CITY OF CORCORAN
DEPARTMENT OF PUBLIC WORKS

TECHNICAL SPECIFICATIONS FOR

Water Well 5F & 8C

Prepared by:

A & M
WATER RESOURCES

February 2023

CITY OF CORCORAN DEPARTMENT OF PUBLIC WORKS

WATER WELL 5F & 8C
TECHNICAL SPECIFICATIONS
DIVISIONS AND SECTIONS

Prepared by Certification:

In accordance with the provisions of Section 6735 of the Business and Professions Code of the State of California, these specifications have been prepared by or under the direction of the following Civil Engineer, licensed in the State of California.

A&M CONSULTING ENGINEERS, INC.
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SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 BRIEF PURPOSE OF PROJECT / GENERAL

A. The purpose of the project is to construct a new water well along with the relocation of an existing water well. The project will create two operable municipal water wells for the City of Corcoran.

B. All work shown and specified in the Contract Documents shall be the work of this Construction Contract.

1.02 NOMENCLATURE

A. Where the term "Engineer", is used throughout these Contract Documents, they shall mean the firm of A&M Consulting Engineers as may be abbreviated by A&M.

B. The terms "Contractor" and/or "Prime Contractor" where used within the body of a specific Construction Contract, shall refer to the individual or company who has entered into an agreement with the Owner to perform the work contained within the Contract Document. The lack of word capitalization shall be incidental.

1.03 ABBREVIATED SUMMARY OF CONTRACT WORK

A. Furnish all labor, equipment, materials, tools, means, methods, and incidentals necessary to complete the Work as required by the Contract Documents for this Construction Contract. Each contractor shall coordinate, through the Owner/Engineer, the work of their contract with the work by others.

1.10 EXISTING CONDITIONS

A. The Drawings show certain information that has been obtained by the Owner regarding various pipelines, utilities and structures that exist at the location of the project both below and at grade.

B. The Owner and the Engineer expressly disclaims all responsibility for the accuracy or completeness of the information given on the Drawings with regard to existing facilities.

C. In the case where the Contractor discovers an obstruction not indicated on the Drawings or not described via specification reference, then the Contractor shall immediately notify the Engineer of the obstructions' existence.

D. The Engineer will determine if the obstruction is to be relocated or removed.

E. Compensation for this extra work will be paid for in accordance with the provisions in the Contract for "Extra Work".

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 011100

SECTION 011400 - WORK RESTRICTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Site access and control of areas outside of site.

B. Contractor use of the premises.

C. Contractor storage, parking and deliveries.

D. Work hours, employee conduct and miscellaneous employee requirements.

E. Contract requirements related to maintaining Owner's current operations

F. Suggested construction sequence.

1.02 SITE ACCESS AND CONTROL

A. Contractors shall use the designated entrance to the site as shown on the drawings. If no site entrance is designated, Contractors shall use an entrance designated by the Owner's Construction Representative.
   1. The Owner may permit, solely at the Owner's discretion, the temporary use of another entrance for site access.
   2. The Owner will only review requests made by the Contractors for an exception to the designated site entrance if made in writing at least 72 hours in advance of each of the times desired for use.

B. All Contractors are responsible to employ methods to prevent construction materials and/or debris from leaving the site. All Contractors are responsible to routinely monitor the areas surrounding the site during the day as well as at the end of the work-day and to immediately clean up any area to its previous condition.

C. The Contractors shall employ methods to prevent the transmission of dirt from vehicles driving on exposed areas of the site from reaching the surrounding roadways. The Contractors will be responsible to immediately clean the roadway, should the measures being taken by the Contractors not satisfactorily control the transmission of any dirt to the roadway.

D. Any damages to areas outside the site, spills of soil, liquid, or any other material shall immediately be repaired, cleaned and restored to its previous condition.

E. The Contractors shall comply with all state and local requirements for allowable weight limits of vehicles on all roads.

F. The Owner reserves the right to back charge the Contractors for all costs associated with maintaining the grounds as well as maintaining areas outside the site, which may be disturbed by the Contractors should the Contractors fail to maintain or repair the aforementioned in a condition acceptable to the Owner.

G. The Contractor shall not close any road for any period in time unless approved ahead of time by the City of Corcoran.

H. Keep all existing driveways, roads, and parking areas free and clear of materials and equipment. Do not unreasonably encumber the work area with materials and equipment.

I. The Contractors are responsible for cleaning up the work area. Failure to maintain a clean work site daily, will result in others performing the work and the Contractor being back charged for the cleaning cost plus construction administration fees.

J. Do not discard or dispose of any waste on-site.

K. The Contractors shall be responsible for managing dust.

1.03 CONTRACTOR USE OF THE PREMISES

A. Premises, for the purpose of this Contract, shall mean the site, buildings and other structures located within the property line or in any temporary or permanent construction easements identified on the plans.

B. The Contractors shall use and manage the premises and the associated construction activities as follows:
   1. To not hinder the Owner's ability to operate their facilities.
   2. To allow other Prime Contractors to install their work and complete their contractual obligations in the time period specified.
   3. To allow for stockpiling of construction material and debris without any significant hardship, as defined by the Owner's Construction Representative, on the Owner or other contractors.
   4. To allow for the stockpiling of excavated soil and imported fill, when called for, without any significant hardship, as defined by the Owner's Construction Representative, on the Owner or other contractors.
   5. To allow utility companies to install their work.
   6. To allow for the delivery of equipment and materials by independent trucking companies by leaving enough space for backing in and out of areas.
   7. To allow for the safe, unimpeded travel way of the Owners vehicles, Owner's Construction Representative's vehicles, Engineer's vehicles, construction vehicles and heavy construction equipment about the entire site.

C. Contractors shall maintain the premises in a safe condition throughout the construction period. Compliance with OSHA regulations and site safety shall be the responsibility of the Contractor as it relates to work of the Contract. The posting of all applicable OSHA safety signs shall be the responsibility of the Contractors.

D. Contractors shall be responsible for protecting Owner's property. All existing buildings, structures, shrubs, trees, lawn fixtures, sculptures and misc. equipment shall be protected at all times. Any removals or relocation of said objects, if allowed shall be as directed by Owner's Construction Representative.

E. Contractors shall protect all of the physical structures, property and improvements upon the site from damage by their Work and shall immediately repair or replace damage caused by

construction operations, employees or equipment employed by the Contractor. All labor, materials and equipment and outside contractors that are employed by the Owner to repair damage caused by the Contractor shall be billed to the Contractor directly or withheld from money due the Contractor for work already completed.

F. Keep all existing operations areas, driveways, roads, and parking areas free and clear of materials and equipment. Do not unreasonably encumber the site with materials and equipment. Confine stockpiling of excess excavated material, materials and equipment to areas selected under the Site Utilization Plan or as designated by the Owner's construction representative. Locate storage sheds and trailers to areas designated in the plan or by the Owner's Construction Representative.

G. Immediately remove excess excavated material or relocate to areas on the site requiring placement of fill. Do not stockpile excess material on the site.

H. Do not discard or dispose of any waste on-site.

I. Open fires will not be permitted on the site.

J. Install erosion control measures as indicated in the Contract. The Contractor shall confine stormwater runoff to the site.

K. The General Contractor shall be responsible for managing dust as specified in Section 015719.

1.04 CONTRACTOR STORAGE, PARKING AND DELIVERIES

A. Do not unreasonably encumber the premises with materials and equipment. Do not store material in existing buildings. Store all equipment and materials to allow the Owner's employees to operate and conduct their business safely.

B. Confine premise storage areas to locations designated by the Owner. Immediately repair or replace damaged facilities to the satisfaction of the Owner and to a condition that existed before the damage occurred as determined by preconstruction photographs, or if photographs are unavailable, to that deemed by the Owner.

C. No materials storage will be permitted within the buildings at any time during construction.

D. Storage of chemicals and paint materials shall be outside the existing or new structures and shall follow manufacturer's storage/handling guidelines.

E. Contractors shall provide minimum of 48 hours advance written notice to the Owner's Construction Representative for deliveries of materials, site visits by inspectors, manufacturer's representatives or any other occasion that impacts the use of the site. Contractors shall be responsible for any costs that are incurred by the owner, for failure to meet previously agreed upon appointments or work schedules.

F. Parking shall be in the designated areas of the site only. All automotive type vehicles are to be locked when parked or unattended to prevent unauthorized use. Do not leave vehicles or equipment unattended with the motor running or the ignition key in place. Any vehicles or trucks in non-designated areas may be towed at contractor's expense.

1.05 WORK HOURS, EMPLOYEE CONDUCT AND MISCELLANEOUS EMPLOYEE REQUIREMENTS

A. The Contractors will be permitted to schedule working days and hours as specified in the General Terms and Conditions, if no times are specified therein then the work hours shall be

Monday - Friday 8:00 am - 4:00 pm.

B. Employees are to act in a professional manner. Any employee using inappropriate language or who is disruptive to the work environment will be banned from the site.

C. Any employee found under the influence of any drug or alcohol will be banned from the site.

1.06 CONTRACT REQUIREMENTS RELATED TO MAINTAINING OWNER'S CURRENT OPERATIONS

A. The Contractors shall schedule working days and hours as specified. The Contractors shall pay all excess costs for inspection services provided by the Owner/Engineer for working beyond the times specified.

B. The hourly rate paid for inspection services beyond normal working hours shall be at a maximum billing rate of $180 per hour, which shall be used to compute the overtime hourly charge.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 011400

SECTION 012500 - PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the requirements for substitution of specified products during construction.

B. *The* Engineer *will consider requests for substitutions only within* ***thirty (30)*** *days from the date of the Notice to Proceed.*

C. Only products not specifically named in the bid are eligible for substitution in accordance with the requirements contained herein these specifications.

D. Products named by the Bidder, at the time of bid, shall be furnished and installed and substitutions will not be considered by the Owner/Engineer for those products named in the bid.

1.02 CONTRACTOR'S OPTIONS

A. For products specified only by reference standard, select any product meeting that standard.

B. For products specified by naming several products or Manufacturers, select any one of the products or Manufacturers named which complies with the Specifications.

C. Where products are not named, then submit products that meet the specifications.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Name - The Drawings and Specifications list acceptable Manufacturers, commercial names, trademarks, brands and other product, material and equipment designations. Such names are provided to establish the required type, quality and other salient requirements of procurement.

B. Equals - An item equal to that named or described on the Drawings or in the Specifications may be provided by Contractor if accepted by the Engineer.

C. A request for product substitution constitutes a representation that the Contractor:
   1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
   2. Shall provide the same warranty for the Substitution as for the specified Product.
   3. Shall coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner, including extra charges by material suppliers and vendors.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Shall reimburse the Owner and the Engineer for review or redesign services associated with re-approval by authorities.
   6. Shall reimburse the Owner for all additional engineering services claimed by the Engineer for extra services associated with the review of the Contractor’s substituted item since it could not have been originally included in the Engineer’s professional engineering services agreement. Reimbursement shall be based on the man-hours expended, at current billing rates.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure:
   1. The Contractor shall submit the REQUEST FOR SUBSTITUTION FORM for consideration including all required information.
   2. The Contractor shall use the form included within this Section.
   3. All forms shall be type written.
   4. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.

F. The burden to prove product equivalence rests on the Contractor.

G. The Engineer will notify Contractor in writing of decision to accept or reject request and at that time the Contractor can make a formal submittal in accordance with the requirements contained in Section 013300.

H. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

PART 3 - EXECUTION

NOT USED

This space left intentionally blank.

REQUEST FOR SUBSTITUTION FORM

Project: _____ Substitution Request Number:_____

Contractor:_____

Address:_____

To:_____ Date:_____

A&M Project Number: Owner: City of Corcoran

Contract Name:_____ Contract No.:_____

Specification Title:_____

Section:_____ Page:_____ Article/Paragraph:_____

Drawing No(s).:_____

Proposed Substitution:_____

Manufacturer:_____ Address:_____

Trade Name:_____ Phone #: (____)_____

Installer:_____ Address:_____

Phone #: (____)_____

History: ___New product ___2-5 years old ___5-10 years old ___More than 10 years old

Differences between proposed substitution and specified product:

___Point-by-point comparative data attached

Reason for not providing specified item (Attach separate sheet if necessary):

Typical Similar Installation:

Project:_____

Engineer :_____

Address:_____

Owner:_____

Date Installed:_____

Submit complete installation list on separate sheets.

Proposed substitution affects other parts of Work: ___No ___Yes

Explain:_____

Gross Savings to Owner for accepting substitution: $_____

Proposed substitution changes Contract Time: ___No ___Yes

Add / deduct (circle):_____days

Supporting data attached for evaluation of the proposed substitution:

___Product Data ___Photos ___Drawings ___Tests ___Reports ___Samples

___Other (explain):_____

Attached data includes description, specifications, drawings, photographs, performance and test data adequate for evaluation of request; applicable portions of data are clearly identified.

Attached data also includes a description of changes to Contract Documents that proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. Proposed Substitution has been fully checked and coordinated with Contract Documents.
2. Proposed Substitution does not affect dimensions shown on Drawings.
3. Proposed Substitution does not require revisions to any other Prime Contractor's work.
4. The undersigned will pay for changes to design, including Engineering design, detailing, and construction costs caused by requested Substitution.
5. Proposed Substitution will have no adverse affect on other trades, construction schedule, or specified warranty requirements.
6. Maintenance and service parts will be locally available for proposed substitution.
7. The undersigned further states that the function, appearance, and quality of proposed Substitution are equivalent or superior to specified item.

