM

Sample Status: Approved
State Well Number:
Collector: WG0282
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	3.3 µg/L		0.05	1.0	JS1016	8/1/2022
Turbidity	SM 2130 B	0.35 NTU		0.1	0.1	AR1441	8/1/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	8/2/2022
Chromium	SM 3113 B	22 µg/L		1	10	Js1016	8/2/2022
Tin	SM 3113 B	430 µg/L		10	20	JS1016	8/2/2022
pH	SM 4500 H+	7.9 SU				AR1441	8/1/2022
Chlorine Residual, Free	SM 4500-Cl G	0.41 mg/L		0.02	0.02	AR1441	8/1/2022
Chlorine Residual, Total	SM 4500-Cl G	NA		0.02	0.02	AR1441	8/1/2022

NA = not analyzed
MDL = Method Detection Limit
RL = Reporting limit

P = Present *A = Absent*
J2 = Reported value is estimated; Did not meet the required QC criteria
J3 = Reported value is biased high; LFB recovered above QC criteria
Q = Sample analysis is performed outside of the method specified Holding time.

P.O. Box 1058
Coachella, CA 92236

CHAIN OF CUSTODY

Laboratory:

Order No. 22080118 | Customer Name: Chromium (VI) Studies | Requires State Forms ☐ | Turn Around Time: Standard ☐ Rush ☐ | LIMs Entry

Project: Simulated Distribution System Bench Top Study | Employee ID: 282 | Project #: 535

Collect Date/Time		Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total		Comments
08/01/22	10:08 AM	22080118-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				292		0.41	NA	Day 14 - Test C
08/01/22	10:08 AM	22080118-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				292		0.41	NA	Day 14 - Test C
08/01/22	10:08 AM	22080118-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W				292		0.41	NA	Day 14 - Test C
08/01/22	10:08 AM	22080118-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W				292		0.41	NA	Day 14 - Test C
08/01/22	10:08 AM	22080118-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	None	250 ml HDPE	1	W				292		0.41	NA	Day 14 - Test C

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
[signature]	282	CVWD	[signature]	1508	CVWD	220815	15:20	

Sample Matrix (SM): W=Water; S=Soil; Sl=Sludge

All samples are grab unless specified as a 24 Hour

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

Final Analytical Report

22080812

Customer: Chromium (VI) Studies

Coachella Valley Water District
Water Quality Laboratory
ELAP No. 1780

Route: Simulated Distribution System Bench Top Study

Report Date: 02-Sep-22

Lab Sample ID: 22080812-01
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 8/8/2022 11:48 AM
Received Date/Time: 8/15/2022 1:30 PM

Sample Status: Approved
State Well Number:
Collector: SH1509
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	3.6 µg/L		0.05	1.0	SH1509	8/8/2022
Turbidity	SM 2130 B	0.33 NTU		0.1	0.1	AR1441	8/8/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	8/9/2022
Chromium	SM 3113 B	21 µg/L		1	10	JS1016	8/9/2022
Tin	SM 3113 B	420 µg/L		10	20	JS1016	8/8/2022
pH	SM 4500 H+	8.0 SU				AR1441	8/8/2022
Chlorine Residual, Free	SM 4500-Cl G	0.44 mg/L		0.02	0.02	AR1441	8/8/2022
Chlorine Residual, Total	SM 4500-Cl G	NA		0.02	0.02	AR1441	8/8/2022

NA = not analyzed
MDL = Method Detection Limit
RL = Reporting limit

P = Present *A = Absent*
J2 = Reported value is estimated; Did not meet the required QC criteria
J3 = Reported value is biased high; LFB recovered above QC criteria
Q = Sample analysis is performed outside of the method specified Holding time.

P.O. Box 1058
Coachella, CA 92236

CHAIN OF CUSTODY

Laboratory:

Order No. 22080812 | Customer Name: Chromium (VI) Studies | Requires State Forms | Turn Around Time: Standard | Rush | LIMs Entry

Project: Simulated Distribution System Bench Top Study | Employee ID: SH1509 | Project #: 535

Collect Date/Time		Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total		Comments
8/8/2022	11:48	22080812-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W				292		0.44	NA	Day 21 - Test C
		22080812-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W				292		0.44	NA	Day 21 - Test C
		22080812-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W				292		0.44	NA	Day 21 - Test C
		22080812-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W				292		0.44	NA	Day 21 - Test C
		22080812-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	None	250 ml HDPE	1	W				292		0.44	NA	Day 21 - Test C

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
	1509	CVWD		1508	CVWD	220815	13:30	

Sample Matrix (SM): W=Water; S=Soil; Sl=Sludge

All samples are grab unless specified as a 24 Hour

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

Final Analytical Report

22081512

Customer: Chromium (VI) Studies

Coachella Valley Water District
Water Quality Laboratory
ELAP No. 1780

Route: Simulated Distribution System Bench Top Study

Report Date: 02-Sep-22

Lab Sample ID: 22081512-01
Sample Site: CWA Well 17 - 0.8 SnCl2-0.5 Cl2
Collection Date/Time: 8/15/2022 9:23 AM
Received Date/Time: 8/15/2022 1:30 PM