This request for product substitution also constitutes a representation that I, as the Contractor:

1. Has investigated proposed Product and determined that it meets or exceeds the quality of the specified Product.
2. Shall provide the same warranty for the Substitution as for the specified Product.
3. Shall coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner, including extra charges by other Prime Contractors, material suppliers, and vendors.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Shall reimburse the Owner and the Engineer for review or redesign services associated with re-approval by authorities.
6. Shall reimburse the Owner for all additional engineering services claimed by the Engineer for extra services associated with the review of the Contractor's substituted item since it could not have been originally included in the Engineer's professional engineering services agreement. Reimbursement shall be based on the man-hours expended, at current billing rates.

Contractor's Authorized Representative (Typewritten):_____

Authorized Signature:_____

Date:_____

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this Section specifies the procedures used to process partial payments and the Final Payment Request.

1.02 TIME FOR COMPLETION

A. The provisions of the Contract relating to the time for performance and completion of the Work are for the purposes of enabling the Owner to proceed with the construction of a public improvement in accordance with a predetermined program, and inasmuch as failure to complete the Work within the period herein specified may result in damage or loss to the Owner, time is of the essence of the Contract.

B. Time for completion of the Work shall be in accordance with that stipulated in the Contract Documents.

C. The date for completion will be calculated from the date shown on the Notice to Proceed. The Contractor shall execute the Work with diligence from day to day, and complete it within the time fixed.

D. To define the date of substantial completion, the Project will be considered complete when all Work covered by the Contract has been performed and all installations and equipment have been tested and are ready for permanent use. Removal of the Contractor's equipment and other minor adjustments which do not prevent use of the Project will not be a factor in establishing the date of substantial completion.

E. The foregoing, the Engineer will establish the date of substantial completion when the project is accepted and ready for operation, and no large or major items of work are as yet outstanding. At such time, the Engineer will issue a punch list, itemizing the items of work remaining. The punch list will include "minor" items only, as defined solely by the Engineer. Any prior punch lists, which include "major" or significant items, as defined by the Engineer, shall not be a criterion in establishing the date of substantial completion.

1.03 PARTIAL COMPENSATION

A. At the Owner's discretion, the Contractor may receive compensation for materials and products delivered to the site yet not installed providing:
   1. A canceled check or paid bill from the supplier is submitted to the Engineer indicating that the Contractor has paid the supplier for the material or equipment.
   2. The material or piece of equipment is properly stored and protected from the elements and/or vandalism in accordance with the manufacturer's written requirements for long term storage.
   3. A certificate of insurance is provided for the material or piece of equipment in the event of a fire, vandalism, theft, etc.
   4. A bill of material is delivered to the Engineer at the time of delivery itemizing the subject material or equipment. Payment will be made for on-site material and/or equipment in the amount of 80% of the gross amount of the paid invoice. This payment will be subject to the normal retainage of the partial estimate.
   5. The Engineer has agreed to the pre-purchasing of the materials.

B. The Contractor may not receive compensation for materials and products stored in the Contractor's yard or shop unless permitted by the Owner.

1.04 APPLICATIONS FOR PAYMENT

A. The Contractor shall review the percentage of work completed during the payment period with the Engineer, based on the bid items in the proposal. The Engineer shall make the final decision on the percentage of work completed.

B. Submit one (1) copy of each payment application, completed, signed and notarized.

C. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

D. The payment application shall include a Contractor Invoice and an Owner Claim Voucher.

E. Provide completed Labor Affidavit Form for each pay period included in the certified payroll reports for each payment application for both the contractor and any subcontractor(s).

F. Submit payment application to Engineer no later than the first day of each month. Payments received after the first day of each month shall be reviewed and processed after the first day of the following month. Only one application for payment will be reviewed and processed each month.

G. Submit certified payroll receipts for all workers and subcontractors. Payroll receipts shall be submitted with every application for payment. All payroll receipts shall be certified correct and notarized by a Notary in the State of California. Application for Payment will not be processed unless all payroll receipts are received.

H. Contractor shall pay all workers and have all subcontractors pay all workers the prevailing California state Wage Rates.

I. Owner may conduct on-site interviews with all workers to verify payments of prevailing wage rates are enforced.

J. The Engineer shall submit the documentation along with an Engineer’s Payment Report to the Owner for payment.

K. Retainage in the amount of 5% will be held from each partial payment. Retainage will only be released upon full completion of the project and will be included in the final payment.

1.05 ACCEPTANCE OF FINAL PAYMENT REQUEST

A. The Contractor shall be conclusively deemed to have accepted the Final Payment Request as a correct statement of the total liability of the Owner and of the compensation paid and to be paid to the Contractor by the Owner unless within seven (7) days after delivery of his copy of the Final Payment Request to him, the Contractor shall return such copy to the Owner together with a statement of his objections to such request and of any claim for damages or compensation in excess of the amounts shown on the Request. The acceptance by the Contractor of the Final Payment Request approved by the Owner shall constitute a release and shall discharge the Owner from all further claims by the Contractor arising out of or relating to the Contract, including but not limited to, a release from all impact costs.

1.06 SCOPE OF PAYMENTS

A. The Contractor shall receive and accept the compensation as herein provided, in full payment for furnishing all materials, labor, tools, and equipment and for performing all work contemplated

and embraced under the Contract, also for all loss or damage arising out of the nature of the Work or from the action of the elements, or from any unforeseen difficulties or obstructions which may arise or be encountered during the prosecution of the Work, and for all risks of every description connected with the prosecution of the Work, until its final acceptance by the Owner, also for all expenses incurred by, or in consequence of, the suspension or discontinuance of the said prosecution of the Work as herein specified, and for all actual or alleged infringements of patent, trademark, or copyright, and for completing the Work and the whole hereof, in an acceptable manner, according to the Plans, Specifications, and other Contract Documents. The payment of any partial or final estimate shall in no way or in no degree prejudice or affect the obligation of the Contractor, at his own cost and expense, to renew or replace all defects and imperfections, or damages. The Engineer shall be the judge, and the said Contractor shall be liable to the Owner for failure so to do.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION 012900

SECTION 012973 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Schedule of Values

1.02 SCHEDULE OF VALUES

A. Submit for approval prior to the start of the work a Schedule of Values that indicates a breakdown of the labor, materials and equipment and other costs used in the preparation of the bid. This schedule shall be in sufficient detail to indicate separate figures for such items as excavation, concrete, equipment and all other items making up the lump sum price. The cost breakdown shall be separately itemized for each lump sum bid item in the project.

B. Where the cost breakdown includes items for bond payment, insurance payment, job set-up, or job mobilization, these items will be paid based on paid invoices and copies of cancelled checks.

C. Submit a Schedule of Values to the Engineer for review and approval within fifteen (15) calendar days from the date shown on the Notice to Proceed.

1.03 FORM OF SUBMITTAL

A. Use the Table of Contents of the Contract Specifications as a basis for format for listing costs of work for Sections under Division sections apply to work. Not all Sections need be assigned a breakout price as determined by the Engineer.

B. Identify each line item with number and title as listed in Table of Contents.

C. Provide dollar values for each line item for labor, overhead, profit, material, and equipment components for each category of work if requested by the Engineer.

D. List quantities of materials specified under unit price allowances.

E. The Schedule of Values, after approval by the Engineer, shall be the basis for the Contractor's Application for Payment.

F. The first Application for Payment will not be reviewed prior to an approved breakdown.

1.04 PREPARATION OF SCHEDULE OF VALUES

A. Breakdown schedule of values based on bid items in proposals with further breakdown below each item. In addition to the above, provide a separate line item cost below each bid item, as applicable, for each of the following items which shall be supported by proof where requested by Engineer:
   1. Performance and payment bonds.
   2. Insurance.
   3. Mobilization and Demobilization (Amounts shall be equal in value).
   4. Temporary facilities and measures as specified in Section 015000.
   5. Preparation of the Project Construction Schedule, and updates, as specified in Section 013300.

6. Rubbish removal and daily cleaning up. (Provide a total dollar amount and a daily rate for each calendar day during the contract period.)
7. A total dollar amount for furnishing all the Operations and Maintenance Manuals specified throughout the specifications.
8. Record Drawing retainage amount specified in Section 017839.
9. Final cleaning.

B. Show total costs including overhead and profit.

C. Provide additional details and data to substantiate the cost breakdown as requested by the Engineer.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 012973

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes:
   1. Requests for Interpretation or for information
   2. Administration of subcontracts
   3. Coordination of work with other Contractors, utility companies, and the Owner/Engineer
   4. Communication and coordination requirements
   5. Qualifications of Contractor's job site superintendent

B. Site staffing requirements for the Contractor's superintendent are also specified herein, the costs for which shall be included in the Contract price.

1.02 REQUEST FOR INTERPRETATION OR INFORMATION

A. The Contractor shall use the Request for Interpretation/Information Form included within this Section when the Contractor feels that additional information is needed to perform the work of the Contract.

B. The Engineer will respond to requests utilizing the form provided herein.

C. The Engineer's verbal response(s) to the Contractor's formal requests, if provided, shall not constitute an official response and if acted upon by the Contractor are done so at the Contractor's own risk and liability and shall not be subject to claims for additional compensation.

D. A signed facsimile of the form will be accepted. The original of the form must be signed and provided to the project manager.

E. The Engineer will respond in writing to the request as soon as possible.

1.03 SUBCONTRACTOR ADMINISTRATION AND COORDINATION

A. Terms and conditions of the Contract shall be binding upon each subcontractor.

B. Furnish each subcontractor and major equipment vendor at least one (1) copy of the Plans and Technical Specifications.

C. Provide at least one (1) copy of each approved shop drawing to each subcontractor whose work may depend upon the contents of the shop drawing submittal. The Owner reserves the right to stop all work, without claims for delay, until such time as appropriate subcontractors are furnished with appropriate shop drawings.

D. Each Contractor shall sequence and schedule the work of subcontractors. Coordinate construction and administration activities of subcontractors. The Engineer and Owner will not accept telephone calls, facsimiles or office visits from any subcontractors on the project. Subcontractor and vendor questions and clarifications shall be directed to the Engineer by the Contractor.

E. The Contractor's on-site project superintendent shall inspect all the work of all of his/her subcontractors, as it is being constructed. The Contractor's subcontractor shall not be permitted to do any work on the site without the Contractor's job site superintendent also being there to inspect the work as it is being performed.

1.04 UTILITY COORDINATION

A. Comply with the requirements of PG&E.

B. Comply with the utility coordination requirements contained in the General Conditions.

1.05 PUBLIC/PRIVATE UTILITIES

A. Notify all public and private utilities for location and mark out of existing utilities in the vicinity of the work using 811 services.

B. Repair all utilities damaged during the Work to the standards and approval of the respective utility at no cost to the Owner.

1.06 SPECIFIC COORDINATION REQUIREMENTS

A. The Contractor shall sequence and schedule work so as not to interfere with the work by others and to afford each Contractor the time to complete their contractual obligations with the Owner. Coordinate the work of this Contract with the work by others. Coordination includes, but is not limited to, the following:
   1. Schedule work with all trades throughout the project to prevent interference.
   2. Accomplish work in coordination with the other Contractors in a manner that will allow each Contractor adequate time (at the proper stage of construction as determined by the Owner/Engineer) to perform and complete the work of their contract.
   3. The Contractor shall annotate on each of his own shop drawings and submittals, information that is relevant to the work of others or where potential conflicts in the installed work may occur. The Contractor shall “bubble” in green ink the area of potential conflict so as to alert the reviewer.
   4. Each prime Contractor shall provide the Engineer with a list of shop drawings that they may require to properly coordinate the work. If a list is not provided to the Engineer within fifteen (15) calendar days from the date of the Notice to Proceed, then it shall be taken that shop drawings of other prime Contractors are not required. Each prime Contractor shall be responsible for providing the list within the time specified.
   5. In case of conflicts due to improper coordination by any Contractor, the Owner/Engineer’s resolution will be final. No compensation will be awarded for extra work required to resolve conflicts or to coordinate the work of all contracts.
   6. Coordinate space requirements, supports, and installation of mechanical, electrical and plumbing work which may be indicated diagrammatically on the Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practicable. Place runs parallel with building lines. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and to facilitate repairs.
   7. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of all fixtures and outlets with finish elements and work by all other trades.

B. Shop Drawings and Submittals Coordination Procedure:
   1. The Engineer will forward copies of relevant shop drawings to all prime Contractors, whose work may be subject to that of others, as solely determined by the Engineer.
   2. The Contractor shall then, within five (5) calendar days of receipt, review said shop drawings provided by the Engineer for the purposes of resolving field and fabrication problems and as a way to coordinate the work.
   3. Immediately notify the Engineer should a purported conflict in the work be discovered so that the Engineer can investigate and take appropriate action.

4. If a shop drawing was so provided by the Engineer and a conflict in the work was not brought to the attention of the Engineer, then the conflict shall be immediately corrected by the Contractor submitting the shop drawing.

C. Each Contractor shall also coordinate the work by complying with the following:
   1. Construction Schedule: Each Contractor shall provide a construction schedule as specified in Section 013216 - Construction Schedules.
   2. Weekly Schedule: By 3:00 PM of each Friday during the construction period
   3. Email Account: Each Contractor shall maintain an email account that shall be used to improve communication. An email shall not constitute a formal advisement regarding the terms and conditions of the contract. Email shall only be considered an informal way of notifying relevant parties of project related activities.
   4. Work Plan: All Contractors shall within five (5) calendar days from the date of the Notice to Proceed, submit to the Engineer a type written work plan in bullet format of the sequence of construction activities from start to finish of construction. A facsimile will not be accepted. All work plans shall include a description of the different major phases of construction as pertaining to the individual construction contract. As a minimum each work plan shall include the tasks and subtasks specified in Section 013216 for the project schedule.
   5. Equipment and Startup Schedule: All Contractors shall also submit a preliminary equipment delivery schedule and a preliminary startup schedule for all equipment and systems being furnished under the Contract. This schedule shall be submitted within 30 calendar days from the date of the Notice To Proceed.
      a. Include an early and late date for each item.
      b. Indicate the time necessary to physically install and ready each item so that other work can be completed by other Prime Contractors.
      c. The Engineer may waive this schedule if the Contractor has adequately shown the information on the construction schedule, in the opinion of the Engineer.