Sample Status: Approved
State Well Number:
Collector: SH1509
State Source Code:

Analyte	Method	Result	Qualifier	MDL	RL	Analyst	Anal. Date
Chromium (Hexavalent)	EPA 218.6	3.9 µg/L		0.05	1.0	SH1509	8/15/2022
Turbidity	SM 2130 B	0.39 NTU		0.1	0.1	AR1441	8/15/2022
Electrical Conductivity	SM 2510 B	290 µmhos/cm		1	1	AR1441	8/16/2022
Chromium	SM 3113 B	23 µg/L		1	10	JS1016	8/16/2022
Tin	SM 3113 B	400 µg/L		10	20	JS1016	8/16/2022
pH	SM 4500 H+	8.1 SU				AR1441	8/15/2022
Chlorine Residual, Free	SM 4500-Cl G	0.37 mg/L		0.02	0.02	AR1441	8/15/2022
Chlorine Residual, Total	SM 4500-Cl G	NA		0.02	0.02	AR1441	8/15/2022

NA = not analyzed
MDL = Method Detection Limit
RL = Reporting limit

P = Present *A = Absent*
J2 = Reported value is estimated; Did not meet the required QC criteria
J3 = Reported value is biased high; LFB recovered above QC criteria
Q = Sample analysis is performed outside of the method specified Holding time.

P.O. Box 1058
Coachella, CA 92236

CHAIN OF CUSTODY

Laboratory:

Order No. 22081512 Customer Name: Chromium (VI) Studies Requires State Forms Turn Around Time: Standard Rush LIMs Entry

Project: Simulated Distribution System Bench Top Study Employee ID: SH1509 Project #: 535

Collect Date/Time		Sample ID - Site ID	List of Tests	Preservatives	Bottle Type	# Bottl	CODES SM	CODES ST	Sample pH (SU)	Sample Temp (C)	Sample Cond (umho/cm)	Sample DO (mg/L)	Sample CL2 (mg/L) Free/Total		Comments
08/15/22	0923	22081512-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr6	Buffer (218.7); <4C	250 ml HDPE	1	W								Day 28 - Test C
08/15/22	↓	22081512-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cr	HNO3 to pH < 2	250 ml HDPE	1	W								Day 28 - Test C
08/15/22		22081512-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	EC	Iced; <4C	250 ml HDPE	1	W								Day 28 - Test C
08/15/22		22081512-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Cl Res, pH, Turb	Iced; <4C	1 L PE	1	W								Day 28 - Test C
08/15/22		22081512-01 - CWA Well 17 - 0.8 SnCl2-0.5 Cl2	Sn	None	250 ml HDPE	1	W								Day 28 - Test C

Released by (Sign)	ID#	Company	Received by (Sign)	ID#	Company	Date	Time	Temp. C/On-Ice
	1509	CVWD		1508	CVWD	220815	13:30	

Sample Matrix (SM): W=Water; S=Soil; Sl=Sludge

All samples are grab unless specified as a 24 Hour

Sample Type (ST): FF=First Flush; RT=Routine; RP=Repeat; Rm=Replacement; Nw=New; Rs=Resample; Ts=Test; Sp=Special; 24= 24 Hours; 4Q=4 Quarters; 7s=7 samples; Gr=grab; Re=reading; Tr=triggered; Ts=test; O=other

Table 1. Results for Simulated Distribution System Bench-top Study
Coachella Water Authority - Well 17
7/19/2022 - 8/15/2022

Source	Day	Test	pH (Std units)	EC (uS/cm)	Turbidity (NTU)	RL: 10 µg/L Total Cr (ug/L)	RL: 1.0 µg/L Cr-6 (ug/L)	RL: 20 µg/L Sn (ug/L)	Free Cl2 (mg/L)	Settled Solids (visual) Y/N	Comments
CWA Well 17 - raw (EDT) (22071812-01)	1	A	7.7	290	0.17	21	19				
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22071812-02)	1	B	7.8	290	0.24	21	1.0	490	0.48	N	
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22071812-03)	1	C'	8.0	290	0.26	21	<1.0	470	0.48	N	
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22072018-01)	3	C	7.4	290	0.28	19	2.5	430	0.46	N	
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22072511-01)	7	C	7.8	290	0.45	20	3.1	510	0.34	N	
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22080118-01)	14	C	7.9	290	0.35	22	3.3	430	0.41	Y - particulates present at bottom	
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22080812-01)	21	C	8.0	290	0.33	21	3.6	420	0.44	Y - particulates present at bottom	
CWA Well 17 + 0.8 mg/L SnCl2 (0.5 mg/L Sn) + 0.5 mg/L Cl2 (22081512-01)	28	C	8.1	290	0.39	23	3.9	400	0.37	Y - particulates present at bottom	