D. Project Coordination Meetings: All Contractors shall participate in and attend the Project Coordination Meetings as specified below:
   1. A minimum of (2) project coordination meetings will be held at the Engineer's or Owner's office as specified herein and in Section 013216.
   2. The meetings will be held when so called for by the Engineer.
   3. The Engineer will prepare the final agreed version of the schedule and distribute it to all Contractors.
   4. The Engineer reserves the right not to hold these meetings if in his/her opinion they are not needed.
   5. All Prime Contractors shall be required to attend the meetings.

1.07 CONTRACTOR'S JOB SITE SUPERINTENDENT

A. Each Contractor shall employ an on-site superintendent as specified herein below. He/She shall be a full-time employee of the Contractor.

B. Each Contractor shall name the job site superintendent within five (5) days of the Notice To Proceed. A letter to the Engineer shall be provided.

C. He/She shall have the authority to sequence and schedule the work, and to staff the project, so as not to interfere with the work by others and to complete the work daily within the time so required.

D. Each Superintendent shall have a minimum of five (5) years of experience as a job site superintendent for projects of equal size and complexity.

E. Contract superintendents shall be qualified and experienced person who shall act to schedule and sequence the work on a daily basis.

F. Contract superintendents may be a foreman or crew supervisor.

G. Each superintendent shall be qualified to perform the duties so required to successfully complete the work in accordance with the Contract Documents.

H. All other construction superintendents shall be on the project site while work under his/her contract is being performed, either by direct forces or by subcontractors as stipulated above for subcontractor coordination.

I. Each superintendent shall also visit the site daily when work is not being performed under their Contract for coordination purposes, through the Owner/Engineer. He/She shall remain on the site for a minimum of one (1) hour, if work is being performed by others. He shall telephone the Engineer's designated field representative to advise him/her that they are on the site to discuss matters related to coordination.

J. Each superintendent shall speak English. If required by the Engineer, provide a resume for the proposed superintendent that shall be typed and shall list the qualifications of the superintendent. Prior to the Contractor assigning a superintendent to the project, he may wish to arrange an interview with the Engineer to determine the proposed superintendent's ability to properly coordinate the work through the Owner/Engineer. The Contractor shall employ a superintendent acceptable to the Owner.

THIS SPACE LEFT INTENTIONALLY BLANK.

REQUEST FOR INTERPRETATION/INFORMATION (RFI)

OWNER'S NAME: City of Corcoran

PROJECT NAME & CONTRACT DESIGNATION:
CONSTRUCTION CONTRACT NO.:

Product, Item, or System:	
Request Date:	RFI No.:
Specification Section:	Paragraph Ref:
Contract Drawing Reference(s):	
Describe Request:	
Signed:	See Contractor's Attachments for Additional Description for Information
Owner/Engineer Response:	
Engineer (Printed):	See Engineer's Attachments for Additional Information
Engineer's Signature & Date	*Response Accepted By Contractor* *Contractor's Signature & Date*
The Work shall be carried out in accordance with these supplemental instructions without change in Contract amount or Contract time for completion. Prior to proceeding with these instructions, indicate your acceptance of these instructions by signing where indicated and returning this form to the Engineer.	

END OF SECTION 013100

SECTION 013119 - PROGRESS MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the requirements for progress meetings.

1.02 PRE-CONSTRUCTION CONFERENCE

A. Each Contractor is required to attend the pre-construction conference at a location, date, and time selected by the Owner.

B. The owner, a partner, or a corporate officer representing each Contractor shall attend the conference. The job site superintendent and office project manager for each Contractor shall also attend.

C. The Engineer will prepare an agenda for the conference.

1.03 PROGRESS MEETINGS

A. Progress meetings will be held approximately once every two (2) weeks during the project. The Owner may elect to hold meetings more or less frequently.

B. At least seven (7) calendar days advance notice will be given by the Engineer or the date for the upcoming meeting will be set during the progress meeting.

C. Attendance at progress meetings shall be mandatory. An amount of $1,000 shall be deducted from the Contract Amount for each announced meeting not attended by the Contractor.

D. The owner, a partner, or a corporate officer representing the Contractor shall attend each announced progress meeting. The job site superintendent and office project manager for each Contractor shall also attend.

E. Subcontractors shall attend when requested by the Owner or Engineer at no cost to the Owner.

F. Meetings will be conducted by Engineer at a location selected by the Owner, normally at or adjacent to the project site.

G. The minimum agenda will cover:
   1. Review minutes of previous meetings.
   2. Identify present problems and resolve them.
   3. Plan work progress during next work period.
   4. Review the status of off-site fabrication and delivery schedule.
   5. Review shop drawings and submittal schedules.
   6. Review change order status.
   7. Review status of construction progress schedule.
   8. Coordinate access requirements.
   9. Other business related to the work.

1.04 OTHER MEETINGS

A. Attend special meetings which may be required or called for by Federal, State or Local authorities, utility companies, Owner, Engineer or any other firm, person or organization related to the project.

1.05 CONDUCTING MEETINGS

A. General - This paragraph covers Owner and/or Engineer meetings with Contractor and/or his subcontractors. Neither Owner nor Engineer wishes to meet solely with a subcontractor and requests for such meetings will be discouraged. If a meeting is deemed necessary, every effort will be made to have Contractor attend. If, for some reason, circumstances do not allow such, the meeting may be held, minutes of the meeting will be sent to contractor and decisions on any major questions will be reserved until contractor has been consulted. Subcontractors may accompany contractor to meetings provided contractor notifies Engineer in advance.

B. Chairman - When Engineer/Owner attend meetings, Engineer, or his duly authorized representative, will act as chairman. Should Owner-Contractor meetings be necessary, Owner will chair such meetings.

C. Notices - Engineer or Owner will issue notices of meetings to all parties concerned and will note, thereof, who must attend and who may attend if they so desire. When a Contractor desires a formal meeting, make a request through Engineer. Except when Engineer determines that a prompt meeting is essential, all notices will be issued at least one week in advance of the meeting date.

D. Agenda - All parties shall inform Engineer of items desired to be discussed and Engineer will notify all parties of all items to be considered. This is to allow each party to fully prepare for the meeting. This shall not be construed to mean that other items cannot be brought up at the meetings.

E. Time Limits - It is the intent to hold productive and efficient meetings and to keep them as short as is reasonably possible. The Chairman will be the sole judge as to whether or not further discussion on any matter is warranted and all discussions shall cease when he so orders.

F. Minutes - Minutes of meetings will be kept, written and distributed by the Chairman or his duly authorized representative. Minutes of all meetings will be available upon request to the Chairman.

G. Conduct - It is the intent to conduct all meetings in an orderly manner, to reasonably discuss all items and to hear and observe the rights and opinions of all parties. The Chairman will allow each party to speak, however, he reserves the right to order any individual to leave the meeting at any time for any reason.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 013119

SECTION 013216 - CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for preparing construction schedules and for keeping them up to date.

B. Prepare a Gantt Chart type schedule and keep it up to date as specified hereinafter.

C. All schedules shall be submitted in accordance with the requirements contained herein in Section 013300.

D. Refer to Section 013100 regarding the requirements for attendance at Project Coordination Meetings and additional requirements concerning the submission of other project coordination and sequencing information.

1.02 SCHEDULE PREPARATION MILESTONE DATES & REQUIREMENTS

A. Each Contractor shall prepare Draft #1 Construction Schedule for presentation and discussion during Project Coordination Meeting No. 1.
   1. The Engineer will provide at least seven (7) calendar days written notice regarding the date of the first meeting.
   2. Draft #1 Construction Schedule shall be prepared as specified hereinafter.
      a. The schedule shall show all the major and subordinate tasks necessary to complete the project in the specified time and interim milestones.
      b. It shall allow adequate time for other Prime Contractors to complete their related work as best estimated by the Contractor. It being understood that the Contractor's allotted time for others to perform their work is non-binding and does not relieve the Contractor from completing all the work in the specified contract completion time in accordance with the Contract Documents. It also being understood that this is the Contractor's realistic best estimate of the time needed for others to complete their related work.
      c. The schedule shall also show the dependencies and time allocated for each task.

B. As a result of the first meeting, a better understanding of each Contractor's time requirements will have been achieved. Within five (5) working days of the date of *Project Coordination Meeting No. 1*, each Contractor shall prepare Draft #2 Construction Schedule and submit it to the Engineer and each other Prime Contractor for review. Each Contractor shall mail his/her schedule to all parties via Overnight Mail with a Return Receipt Requested.
   1. All Contractors shall deliver to the Engineer the electronic file of his/her Draft #2 Construction Schedule at the meeting. The Engineer will use the data files to prepare the Draft Combined Construction Schedule.
   2. The final schedule shall be implemented by all Prime Contractors on a daily basis. All tasks and subordinate tasks shall be completed on schedule.
   3. Each Contractor shall increase resources as needed to comply with the established milestone dates should the schedule start to lag.
   4. The Engineer's decision regarding the time alloted for a given task shall be final and each Contractor shall apply necessary resources to accomplish the work. Submission of a bid shall be intended to mean that the Contractor agrees that the determination is binding.

1.03 PRIME CONTRACTORS SCHEDULE TYPES

A. Gantt Chart Type: The General Contractor shall prepare a Gantt Chart type schedule as specified hereinafter.

1.04 CONSTRUCTION SCHEDULE - GENERAL

A. Coordinate the work and maintain the construction schedule. In the event actual progress begins to lag the schedule, promptly employ additional means and methods of construction to make up the lost time.

B. Keep the construction schedule current and revise and resubmit as often as necessary to accurately reflect the conditions of the work, past progress and anticipated future progress.

C. The construction schedule shall be completed, submitted, and deemed received by the Engineer prior to the first payment application.

D. The schedule, when approved by the Engineer and the Owner, shall establish the dates for starting and completing work for the various portions of the Contract. It shall be the duty of the Contractor to conform to his/her own schedule and to perform the work within the time limits indicated. Failure to adhere to the approved schedule shall expose the Contractor to disputes, claims and additional costs incurred by others.

E. Coordinate letting of subcontracts, material purchases, shop drawing submissions, delivery of materials, and sequence of operations, to conform to the schedule.

F. Coordinate the construction schedule with the proposed schedules of the equipment suppliers and subcontractors.

G. The schedule shall show the critical sequence items where new units must come online before existing facilities go offline, if applicable to the project. The schedule shall also show, in detail, the proposed sequence of the work and the estimated date of starting and completing each stage of the work in order to complete the project within the contract time.

H. The schedule shall be plotted out in color and shall be 36-inch by 40-inch. It shall contain as many sheets as are necessary to show all rolled down tasks. Partially printed schedules will not be accepted. Each Contractor shall arrange to have it plotted on a color plotter suitable for the intended application.

I. Prepare the schedule in a manner so that the actual progress of the work can be recorded and compared with the expected progress.

1.05 CONSTRUCTION SCHEDULE - GANTT CHART TYPE

A. The schedule shall show, in detail, the proposed sequence of the work and the estimated date of starting and completing each stage of the work in order to complete the project within the contract time.

B. Prepare the schedule in a manner so that the actual progress of the work can be recorded and compared with the expected progress.

C. Coordinate the construction schedule with the proposed schedules of the equipment suppliers and subcontractors.

D. The schedule shall be plotted out in color and shall be 36-inch by 40-inch. It shall contain as many sheets as are necessary to show all rolled down tasks. Partially printed schedules will not be accepted. Each Contractor shall arrange to have it plotted on a color plotter suitable for the intended application.

E. The schedule shall show the following:
   1. Task links/task dependency in blue ink.

2. Work under the Contract in green ink.
3. Work by others in blue ink.
4. Milestone dates (zero duration) by a red diamond.
5. The end date for each task and subtask at the end of a bar.
6. The description of all major tasks within the bar. The bar shall be red.
7. Critical path.

1.06 REVISION OF PROJECT PROGRESS SCHEDULE

A. Each Prime Contractor shall evaluate and provide updated construction schedules monthly in accordance with job requirements. Each update shall be submitted to the Engineer for information purposes and be provided by the last Friday of every month

B. Each Contractor shall modify his construction schedule to accommodate coordination of the construction contracts by the Owner/Engineer without claims for additional compensation or delay.

C. The Engineer will provide an electronic version of the Final Combined Construction Schedule for use in keeping the schedule up to date.

D. From time to time, and at stages deemed appropriate by the Engineer, the Engineer may issue updated schedules to reflect the project's status. The percent complete for each task may be shown, as determined by the Engineer.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 013216

SECTION 013223 - SURVEYING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Project record documents shall be prepared as specified herein.

1.02 QUALITY ASSURANCE

A. The Contractor shall employ a land surveyor licensed in the State where the project is located. The surveyor shall be acceptable to the Engineer in terms of experience and qualifications.
   1. Submit evidence of the surveyor's errors and omissions (professional liability) insurance coverage in the form of an insurance certificate.
   2. The surveyor shall maintain a minimum coverage of $1,000,000 for professional liability.
   3. The Owner, Engineer, and Contractor shall be named as insurance certificate holders.
   4. A thirty-day cancellation notice shall be provided.
   5. Physical work shall not be performed until the certificate is provided and approved by the Owner.

B. All instruments used on the project shall be of professional quality and in first class condition.
   1. All instruments shall have been calibrated by a manufacturer's service station within the last twelve (12) months.
   2. Submit certificate of calibration or paid invoice showing that the unit has been calibrated, if so required by the Engineer.

1.03 SUBMITTALS FOR REVIEW

A. Submit name, address, and telephone number of Surveyor before starting survey work.

B. Surveyor's professional liability insurance certificate.

C. On request, submit documentation verifying accuracy of survey work.

D. Submit a copy of the site drawing signed by the land surveyor showing locations of other benchmarks set by the surveyor, baseline location and offset hubs. If requested, the Engineer will provide a reproducible drawing or a drawing in digital format for use by the surveyor.

1.04 EXAMINATION

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Engineer of any discrepancies discovered.

1.05 SURVEY REFERENCE POINTS

A. The Contractor's surveyor shall locate and protect survey control and reference points located throughout the project site.

B. Control datum for survey is that indicated on the Drawings or will be provided by the Engineer.

C. The Contractor shall protect survey control points prior to starting any site work. Preserve permanent reference points during construction.

D. Promptly report to the Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
   1. The surveyor shall replace dislocated survey control points based on original survey control when directed by the Engineer.

2. Make no changes without prior written notice to Engineer.

E. The surveyor shall set control lath for rough and final grading purposes. Lath shall be placed at sufficient intervals to control grade or as directed by the Engineer.

F. All new structures, pits, chambers, drainage pools, curbs, roads, swales, and other physical elements shall be located by survey control.

G. Underground pipelines need not be located using survey control but shall be located using standard survey equipment operated by persons experienced in their operation.

1.06 SURVEY REQUIREMENTS

A. The Engineer will provide one (1) benchmark.

B. The Contractor shall, with his own forces, obtain working or construction lines or grades as needed subject to the check of the surveyor. The surveyor shall set offsets.

C. Establish elevations, lines, offsets and levels. Locate and lay out by instrumentation and similar appropriate means:
1. Site improvements including pavements, stakes for grading, curbs, fill and topsoil placement, utility locations, slopes and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations, and equipment foundations.

D. Provide tie distances on record drawings to all underground structures, valves, pipes, and utilities installed as work of this Contract.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 013223

SECTION 013300 - SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for making submissions for the project. Electronic submissions will be required unless expressly noted otherwise.

B. Refer to Section 013216 - Construction Schedule for the requirements concerning the submission of construction schedules and for making updates thereto.

1.02 IDENTIFICATION OF SUBMITTALS

A. Each and every submission shall be provided by the Contractor and shall be accompanied by a SUBMISSION TRANSMITTAL FORM. The Contractor shall use the specimen form made a part of this Section. Submittals not containing the form will be returned to the Contractor un-reviewed. The Engineer will not review project submissions until such time as the form is competed in its entirety. Identify each submittal and resubmittal using the form.

B. Each individual submittal shall be identified with a 'submission log number' as specified here in this example: 033000.01-1
   1. The Section number for which the submittal applies, followed by a period, shall be indicated, "033000.".
   2. The submittal within the Section shall be indicated by the next grouping "01". For instance and in this example, the concrete design mix may be submission "01", the waterstop catalog cut may be "02", and so on. Submittals shall be sequentially numbered within the Specification Section, i.e. 01, 02, etc.
   3. The number of times the submission was made shall be preceded by a dash and a numerical suffix as follows: "-1". In this example, the concrete design mix is being submitted for the first time. Use the number "1" for the first time it is being submitted.
   4. Subsequent submissions of the concrete design mix shall utilize the original number and a sequential numeric suffix, i.e. "2" for a resubmission, "3" for the second resubmission, and so on. Substitute the new number for the original "1".

C. Where a layout drawing, containing different elements of the project, is being submitted and there is a question as to what the log number might be, then the Contractor shall contact the Engineer so that an agreed upon log number can be assigned.

D. It is incumbent on the Contractor to initially assign the submission log number designation to each submission. Submissions not containing a log number, as specified above, will be returned to the Contractor un-reviewed by the Engineer.

E. Every submittal shall also be accompanied by a Transmittal Letter (or "Speed Form") addressed to the Engineer's Project Manager as hereinafter defined.

1.03 COORDINATION OF SUBMITTALS

A. Prior to submitting to the Engineer, fully coordinate all interrelated work. As a minimum, do the following:
   1. Determine and verify all field dimensions and conditions by field measuring existing conditions and the installed work of this Contract and work by others.
   2. Coordinate with all trades, subcontractors, vendors, system and equipment suppliers and Manufacturers, public agencies, and utility companies and secure all necessary approvals, in writing.

B. Make submittals in groups containing all associated items that in some way depend upon each other.

1. This also applies to color charts, as one color may not be able to be selected without the selection of other colors so as to form a color-coordinated group.
2. The Engineer may elect not to review partial or incomplete submissions, whereupon he will notify the Contractor of the additional submissions that are required before a review can be made.

1.04 TIMING OF SUBMITTALS

A. Make submittals far enough in advance of scheduled dates of installation to provide time for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery. The Engineer will review submittals in a manner as expedient as possible, and will generally send a written response to the Contractor within seven (7) calendar days of receipt of submittals.

B. Submissions may be returned reviewed, unreviewed, rejected, returned conditioned upon submission of related items, or for other reasons set forth in the Contract Documents.

C. Make submissions well in advance as the returning, rejecting or disapproval of submissions or other similar circumstances are possible and are deemed "avoidable delays". Costs for these delays or those attributed to Contractor's tardiness in making submittals shall be borne by the Contractor.

D. ***All*** submittals requiring Engineer's review (except operations manuals) as required under the technical specifications of these documents shall be submitted within **FORTY FIVE (45)** consecutive calendar days after the date of the Notice to Proceed. An amount of **$250** per calendar day shall be deducted from payment due the Contractor for ***each*** day that an outstanding submittal exists, said amount being the cost associated with the Engineer's review.

E. Operation and maintenance manuals shall be submitted at least **FORTY FIVE (45)** consecutive calendar days prior to scheduled startup of the unit or system.

F. If material or equipment is installed before it has been deemed to be in general compliance with the Contract Documents, as determined by the Engineer, the Contractor shall be liable for its removal and replacement at no extra charge and without an increase in contract time.

1.05 DESTINATION OF SUBMITTALS

A. Each submission of documents shall be accompanied by a transmittal form containing the name of the project, the contract name, the Engineer's project manager, a submittal ID number, and a description of content for the submitted items.

B. A copy of the TRANSMITTAL FORM shall also be provided to the Engineer's inspector at the job site.

C. Electronic submittals shall be transmitted through email, pending instruction by the Engineer.

D. Other submissions, such as material samples or other items as instructed by the Engineer, shall be sent to the Engineer's office as follows:

A&M Consulting Engineers
220 N Locust Street
Visalia CA 93291
Attention: A&M Project Manager (Named at Pre-Construction Conference or in the Notice to Proceed)

1.06 CLARITY OF SUBMITTALS

A. All printed materials shall be neat, clean, professionally drafted by hand or by computer, clear,

legible, and of such quality that they can be easily reproduced by normal photocopying.

B. All electronic submittals shall be produced with a minimum resolution of 300 dpi.

C. Binders of information shall be separated into groups, subsystems, or similar equipment/function. Copies not conforming to this paragraph will be returned to the Contractor without the Engineer's review.

1.07 CONTRACTOR'S REPRESENTATION

A. By making a submission, the Contractor represents that he has determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving equipment into an enclosed space, materials, catalog and model numbers and similar data and that he has checked and coordinated each submission with other work at or adjacent to the project site in accordance with the requirements contained in Section 013100 - Project Management and Coordination and the Contract Documents.

B. Every SUBMISSION TRANSMITTAL FORM shall contain the Contractor's approval stamp and date showing that the submittal has been approved by the Contractor. The Engineer will not review submittals that have not yet been reviewed and approved by the Contractor.

1.08 ENGINEER'S REVIEW

A. Engineer will review and comment on each submission conforming to the requirements of this Section.
   1. Engineer's review will be for conformance with the design concept of the project and will be confined to general arrangement and compliance with the Contract Documents only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, laying lengths, tolerances, interference's, for coordinating the work by others or subcontractors.
   2. The Engineer's review of a separate item, or portion of a system, does not represent a review of an assembly or system in which the item functions.

B. The Engineer will mark submittals as follows:
   1. NO EXCEPTION TAKEN (**A**) - No corrections, no marks. The content of this submittal has been reviewed by the Engineer and been found to be in general compliance with the Contract Documents. No further submission of this submittal is required and the information contained in the submittal may be built into the work in accordance with the Contract Documents.
   2. MAKE CORRECTIONS NOTED (**B**) - Minor amount of corrections. The content of this submittal has been reviewed by the Engineer and has been found in general to be in compliance with the Contract Documents. The notations made on the submittal by the Engineer shall be incorporated into the work in accordance with the terms and conditions of the Contract Documents. No further submission of this submittal is required.
   3. AMEND AND RESUBMIT (**C**) - The content of this submittal has been reviewed by the Engineer and this review has determined that additional data and/or modification to the submitted data or other changes are required to bring the work represented in this submittal into compliance with the Contract Documents. This submittal shall be reviewed and revised in accordance with the Engineer's comments and resubmitted to the Engineer for review. The information contained on the resubmittal shall not be incorporated into the work until the submittal is returned to the Contractor marked "NO EXCEPTION TAKEN" or "MAKE CORRECTIONS NOTED".
   4. REJECTED (**D**) - The content of this submittal has been reviewed by the Engineer and has been determined not to be in accordance with the requirements contained in the Contract Document and requires too many corrections or other justifiable reason. The submittal shall be corrected and resubmitted or a submittal of an alternate shall be provided. No items are to be fabricated under this mark.
   5. SUBMIT SPECIFIED ITEM (**E**) - The content of this submittal has been reviewed by the Engineer and this review has indicated that the work displayed in the submittal is not in

compliance with the Contract Documents. The Contractor shall submit another submittal for this portion of the work, which complies with the Contract Documents.

6. RECEIVED (**R**) - This submittal is accepted on the project and filed for record purposes only, in accordance with the terms and conditions of the Contract Documents. Documents marked "RECEIVED" will not be returned.

C. No payment will be made on any item for which a submission is required if such submission:
   1. has not been made,
   2. has been made but was not stamped "No Exceptions Taken" by Engineer,
   3. has been made and stamped "Make Corrections Noted", but contractor has not complied with Engineer's notes marked on the submittal,
   4. has been made and stamped "No Exceptions Taken", but item provided does not conform to the shop drawing nor to the Contract Documents.

D. Submittals not required by these specifications will not be recognized or processed.

E. Provide an 8-inch by 10-inch space for the Engineer's review stamp.

1.09 RESUBMISSIONS

A. Prepare new and additional submissions, make required corrections, and resubmit corrected copies until found in compliance with the Contract Documents.

B. On, or with, re-submittals, clearly describe revisions and changes made, other than the corrections requested by Engineer, which did not appear on the previous submissions.

1.10 CONTRACTOR'S RESPONSIBILITIES

A. Engineer's review of submittals shall not relieve the Contractor of his/her responsibility for any deviation from the requirements of the Contract Documents nor relieve the Contractor from responsibility for errors or omissions in the submittals.

B. No portion of the work requiring a submission shall be commenced until the Engineer has found the submission in general compliance with the Contract Documents.

C. The Contractor shall provide written notification of any specification or drawing deviation.

1.11 EXCESS COSTS FOR ENGINEERING/ENGINEERURAL SERVICES

A. The Owner will charge to the Contractor, and will deduct from the partial and final payments due the Contractor, all excess engineering and Engineerural expenses incurred by the Owner for extra services (work) conducted or undertaken by the Engineer as stipulated below:
   1. Services and other similar charges because of the Contractor's errors, omissions, or failures to conform to the requirements of the Contract Documents as related to administrative charges associated with non-compliance with the requirements for making project submissions.
   2. Services and other similar charges required to examine and evaluate any changes or alternates proposed by the Contractor and which may vary from the Contract Documents.
   3. Services and other similar charges as a result of the Contractor's proposed substitution of materials, equipment or products which require a redesign of any portion of the project, as contained in the Contract Documents at the time of bid.
   4. Services and other similar charges as a result of the Contractor's proposed substitution of products which require an engineering and/or Engineerural evaluation, beyond the time stipulated in Section 012500, to determine if the substituted product is equal to that specified.
   5. Services and other similar charges as a result of changes by the Contractor to dimensions, weights, sizes, voltages, phase, horsepower, materials of construction, and similar physical or operating characteristics of the product furnished which require redesign of the project in any way.
   6. Services and other similar charges for the review of resubmissions of shop drawings that have been marked as "No Exceptions Taken" or "Make Corrections Noted".
   7. Services and other similar charges for the review of shop drawings submitted more than two (2) times for the same product or portion of the work.

1.12 MISCELLANEOUS SUBMITTALS

A. Provide a Submittal Schedule within seven (7) calendar days from the date of the Notice to Proceed. The Submittal Schedule shall list all submittals for the project referenced by draft log number. Provide the estimated date that the submittal will be transmitted to the Engineer for review.

B. Within seven (7) calendar days from the date of the Pre-Construction Meeting, submit a Proposed Products List. This list shall be a complete listing of all products proposed for use, with name of manufacturer, service headquarters, trade name and model number of each product. Partial listings will not be accepted.

C. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.13 SUBCONTRACTOR LIST

A. The Contractor shall submit within THIRTY (30) calendar days after the date of the Notice to Proceed, a list of all subcontractors, including the names of the major subcontractors that were submitted at the time of the bid.

1.14 MATERIAL SAFETY DATA SHEETS (MSDS)

A. Comply with "Right to Know" requirements concerning notification of the use of toxic substances.

B. Any product or substance used by the Contractor or its subcontractors which is listed in Subpart Z of OSHA Part 1910 Title 29 of the Code of Federal Regulations entitled "Toxic and Hazardous

Substances" shall be identified to the Owner/Engineer by the Contractor's submission of a standard Material Safety Data Sheet (MSDS) in accordance with "Right To Know" requirements.

C. Products will not be permitted to be kept on site without a MSDS.

1.15 SHOP DRAWINGS

A. Submit shop drawings for all fabricated work, for all manufactured items and for items specifically required by the specifications.

B. Submit one (1) electronic copy of each standard drawing, catalog cut, or other material. All shop drawings or submittals that are not in the standard 8-1/2" x 11" format shall be submitted both electronically and in paper. Samples shall be delivered directly to the office of the Engineer. The Engineer will return an electronic copy of each submittal once reviewed.

C. Subcontractors shall submit shop drawings directly to the Contractor for checking. Thoroughly check subcontractors' shop drawings for measurements, sizes of members, details, materials, and conformance with the Contract Documents.
   1. Return submittals which are found to be inaccurate or in error.
   2. Do not submit to the Engineer until all corrections have been made.

D. Clearly show the relationship of the various parts of the project and where the information provided on the submission depends upon field measurements and existing conditions.

E. The Contractor shall make all measurements, confirm existing conditions, and include them on the shop drawings before making a submission to the Engineer.

F. Submissions for a single item, or group of related items shall be complete.

G. When submitting Manufacturers' catalogs, pamphlets or other data sheets, in lieu of prepared shop drawings, clearly mark the items being submitted for review.

H. If the shop drawings contain any departures from the contract requirements, specifically describe them in the letter of transmittal.
   1. Where such departures require revisions to layouts, structural, Engineerural, electrical, HVAC or any other changes to the work as shown, Contractor shall, at his own expense, prepare and submit revised drawings accordingly.
   2. Make drawings the same size as the Contract Drawings and to the same scale.

1.16 SAMPLES

A. Where required, or where requested by the Engineer, submit sample or test specimens of materials to be used or offered for use.
   1. Samples shall be representative, in all respects, of the material offered or intended, shall be supplied in such quantities and sizes as may be required for proper examination and tests, and shall be delivered to Engineer, prepaid, along with identification as to their sources and types of grades.
   2. Submit samples well in advance of anticipated use to permit the making of tests or examinations.

B. Samples will be checked for conformance with the design and for compliance with the Contract Documents.

C. Work shall be in accordance with the approved sample. The use of materials or equipment for which samples are requested or required to be submitted is not permitted until such time that the Engineer has completed his review.

1.17 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation. Provide manufacturer's instructions with shop drawings.

1.18 CERTIFICATIONS

A. Submit certifications of compliance indicated in the Contract Documents.

B. Certifications shall be complete and exact, they shall be properly authenticated by the written signature, in ink, of an owner, officer or duly authorized representative of the person, firm or organization issuing such certification and they shall guarantee that the materials or equipment are in complete conformance with the requirements of these specifications.

1.19 COLORS AND PATTERNS

A. Unless the precise color and pattern are specified, whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts for Engineer's and Owner's review and selection.

1.20 TEST RESULTS AND INSTALLATION

A. Whenever field startup services are specified, the Contractor shall obtain from the manufacturer and submit to the Engineer Manufacturer Startup Reports (MSR's). The report shall detail the results of the field visit and all special conditions resulting from the startup.

B. Whenever field or factory tests are required on materials, equipment and systems, such tests shall be performed and the test results submitted to Engineer in the form of a MSR.

C. Do not deliver to the project or incorporate into the work any materials or equipment for which Engineer has not completed his review and found same to be in general conformance with the Contract Documents.

D. Submit MSR's within thirty (30) calendar days after the date of the startup or factory test.

1.21 SPARE PARTS LIST

A. Prepare a list of all spare parts specified to be provided in other Sections. Compile the total list for the purposes of reviewing actual spare parts delivered versus spare parts specified to be provided. The list shall reference the Section, model number, and quantity to be provided.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

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CONTRACTOR'S COMPANY NAME
ADDRESS

SUBMISSION TRANSMITTAL FORM

CLIENT NAME: City of Corcoran
PROJECT TITLE: Water Well 8 & 5F

A&M PROJECT NO.:

Product, Item, or System Submitted:			
Submission Date:		Submission Log No.:	
Specification Section:		Paragraph Reference:	
Contract Drawing Reference(s):			
Manufacturer's Name:			
Manufacturer's Mailing Address:			
Manufacturer's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
Supplier's Name:			
Supplier's Mailing Address:			
Supplier's Contact Information:	*Name*	( ) *Tel. no.*	*Email*
This item is a substitution for the specified item:		_____No	_____Yes
Contractor's Approval Stamp with Signature & Date		<u>Contractor's Brief Comments or Remarks</u> (attach separate letter as needed): By making this submission, we represent that we have determined and verified all field measurements and dimensions, field construction criteria, site and building constraints in terms of limitations in moving the item into the enclosed space, materials, catalog and model numbers and similar data and that we have checked and coordinated this submission with other work at or adjacent to the installed location in accordance with the requirements contained in the Contract Documents.	

END OF SECTION 013300

SECTION 014100 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Codes

B. Governing agencies

C. Permits

1.02 CODES

A. Comply with the requirements of the various codes referred to in these Specifications. Such codes shall be the date of the latest revision in effect at the time of receiving bids.

B. If there is a conflict between local, state, and/or Federal regulatory requirements, seek a consultation with the State Department of Labor. Resolve conflicts to the satisfaction of the State Department of Labor prior to commencing work.

C. Electrical Work: Conform to the requirements of the National Electrical Code (NEC) unless otherwise shown or specified. The Owner will be the sole judge of the interpretation of these rules and requirements.

1.03 GOVERNING AGENCIES

A. All work shall conform to and be performed in strict accordance with all governing agencies such as, but not limited to:
   1. Occupational Safety and Health Act - OSHA
   2. State Building Code
   3. State Fire Code
   4. National Fire Protection Association - NFPA
   5. National Electrical Code
   6. State Plumbing Code
   7. California State Energy Conservation Construction Code
   8. City Codes, Rules, Laws and Ordinances
   9. PG&E
   10. City of Corcoran

1.04 PERMITS AND INSPECTIONS

A. Representatives of the Owner shall have access to the work for inspection purposes. The Contractor shall provide facilities suitable to the Owner to facilitate inspections of the installed work.

B. Obtain and pay for all permits, fees, licenses, certificates, inspections and other use charges required in connection with the work.

C. Such permits include, but are not limited to:
   1. Dewatering Permit, if dewatering is required (All Contracts)
   2. Transportation and disposal of construction debris (All Contracts)

3. Electrical Service
4. Well Completion Report for Well

D. The following permits and/or certifications will be obtained by the Owner from the appropriate permitting agencies:
   1. City of Corcoran Encroachment Permit

1.05 COORDINATION WITH ELECTRIC UTILITY COMPANY

A. Comply with the utility company requirements for the incoming electric service.
   1. Pay the utility company's charges in connection with the installation of the incoming service.

1.06 COORDINATION WITH WATER UTILITY

A. Comply with the water utility requirements for water and fire service connections. Obtain and pay for all necessary permits from the water utility. Obtain authority to connect to the existing water mains.
   1. Make necessary connections to existing public water mains under supervision of the water utility representative.

B. Pay the water utility's charges for the connections.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 014100

SECTION 014500 - QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements for monitoring the quality of the constructed project.

B. Work of this Section also includes services of an independent testing laboratory for quality assurance testing.

1.02 REFERENCES

A. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

B. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

C. ASTM D4561 - Practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.

D. ASTM E699 - Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

1.03 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, Manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or speci-fied requirements indicate higher stan-dards or workmanship that is more precise.

C. Perform work by persons qualified to produce workmanship of specified quality.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

E. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

1.04 MOCK-UP

A. Tests will be performed under provisions identified in this Section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashing, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining work.

D. Where a mock-up has been accepted by the Engineer and is specified to be removed, then the Contractor shall remove the mock-up and the clear area when directed to do so by the Engineer.

1.05 QUALITY ASSURANCE - TESTING LABORATORY

A. In order to establish compliance with the Contract Documents, materials shall be tested, examined and evaluated before they are incorporated into the work. During and after installations, additional tests, examinations, and evaluations shall be made to determine continued compliance throughout the course of the work.

B. Testing laboratory shall be a reputable, experienced firm that is capable of performing all of the required testing and authorized to operate in the state in which the project is located.

C. Perform all sampling and testing in accordance with specified procedures and use the materials, instruments, apparatus, and equipment required by the codes, regulations and standards. Where specific testing requirements or procedures are not described, perform the testing in accordance with all pertinent codes and regulations and with recognized standards for testing.

D. In the event that samples and test specimens are not properly taken, handled, stored or delivered or if other requirements of this Section are not complied with, Engineer reserves the right to delegate any or all of this work to others, or to take whatever action deemed necessary to ensure that sampling and testing are properly accomplished, for which all costs shall be borne by Contractor.

E. Engineer reserves the right to disapprove the use of a specific testing laboratory, even after prior approval, if the laboratory fails to meet or comply with the requirements of this Section. If this should occur, immediately discharge the testing laboratory and retain the services of a different laboratory acceptable to Engineer.

F. The testing laboratory shall meet the following criteria:
   1. Be capable of performing all of the required tests.
   2. Be regularly engaged in performing the types of services required.
   3. Have adequate facilities, materials, equipment, and personnel to perform the services.
   4. Have an adequately trained, experienced and qualified staff.
   5. Have at least one registered professional engineer licensed in the state in which the project is located who shall be capable of performing field tests, supervising laboratory testing and interpreting test results. The professional engineer shall be thoroughly knowledgeable in materials, soils, asphalt paving and concrete.
   6. Shall be able to be on the Project site within two hours after being notified.
   7. Comply with the requirements of ASTM C1077, ASTM D3740, ASTM D4561, ASTM E548 and ASTM E699.
   8. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.06 REFERENCE STANDARDS

A. Conform to reference standards by date that the project was last bid.

B. Obtain copies of standards when required by Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 SUBMITTALS

A. Within fifteen (15) calendar days from the date of the Notice to Proceed, submit documentation from three (3) testing laboratories that clearly indicates experience, location, qualifications of staff, and descriptions of any limitations or restrictions of the firm.
   1. Include a price schedule for standard tests and a billing rate schedule for technician classifications.
   2. Based upon this information, the Engineer will select one firm to be the primary testing laboratory and one firm to act as a standby.

B. Certified copies of each test report shall be mailed directly to the Engineer. The Contractor shall arrange with the laboratory to secure copies.

C. Each report shall be in writing and shall include the testing method used, the test results, the specified results, the exact location of where the test specimens were taken, the date taken, Project identification, Contractor's name and other pertinent information required for a complete and meaningful test report.

D. Each report shall be signed and certified by a responsible officer of the testing laboratory.

E. E-mail reports directly to Engineer within 24 hours after the sample is taken, except in those instances when tests cannot be immediately performed because of required curing, incubation periods, or lengthy testing procedures.

F. The laboratory shall verbally communicate test results when requested by the Engineer. This does not eliminate nor replace the requirements for a written report.

1.08 SCHEDULING - LABORATORY SERVICES

A. Except where otherwise specified, the Engineer will determine the number of samples to be taken, the date and time samples will be taken and tests made, the number and type of tests to be performed, who will collect the samples, how they will be handled and stored and when laboratory personnel are required on site.

B. Engineer will notify Contractor of his/her decision to take samples and/or have tests made and provide him with the pertinent information. Contractor is responsible for notifying the testing laboratory and for having the testing performed, on schedule.

C. In addition to the above, Contractor shall make his own arrangements for the sampling and testing of materials he proposes to incorporate into the work. This shall not be paid for out of the cash allowance.

D. Notify Engineer at least 72 hours in advance of the times at which scheduled samples or tests will be conducted.

E. If samples and/or tests cannot be taken or performed when required, delay the work until such time that they can be accomplished. Where possible, any work that has been installed but has not been sampled or tested as required, shall be tested by other means. Upon Engineer's request, uncover any work, which has been buried or covered, and perform special tests designated by Engineer. If the work cannot be tested by other means, Engineer may declare the work unacceptable. All costs associated with noncompliance and for special testing shall be borne by the Contractor and not be paid for out of the cash allowance.

F. Should the testing laboratory be scheduled to take or collect samples or to perform tests, and finds that it is unable to do so as a result of delays in construction, inclement weather, or any other reason, reschedule the tasks for a date acceptable to Engineer. Costs associated with times testing laboratory is unable to perform scheduled services shall be borne by the Contractor and will not be paid for under the allowance.

G. Plan all work and operations to allow for the taking and collection of samples and allow adequate time for the performance of tests. Delay the progress of questionable work until the receipt of the certified test reports.

1.09 TESTING REQUIREMENTS

A. Compaction Testing - Soil:
   1. Perform compaction testing in accordance with ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) or ASTM D1556 Density and Unit Weight of Soil In Place by the Sand Cone Method.
   2. Perform tests and analysis of fill material in accordance with ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. Rammer and 12-inch Drop.

B. Compaction Testing - Asphaltic Concrete Pavement (if applicable):
   1. Perform asphaltic concrete compaction testing in accor-dance with ASTM D2950 - Standard Test Method of Density of Bituminous Concrete in Place by Nuclear Methods.
   2. Calibrate nuclear density measurement equipment based on theoretical maximum specific gravity of asphaltic con-crete pavement material.
   3. Perform test to determine theoretical maximum specific gravity in accordance with ASTM D2041 Theoretical Maxi-mum Specific Gravity of Bituminous Pavement Mixtures. Perform test on mix at plant prior to delivery. Collect sample at plant in accordance with ASTM D979 - Sampling Bituminous Paving Mixtures and perform test in approved laboratory if plant does not have necessary equipment.

C. Concrete Testing (if applicable)::
   1. Collect samples in accordance with ASTM C172, Practice for Sampling Freshly Mixed Concrete.
   2. Make test cylinders in accordance with ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   3. Test concrete cylinders in accordance with ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. Test slump and air entrainment.

D. Asphalt Testing (if applicable)::
   1. Collect samples at point of delivery in accordance with ASTM D979, Standard Practice for Sampling Bituminous Paving Mixtures.
   2. Perform extraction test in accordance with ASTM D2172, Standard Test Meth-ods for Quantitative Extraction of Bitumen from Bituminous Paving Mix-tures.
   3. Perform gradation test in accordance with ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

1.10 TESTING SCHEDULE

A. Compaction Testing of Soil:
   1. Pipe Installation: As directed by the Engineer.
   2. Concrete flatwork: As directed by the Engineer.
   3. Pavement subgrade: As directed by the Engineer.

B. Concrete Testing: Make six (6) concrete test cylinders for each 50 c.y. or fraction thereof.
   1. st two (2) cylinders at 7 days.
   2. st two (2) cylinders at 28 days.
   3. e remaining cylinders shall be tested at a time to be determined by the Engineer. This requirement shall be subject to change as required by the Engineer.

C. Asphalt Testing: As directed by the Engineer.

D. Compaction Testing of Pavement: As directed by the Engineer.

1.11 FIELD OBSERVATION OF CONTRACTOR'S WORK

A. The Engineer will provide periodic observation of the Contractor's work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions. Verify that the existing substrate is capable of structural support or attachment of new Work being applied or attached. Examine and verify specific conditions described in individual specification sections. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance. Seal cracks or openings of substrate prior to applying next material or substance.

B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 FIELD QUALITY CONTROL

A. Allow representatives of the testing laboratory access to the work at all time. Provide all equipment, labor, materials, and facilities required by the laboratory to properly perform its functions. Cooperate with and assist laboratory personnel during the performance of their work.

B. Test specimens and samples shall be taken by the person(s) designated in other Sections, or as directed by Engineer. Conduct field sampling and testing in the presence of Engineer. Provide all materials, equipment, facilities and labor for securing samples and test specimens and for performing all field-testing.

END OF SECTION 014500

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section supplements the General Conditions.

B. The Work of this Section includes temporary facilities, utilities, and controls to be furnished by the Contractors for this project as it is specified herein.

C. This Section is made a part of all Construction Contracts associated with the project. It contains specific references to the particular Contractor supplying said product or service. If no reference is provided then the requirement applies to all Prime Construction Contractors.

D. Temporary electric shall be provided by the Prime Electrical Contractor.

1.02 CARE AND PLACEMENT

A. All temporary and permanent facilities and controls and all other elements on the project site shall meet all standards of the Occupational Safety and Health Act of 1970 and subsequent revisions. Each Contractor shall comply with all requirements of the Act.

B. Each Contractor shall take every precaution and shall provide such equipment and facilities as are necessary or required for the safety of its employees and persons at the site.

C. In the event of damage to existing and/or temporary facilities then immediately make all repairs and replacements to an equal condition prior to the event.

1.03 QUALITY PERFORMANCE

A. Comply with and perform all work in accordance with the requirements of local authorities and utility companies having jurisdiction, and all applicable codes, regulations and ordinances.

B. Secure approvals from the appropriate jurisdictions and utility companies on all repairs, relocations, connections, disconnections and the Work.

C. All barricades, warning signs, lights, temporary signals and other protective devices shall conform with "Manual on Uniform Traffic Control Devices for Streets and Highways", US Government Printing Office.

1.04 SUBMITTALS

A. Each Contractor shall provide a list of contact numbers as follows:
   1. Contractor's superintendent and office project manager (home, beeper, cellular, office, fax, trailer, and email address).
   2. All subcontractors.
   3. All utility companies.
   4. Emergency services such as fire department, police, and ambulance.
   5. Contractor shall also submit the following:
      a. Name and qualifications of person or persons who shall be available to render first aid.
      b. Names, addresses and telephone numbers of personnel who can be telephoned and act on behalf of Contractor in the event of emergencies or other problems requiring prompt attention during winter shutdown, holidays, nights and other periods when the Contractor's superintendent may be absent from the project site.

B. The General Contractor shall provide a sketch showing routing of temporary water service for construction purposes and for exfiltration tank testing. Provide cuts and plumber's certification for backflow device(s).

1.05 CONTRACTOR'S RESPONSIBILITY

A. Each Contractor shall be responsible for the installation, performance, maintenance, and repair of all temporary facilities and controls specified herein this Section as originally provided.

B. The Owner reserves the right to immediately correct a Contractor caused action, if in the opinion of the Owner, the situation may result in the immediate loss of life, property, and degradation of the environment. The costs for actions taken by the Owner shall be deducted from money due or to become due the Contractor. Amounts in excess shall be paid by the Contractor.

C. If the Contractor caused situation is not deemed immediate, then the Contractor shall, within 24 hours of receipt of written and/or verbal notice, correct the defect or unsatisfactory condition.

D. The Owner may repair, correct, replace, or install temporary facilities to correct the situation if the Contractor fails to perform within the allowed time. The costs to make the corrections shall be deducted from money due or to become due the Contractor. Amounts in excess shall be paid by the Contractor.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Owner may use temporary power lines, pipes, roadways or other facilities that each Contractor furnishes, installs, and maintains (then removes at the completion of the work), during the period of construction.

B. The location of all temporary power lines, roadways, and other necessary temporary facilities shall be subject to the approval of the Engineer, and these shall be located and operated so as not to interfere with the operation of the facilities.

2.02 WATER FOR CONSTRUCTION PURPOSES

A. Each Contractor shall obtain water from the nearest potable water source as designated by the Owner.

B. Each Contractor shall install his or her own backflow prevention device at the supply point where it is connected to the Owner's system.
   1. The water purveyor shall approve the device.
   2. The device shall be tested and certified as functioning properly.
   3. Post the certification in a location acceptable to the water purveyor.

C. Each Contractor shall exercise measures to conserve water.

D. All Contractors, subcontractors, and personnel involved in the project shall be permitted to use water for construction purposes as provided under this paragraph.

2.03 SANITARY FACILITIES

A. The General Contractor shall provide and maintain his or her own temporary toilet facilities and enclosures.

B. These facilities shall be maintained in a strictly sanitary manner and be screened from the general public.

C. All facilities shall be in accordance with the Occupational Safety and Health Act (OSHA) standards and all other applicable local codes.

D. All applicable codes and regulations regarding the maintenance and method of waste disposal for these facilities will be strictly enforced. These facilities shall be of the portable type.

E. The Owners sanitary facility will not be available for use by any contractor.

2.04 HEAT

A. Each Contractor shall provide and pay for heating devices and fuel as required to maintain adequate heat for specific construction operations; i.e. painting, application of coatings, etc. where so specified elsewhere in these specifications.

B. The General Contractor shall heat buildings to properly apply paint in accordance with Section 099100 and 099123 requirements.

C. Maintain minimum ambient temperature of 40 degrees F in areas where construction is in progress, unless otherwise indicated in specifications or as required by proposed working conditions and manufacturer's installation/application instructions.

2.05 VENTILATION

A. Each Contractor shall ventilate enclosed areas to assist in the curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.

2.06 BARRIERS AND PROTECTION

A. Each Contractor shall provide railings, barricades, signs, fences, overhead protection, walkway covers and other protective devices to prevent unauthorized entry to construction areas, to allow for the Owner's / Public safe use of the site and to protect existing facilities and adjacent structures from damage from the work.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing buildings.

C. Provide protection for plant life designated to remain.

D. Protect vehicular traffic, stored materials, public utilities, site and structures from damage.

E. Provide warning signs, detour signs and other traffic control devices to insure the safety of plant operators and to adequately direct traffic around the work. Illuminate barricades, obstructions, and warning signs from sunset to sunrise.

2.07 TEMPORARY FENCING

A. Each Contractor is responsible for performance compliance with OSHA standards.

B. Each Contractor shall provide temporary safety fence around all open excavations or other dangerous conditions on the construction site.
   1. All temporary safety fencing shall be designed and erected in compliance with OSHA standards, but in no case less stringent than these specifications for fencing.
   2. Fence is to be bright orange in color, a minimum of 4 feet high, and properly secured using 1" diameter steel pipe at 4'-0" on-center as support posts.
   3. Stake each support post to a depth of 18" and tamp securely into place.
   4. Each post shall be plumb.
   5. Secure fencing to posts using heavy-duty 12" long cable ties or tie wire.
   6. The fence and supports shall remain the property of the Contractor and be promptly removed at the appropriate time.

C. The General Contractor shall install temporary safety fencing around the outside perimeter of each open tank that requires excavation and which is to be constructed under Contract G.
   1. Fencing shall be securely installed and maintained in accordance with OSHA regulations until the railing and grating has been installed.
   2. Fencing shall be installed on exterior tank walls where excavation is required.

2.08 EROSION CONTROL

A. Each Contractor shall provide measures to keep the ground surface well drained, but avoid erosion of embankments, excavations, the project site, and adjacent areas.

B. Each Contractor shall comply with all local codes, rules, and regulations concerning soil erosion.
   1. Use hay bales or silt fences to control erosion to the satisfaction of the Engineer and regulatory agencies. Use hay bales or silt fences to stop silt and sediment from reaching surface waters, parking lots and roads.
   2. Leave erosion control methods in place until ground cover is established or until date of substantial completion.

C. Comply with the requirements also contained in Section 015719 - Environmental Protection.

2.10 DUST CONTROL

A. Each Contractor shall provide measures to control dust resulting from the work.

B. Control dust at locations and in such quantities and frequencies as required to prevent dust from becoming a nuisance to the surrounding area.

C. In the event the Contractor does not adequately provide for dust control, or should insufficient quantities of dust control agents be placed and Contractor fails to place additional quantities within 4 hours after Engineer's direction, Owner will perform the required work by whatever means deemed expedient and all expenses incurred by Owner will be charged to and paid by Contractor.

D. Take care in selecting and applying dust control agents so as not to make roadways or

walkways slippery, muddy or hazardous. Dust control agents shall be acceptable to the Engineer.

E. The General Contractor shall provide all roadways with dust control.

2.11 RUBBISH REMOVAL

A. The General Contractor shall be responsible for overall rubbish removal.

B. Burning of rubbish and trash will not be permitted.

C. The General Contractor shall clean up trash as specified in Section 011400 - Work Restrictions or more often if the trash interferes with the work of others, presents a hazard or if directed by the Engineer.

D. Dispose of rubbish and waste materials in accordance with state regulations and local ordinances.

E. The General Contractor shall also place rubbish containers at locations selected by the Engineer.

1. Furnish adequately sized rubbish containers from the date of initial mobilization to the date of final payment.
2. As a minimum, the Contractor shall furnish ten (10) 55-gallon general trash containers. Secure the top of each container to the container.
3. Secure the container itself so that it does not get blown about the site.

F. The General Contractor shall be responsible for maintaining the site free of trash.

G. Each Contractor shall assist the General Contractor in maintaining the site free of trash and debris.
1. It shall be the sole responsibility of the General Contractor to prevent trash from being blown about the site.
2. Provide a worker to police the site at least for 1 hour at the end of each day that work is being undertaken by the General Contractor.

2.12 ENCLOSURES

A. Each Contractor shall provide and maintain temporary enclosures, sheds, or fenced-in areas to accommodate protection for products, material and equipment.

B. Store equipment that cannot be exposed to outdoors in accordance with Section 016500 - Product Delivery, Storage and Handling.

2.13 SECURITY

A. Each Contractor shall provide security and facilities to protect work from unauthorized entry, vandalism and theft.

B. Coordinate with Owner's security program, if applicable.

C. Each Contractor has full responsibility for the working area until final acceptance and payment.

D. The General Contractor shall maintain the perimeter fence that pre-existed prior to the start of construction. A temporary perimeter fence shall be required at all times during the construction and until the new perimeter fence is installed, or until the project is accepted by the Owner.

E. It shall be the General Contractor's responsibility to lock all gates to the site, and on the access road, at the end of each work day.

F. All company vehicles shall be conspicuously identified, through sufficiently sized lettering on both the passenger and driver sides, with the company name, address and telephone number.
   1. All employee owned vehicles shall have an 8-1/2 inch by 11 inch sign with the company name, address and telephone number placed on the dashboard on the driver side.
   2. Vehicles may be subject to search by the Owner or owner's representatives.
   3. Any vehicle that does not have the company name, address and telephone number will not be permitted on the Owners' property.

G. Submit to the Owner a complete listing of all employees that will or might be performing work at the project site.
   1. Furthermore, provide sufficient information as may be required for the Owner to conduct background checks, in accordance with the Fair Credit Reporting Act.
   2. Background checks may be performed at the discretion of the Owner due to the sensitive nature of the work and the extensive, and sometimes unsupervised, access to Owner property and buildings.
   3. The Contractor shall be required, on request from the Owner, at any time prior to or during the work, to provide releases from its employees and officers to the Owner, A&M, and a background search firm, hired by either the Owner or A&M, to conduct background checks in accordance with the Fair Credit Reporting Act and applicable state law.

2.14 PARKING

A. Do not allow heavy construction vehicle parking on existing pavement, if existing pavement is not scheduled for replacement or restoration.

B. Provide and maintain access to fire hydrants, building entrances, process tanks, doors and the work in general.

C. Each Contractor shall have his or her employees and subcontractors park in areas designated by the Owner/Engineer.

D. Where trades work from their trucks, then coordinate the parking of trucks with other prime contractors.

2.15 DAMAGES

A. Each Contractor, with the prior approval of the Owner/Engineer, shall promptly repair any damage, directly or indirectly caused by the Contractor's operations.

B. All repairs shall be to the complete satisfaction of the Owner and equal in quality to that which pre-existed.

2.16 FIRST AID FACILITIES & EMERGENCY TELEPHONE NUMBERS

A. Each Contractor shall provide and maintain adequately equipped first aid facilities in a location or at locations that are readily accessible to workmen, Engineer and visitors to the site.

B. Provide at least one on-site employee who is properly trained in first aid and who shall be available to render first aid whenever construction is in progress.

C. Provide a list of emergency telephone numbers as specified above.

D. Post the list of emergency telephone numbers as directed by the Engineer.

2.17 REMOVALS

A. Remove all items provided under this Section except as otherwise specified.

PART 3 - EXECUTION

3.01 PROTECTION OF EXISTING UTILITIES AND PUBLIC WORKS

A. Maintain and protect existing utilities and public works including, but not limited to, conduits, sewers, water mains, electric and telephone conductors or conduits, and gas mains encountered during the construction.

B. In the event that it is not possible to cross over, under, around or otherwise avoid the existing utility, the owner of the utility shall be notified that the utility must be altered or moved.

C. In the event that damage shall result to any service pipe for water or gas, or any private or public sewer or conduit, the Contractor shall immediately, and at its own expense, repair same to the satisfaction of the Engineer.

D. Any contents from the pipes, sewers or conduits shall be immediately removed and disposed in accordance with applicable laws.

3.02 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, and materials, immediately following substantial completion and prior to release of retainage.

B. Remove underground installations to a minimum depth of 2 feet.

C. Regrade site to restore to existing slope and elevation and restore the surface.

D. Clean and repair damage caused by installation or use of temporary work.

E. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to be specified condition.

F. Remove temporary parking and access roads.

G. Regrade area to existing slope and elevation and restore the surface to its existing condition.

H. Final payment will not be processed until all removals have been completed to the satisfaction of the Owner/Engineer.

3.03 PROTECTION OF EXISTING PROPERTY

A. Protect existing structures and finishes during performance of the work.

B. Protect existing trees and plants during performance of the work.

C. Do not deposit excavated materials or store materials around trees or plants or attach guy wires to trees.

END OF SECTION 015000

SECTION 015113 - TEMPORARY ELECTRICITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Prime Electrical Contractor shall install temporary light and electricity for use by others.

B. Temporary electricity shall be installed within fifteen (15) calendar days from the date of the pre-construction conference to all areas of the site where new work is planned or where temporary electric facilities are shown on the Contract Drawings, except as specified herein below.
   1. Temporary electric shall be installed to the Engineer's trailer within two (2) days from the date that the trailer is on-site and is ready for power as notified by the Engineer.

1.02 TEMPORARY LIGHT AND ELECTRICITY

A. The Prime Electrical Contractor shall make all necessary arrangements for temporary electric service at the site of the Work.
   1. Install all temporary light and power in accordance with the National Electrical Code.

B. At the Contractor's option, a properly sized generator may be provided during this period with all costs associated with its operation and maintenance being paid for by the Contractor.

C. Provide wiring and other equipment for temporary light and power in accordance with recognized industry standards.
   1. Wiring for temporary light and single-phase power shall, in general, consist of 3 wire, 120/240 volt with branch circuits of #12 conductors minimum.
   2. Provide branch circuits with weatherproof medium base type lamp holders for temporary lighting as required to maintain a minimum of 10 foot candles in the work areas of all buildings being constructed or renovated as work of this project.
   3. Provide branch circuits with fused ground type receptacle outlet for single-phase power.
   4. Provide lamps and fuses, including replacements.
   5. Provide new materials for temporary light and power, except that transformers need not be new if they are in satisfactory operating condition.
   6. Provide ground fault protection (such as portable plug-in type ground fault circuit interrupters) on single-phase 15 and 20 amp receptacle outlets.
   7. Provide receptacle outlets, portable cord connectors and attachment plugs with standard NEMA configurations.

D. Upon completion of the project, remove all temporary electric light and power work and restore all affected finishes and connections.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 015113

SECTION 015719 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Control of environmental pollution and damage that the Contractor must consider for air, water, and land resources in preparing a bid and while constructing the project. This Section includes management of site aesthetics, noise, solid and liquid waste and wastewater, and other pollutants that may be generated by the Contractor.

B. Include all costs associated with environmental protection as specified herein and as specified in other Sections of these specifications in the total price bid.

1.02 DEFINITIONS

A. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
   1. Adversely effect human health or welfare,
   2. Unfavorably alter ecological balances of importance to human life,
   3. Impact wetlands,
   4. Effect other species of importance to man, or;
   5. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

B. Definitions of Pollutants:
   1. Sediment: Soil and other debris that has been eroded and transported by runoff water.
   2. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
   3. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
   4. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
   5. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalies, herbicides, pesticides, organic chemicals, and inorganic wastes.

C. Sanitary Wastes:
   1. Sewage: Domestic sanitary sewage and human and animal waste.
   2. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 PROTECTION OF ENVIRONMENTAL RESOURCES

A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this Contract. Confine activities to areas defined by the Contract Documents.

B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the Engineer. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.

C. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this Contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.

D. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
   1. Box and protect from damage existing trees and shrubs to remain on the construction site.
   2. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
   3. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.

E. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
   1. Temporary Protection of Disturbed Areas: Construct diversion ditches and berms to retard and divert runoff from the construction site to protected wetlands areas as defined in the Clean Water Act and federal, state and local regulations.
   2. Erosion and Sedimentation Control Devices:
      a. Construct or install all temporary and permanent erosion and sedimentation control features as shown or specified in the Contract Documents and as required by the Owner pursuant to direction of the regulatory authority.
      b. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, hay bales, erosion control fencing, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
   3. Manage borrow areas on and off Owner property to minimize erosion and to prevent sediment from entering nearby property, watercourses and local streets.
   4. Manage and control spoil areas on and off Owner property to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby property, watercourses or streets.
   5. Protect adjacent areas from degradation by temporary excavations and embankments.

F. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment.
   1. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule.
   2. Transport all solid waste off Owners' property and dispose of waste in compliance with Federal, State, and local requirements.
   3. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
   4. Handle discarded materials other than those included in the solid waste category as directed by the Engineer.

G. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this Contract.

H. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.

I. Control movement of materials and equipment during construction to prevent violation of water pollution control standards of the Federal, State, or local government.

J. Monitor water areas affected by construction.

K. Protection of Fish and Wildlife Resources:
   1. Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife.
   2. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

L. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources.
   1. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State and Federal emission and performance laws and standards.
   2. Maintain ambient air quality standards set by the Environmental Protection Agency and State, for those construction operations and activities specified.

M. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.

N. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinkle, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.

O. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.

P. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

Q. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the Engineer. Maintain noise-produced work at or below the decibel levels and within the time periods specified in accordance with OSHA and local ordinances, whichever is more restrictive.
   1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 5:00 p.m unless otherwise permitted by local ordinance or by the Engineer.
   2. Repetitive impact noise on the property shall not exceed the following dB limitations:
   3. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this Contract, consisting of, but not limited to, the following:
      a. Use shields or other physical barriers to restrict noise transmission.
      b. Provide soundproof housings or enclosures for noise-producing machinery.
      c. Use efficient silencers on equipment air intakes.
      d. Use and maintain efficient intake and exhaust mufflers on internal combustion engines.
      e. Line hoppers and storage bins with sound deadening material.

f. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.

END OF SECTION 015719

SECTION 016100 - BASIC PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the general requirements for products that are to be furnished, installed, or otherwise incorporated into the project.

1.02 QUALITY ASSURANCE APPLIES TO ALL PRODUCTS

A. In addition to the Contractor's warrantees and guarantees on materials and equipment required under the General Conditions of the Contract and the Technical Specifications contained hereinafter, the Contractor shall also be responsible for all materials, equipment, and products that have or is planned to be incorporated into the work.
   1. The Contractor shall be responsible for the finished work and that it accurately and completely complies with these Contract Documents.
   2. The Contractor shall be responsible for work performed by subcontractors, equipment suppliers, and material vendors.
   3. The Contractor shall be satisfied as to the product's performance before it is ordered for installation. At the Contractor's option, he/she shall have tested each product to determine compliance with these specifications.

B. The Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks.
   1. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of the work.
   2. Such checking is a courtesy service being provided by the Owner and does not relieve the Contractor of his/her responsibilities under this Construction Contract.

C. If witnessed shop tests or inspections are required at the point of manufacture, the Contractor shall keep the Engineer advised as to the progress of the work to allow inspection at the proper time and place. Provide at least two (2) weeks advance notice before scheduled shop tests.

D. Should a dispute arise as to the quality of workmanship, equipment or material performance, then the final decision regarding acceptability with these Contract Documents shall be that of the Owner.

E. At the request of the Engineer, the Contractor shall promptly provide the services of a competent representative of the manufacturer at the project site, fully equipped and prepared to answer questions, perform tests, make adjustments and to prove compliance with the Contract Documents free of all additional charges. Proof of compliance shall be the responsibility of the Contractor, and such special visits to the project site by the manufacturer shall not be eligible under any cash allowances or stipulated man-hours necessary to startup the system and/or train the Owner as may be specified in the Technical Specifications.

1.03 QUALITY ASSURANCE - EQUIPMENT

A. Erect and install products under the supervision of a competent and experienced superintendent. The method of installation, including anchorage, clearances, and tolerances for rotating assemblies, methods of support for equipment and adjacent piping, shall be as recommended by the equipment manufacturer unless detailed on the Drawings or specified.

B. All material furnished shall be new, and guaranteed free from defects in workmanship, installation, and design.

C. Design and fabricate equipment in conformance with ANSI, ASTM, ASME, ASHRAE, IEEE, NEC and NEMA Standards.

1. Equipment shall withstand the stresses that may occur during fabrication, testing, transportation, installation and conditions of operation.
2. Pumps shall conform to the requirements of the Hydraulic Institute.
3. Equipment shall comply with the latest OSHA regulations and the ANSI Safety Standards.

D. Equipment shall be products of Manufacturers who produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as may be needed at any time within the expected life of the equipment.

E. Manufacturers shall also have readily available access to suitable and accurate testing facilities for performing the required shop tests.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Equipment shall have been in successful regular operation under comparable conditions for a period of at least five (5) years.
1. This time requirement does not apply when the manufacturer posts an Owner/Engineer acceptable Performance Bond or Letter of Credit for the duration of the time period that will guarantee replacement of the equipment in the event of failure.
2. The bond shall be in a form that is acceptable to the Owner’s legal council.

B. The Owner reserves the right to reject any material or equipment manufacturer who, although he appears to be qualified and meets the technical requirements, does not provide satisfactory evidence indicating adequate and prompt post-installation repair and maintenance service, as required to suit the operational requirements of the Owner.

C. Whenever it is required that the Contractor furnish materials or manufactured articles or shall do work for which no detailed specifications are set forth, the materials or manufactured articles shall be of the best grade in quality and workmanship obtainable on the market from firms of established good reputation, or, if not ordinarily carried in stock, shall conform to the usual standards for first-class materials or articles of the kind required.

D. Perform work in full conformity and harmony with the intent to secure the best standard of construction and equipment of the work as a whole or in part.

E. Items of any one type of material or equipment shall be the product of a single manufacturer.
1. For ease of the Owner in maintaining and obtaining service for equipment and for obtaining spare parts from as few places as possible, to the maximum extent possible, use equipment of a single manufacturer.
2. The Engineer reserves the right to reject any equipment from various Manufacturers if suitable equipment can be secured from fewer Manufacturers and to require that source of materials be unified to the maximum extent possible.

F. Substitute equipment shall not be fabricated nor installed until after written decision to accept request is received from the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to work under any Section, carefully inspect the work of all other prime trades and verify that all such work is in conformance with the Contract Documents and is complete to the point where the work under that Section may properly commence.

B. Avoid the need to remove and replace work and to avoid unnecessary cutting and patching.

C. Inspect all surfaces to be sure that they have been properly prepared before applying new work to such surfaces.

D. Verify that all work can be installed in strict accordance with the drawings and the approved shop drawings. Immediately report discrepancies to Engineer.

E. Do not proceed with the work under any Section until these conditions are obtained.

3.02 INSTALLATION

A. Furnish and install materials and equipment in accordance with the instructions of the applicable manufacturer, fabricator or processors, except as otherwise provided in the Contract Documents.

B. All work shall be done in a workmanlike manner and set to proper lines and grades. The work shall be square, plumb and/or level as the case may be.

C. Where performance criteria are specified, do all work necessary to attain the required end results.

3.03 FIELD QUALITY CONTROL

A. Neither observations by Engineer nor inspections, tests or approvals by other persons shall relieve the Contractor from his obligations to perform the work in accordance with the requirements of the Contract Documents.

B. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to specifically be inspected, tested or approved by some public body, the Contractor shall assume full responsibility therefore, pay all costs in connection therewith, and furnish the Engineer with the required certificates of inspection, testing or approval.

C. The Owner reserves the right to independently perform laboratory tests on random samples of material or performance tests on equipment delivered to the site.
   1. These tests, if made, will be conducted in accordance with the appropriate referenced standards or specification requirements.
   2. The entire shipment represented by a given sample, samples or piece of equipment may be rejected on the basis of the failure of samples or pieces of equipment to meet specified test requirements.
   3. All rejected materials or equipment shall be removed from the site, whether stored or installed in the work, and the required replacements shall be made, all at no additional cost to Owner.

3.04 ADJUST AND CLEAN

A. Upon the completion of installations, and as a condition of its acceptance, visually inspect all work, adjust all components for proper alignment and touch-up abrasions and scratches to make them completely invisible.

B. Thoroughly examine all materials and equipment with protective or decorative finishes for defects and damage prior to being covered.
   1. In the case of buried items of work, restore protective surface covers so as to conform to the Contract Documents prior to being backfilled, buried or embedded, as the case may be.
   2. In the case of exposed items of work, for which a decorative finish is required, all scratches, discoloration’s, unmatched colors, disfigurations and damages shall be repaired and touched-up so as to provide a neat, clean finish, and be uniform in color.

3.05 UNCOVERING WORK

A. Unless otherwise specified or directed by Engineer, no work shall be covered until it has been observed, tested, photographed, measured, and authorized to be covered by Engineer.

B. Tie distances to above ground physical structures as reference points to all underground utilities, conduits, pits, manholes, valves, and pipelines shall be obtained by the Contractor prior to covering the work. Immediately comply with the Engineer's direction to uncover the work if tie distances were not obtained.

C. If any work has been covered with Engineer's consent and Engineer considers it necessary or advisable that covered work be observed or tested, the Contractor, at Engineer's request, shall uncover, expose or otherwise make available for observation, or testing as Engineer may require, that portion of the work in question, furnishing all necessary labor, material and equipment.

1. If it is found that such work is defective, the Contractor shall bear all the expenses of such uncovering, exposure, observation, and testing of satisfactory reconstruction, including compensation for additional engineering services and an appropriate deductive change order shall be issued.
2. If, however, such work is not found to be defective, the Contractor shall be allowed an increase in the contract price or an extension of the contract time, or both, directly attributable to such uncovering, exposure, observation, testing and reconstruction if he makes a claim therefore as provided in the General Conditions.

3.06 DEFECTIVE WORK

A. The repair, removal, replacement and correction of defective work is a part of this Contract and shall be promptly performed in accordance with the requirements set forth in the General Conditions or other portions of the Contract Documents. All costs in connection with the correction of defective work shall be borne by the Contractor.

B. Products that fail to maintain the performance or other salient requirements of the Contract Documents, shows undue wear, or other deleterious effects during the maintenance period, shall be considered defective.

END OF SECTION 016100

SECTION 016500 - PRODUCT DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Section includes the transportation, handling, storage and protection of products that are to be incorporated into the work.

B. The procedures for turning equipment over to the Owner for installation by others is also included herein.

1.02 GENERAL

A. Items shall be delivered as complete assemblies direct from the manufacturer with all internal wiring, piping, valving, and control devices intact except where partial disassembly is required by transportation regulations, protection of components, or where physical constraints may exist or be created for the setting of the item.

B. Coordinate the disassembly and reassembly requirements with the manufacturer. Determine the need and extent of reassembly prior to bid.
   1. All labor, material and equipment costs associated with the disassembly and reassembly of the product shall be included in the Contract Price.
   2. Where reassembly of equipment is necessary, then the manufacturer shall provide reassembly instruction at the project site.
   3. A technician shall be present during the entire reassembly procedure and the manufacturer shall certify, in writing, that the unit was reassembled properly in accordance with instructions provided by the manufacturer and that all as-specified warranties remain in effect.
   4. The manufacturer's reassembly inspection time shall be in addition to the field service time specified and shall be included in the Contract Price. This time shall not be eligible for payment under any cash allowance item.

C. In the case where equipment is to be installed by others, then the supplying contractor shall be responsible for its reassembly. If reassembly is necessary and the unit(s) are to be set inside an enclosure or building, reassemble the equipment inside said enclosure. The equipment once reassembled shall be turned over to the installing contractor as specified below.

1.03 PACKING

A. Transport products in containers, crates, boxes or similar means such that the products are protected against damage that may occur during transportation.

B. All parts shall be packaged separately or in container where parts of similar systems are grouped.

C. Part numbers shall be indicated on the individual part. Use indelible ink to mark part numbers.

D. All equipment shipments shall be included with a parts list showing a description (name) of the part and the manufacturer's part number.
   1. The parts list shall be shipped in a plastic zippered envelope with the words "Parts List" lettered on it in indelible ink.
   2. The parts list shall be placed inside the shipping container so that it is on the top of the contents.

E. Equipment shall be shipped with storage, handling and installation instructions.

1. The Engineer reserves the right to withhold payment for equipment delivered to the site until such time as the storage, handling and installation instructions are supplied by the manufacturer.
2. In the case where operation and maintenance manuals have been provided by the manufacturer, which includes the installation instructions, then the installation instructions shall also be included with the equipment shipment.

F. All control panels shall be wood crated.
1. All sides of the control panel shall be covered with 3/4" plywood.
2. The control panel number or name shall be printed on all sides of the crate in 1' high black lettering.
3. The manufacturer's name, Contractor's name and project name shall also be printed on the front of the crate.
4. All control panels and centers shall be packaged with three (3) copies of the approved wiring diagram inside the control panel enclosure in a separate plan holder attached to the inside door. The words "APPROVED FOR CONSTRUCTION" shall be indicated on each page of the wiring diagram.

G. Delicate instruments and devices, reagents, chemicals, and glassware shall be shipped in packaging normally provided by the manufacturer.

H. The Contractor shall require the manufacturer to be responsible for the proper packing of all products.

1.04 SHIPPING AND DELIVERY

A. Product deliveries shall be accompanied with a bill of lading indicating the place of origination and the Contractor's purchase order number.

B. Inspect shipments immediately upon delivery, to assure compliance with requirements of the Contract Documents and those products are undamaged.

C. Promptly remove damaged material and unsuitable items from the job site.

D. Provide equipment and personnel to handle products by methods to prevent soiling; disfigurement or damage.

1.05 STORAGE

A. Store sensitive products and all spare parts in weather tight, climate controlled enclosures in an environment favorable to product.

B. Store and protect products in accordance with the manufacturer's instructions.

C. All other products that are to be installed underground or products such as pipe, valves, and fittings shall be stored outdoors but shall be blocked off the ground and covered with impervious sheet coverings.

D. Store fabricated products above the ground on blocking or skids.

E. Store loose granular materials in well-drained areas on solid surfaces to prevent mixing with foreign matter.

F. Provide adequate ventilation to avoid condensation.

G. In accordance with manufacturer's instructions protect bearings, couplings, shafts, rotating components, and assemblies. Protection of said equipment shall be continuous until the time the equipment is placed into permanent service.

H. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

I. Do not store volatile liquids in any building on site.

J. Storage of products shall be the responsibility of the supplying contractor. The installing contractor shall take all necessary precautions to protect the equipment being furnished by others.

K. Store with seals and labels intact and legible.

1.06 EQUIPMENT INSTALLED BY OTHERS

A. All products, except products noted on the Drawings or specified, shall be furnished and installed under this Contract.
   1. Only noted or specified products shall be furnished under this Contract for installation by others.
   2. If it is not noted on the Drawings or specified, then the product shall be furnished and installed under the Contract.

B. The Contractor shall furnish these products to the Owner. These products shall be stored as specified above.

C. The Owner will then advise the installing contractor that the product(s) are ready for installation.
   1. In the case where the product is stored in a proper enclosure, but not stored inside the building to be constructed under this project, then the installing contractor shall move the product into the building to a location adjacent to the final location shown on the Drawings.
   2. In all cases, the installing contractor shall be responsible for moving from storage, uncrating, anchoring, mounting and installing the product as required by the Contract Documents.

D. The Contractor and installing contractor(s) shall be present at the time the equipment is turned over to the Owner. Immediately thereafter, the Owner will turn the product over to the installing contractor for installation.

E. The Owner, Contractor, Engineer and the installing contractor shall inspect the condition of the product at this time.
   1. Any defects in the product will be noted and the Contractor will be advised to make all repairs immediately.
   2. The installing contractor shall still be required to install the product if the damage is deemed cosmetic by the Engineer.
   3. The manufacturer's installation instructions or wiring diagram shall be turned over to the installing contractor at this time by the Contractor.
   4. Any damage occurring to the product during moving, setting and mounting the unit(s) shall be the responsibility of the installing contractor.
   5. The Contractor is advised to take photographs to document the condition prior to it being turned over to the installing contractor.
   6. The installing contractor is advised to take photographs to document the condition prior to its acceptance.

F. The supplied unit(s) remain the property of the Contractor until final acceptance of the work.

G. Any damage caused to the unit(s) due to improper installation, workmanship, and non-compliance with the manufacturer's written installation instructions shall be the responsibility of the contractor who caused said damage. The burden of proof shall rest with the supplying Contractor.

H. In the event the Contractor discovers misuse, abuse or improper installation of the unit(s) by the installing contractor, then he shall immediately notify the Engineer in writing. The Engineer will investigate the accusations and make a determination. The Engineer's determination shall be binding and agreed to by both parties.

I. If the Engineer's determination substantiates the accusations of the Contractor, then the Contractor shall install the unit(s), the costs for which will be paid for as extra work. All costs associated with the extra work change order, including engineering and attorney fees of the Owner and Contractor will be deducted from money due the installing contractor.

1.07 PROTECTION OF WORK

A. The Contractor shall protect the installed work. All costs for protection shall be borne by the Contractor. Provide coverings as necessary to protect installed products from damage, from traffic and subsequent construction operations. Remove when no longer needed.

B. Cover and protect equipment from dust, moisture or physical damage. Protect finished floor surfaces prior to allowing equipment or materials to be moved over such surfaces. Maintain finished surfaces clean, unmarred and suitably protected until accepted by the Owner.

C. Additional time required to secure replacements and to make repairs will not be considered by the Engineer to justify any extension in the Contract Time of Completion. In the event of the damage, promptly make replacement and repairs to the approval of the Engineer at no additional costs.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 016500

SECTION 017423 - CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning during the progress of the work

B. Cleaning prior to final payment

1.02 SCHEDULING

A. Sequence, schedule, and coordinate final cleaning work with the final cleaning work to be performed by other contractors.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning materials shall be appropriate to the surface and materials being cleaned.

B. Provide pads to protect finished surfaces from cleaning materials.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING

A. Keep all buildings, enclosures, and confined areas where work is being performed under the Contract free from unattended combustible materials.

B. Remove rust spots as they develop.

3.02 FINAL CLEANING

A. Remove dust, dirt, grease, stains, paint drips and runs, plastic, labels, tape, glue, rope, and other foreign materials from visible interior and exterior surfaces.

B. Do not move dust from spot to spot. Remove directly from the surface on which it lies by the most effective mean such as appropriately treated dusting cloths or vacuum tools. When doing high cleaning, do not allow dust to fall from high areas onto furniture and equipment below.

C. Dismantle and remove all temporary structures, scaffolding, fencing, and equipment. Remove waste materials, rubbish, lumber, block, tools, machinery, and surplus materials.

D. Perform the following prior to final payment:
   1. Broom clean all exterior concrete surfaces and vacuum clean all interior concrete surfaces.
   2. Dust and spot clean painted and vinyl covered walls.
   3. Clean and polish all unpainted metal on doors such as trim, hardware, kickplates and doorknobs.
   4. Vacuum clean acoustic ceilings.
   5. Repair, patch, and touch-up marred surfaces to specified finish and to match adjacent surfaces.
   6. Remove foreign material from brick.
   7. Replace all broken and scratched glass and mirrors.
   8. Replace all damaged insect screens.

9. Wash and clean interior and exterior window surfaces. All glass shall be clean and free of dirt, grime, streaks and excessive moisture. Wipe drippings and other marks from windowsills, sashes and woodwork. Do not use windowsills in lieu of ladders.
10. Polish bright metal by damp wiping and drying with a suitable cloth. If a polished appearance is not thereby produced, apply appropriate metal polish.
11. Clean and polish all stainless steel surfaces, including control panels supplied under this Contract.
12. Clean all paved roads, lots and drives which were paved as work under this Contract and all existing paved surfaces using a mechanical street cleaner.
13. Repair or repaint damaged pavement markings.
14. Vacuum and clean with a damp cloth light fixtures, including glass and plastic lenses, ceiling and wall mounted lights, cover panels, side panels, louvers, fixture frames and lamps.
15. Clean supply vents and exhaust grilles. Clean gutters and downspouts.
16. Remove all rust spots and stains from new and pre-existing concrete, painted surfaces, and all other surfaces.
17. Wash all existing floors that were in any way impacted by the construction operations.
18. Inspect interior and exterior surfaces, and all work areas, to verify that the entire work is clean and ready for use by the Owner. The project will not be considered substantially complete until all final cleaning has been performed.
19. Clean dirt that has accumulated between grating and grating angles/supports.
20. Vacuum the inside of all control panels provided under this Contract after the panel has been wired.
21. Pressure wash curbs, walks and concrete platforms on new and existing process tankage.
22. Thoroughly clean all pits, galleries, manholes, pipes, channels, tanks, wells and all structures entered upon.

END OF SECTION 017423

SECTION 017500 - STARTING AND ADJUSTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the following:
   1. Starting systems
   2. Testing, adjusting, and balancing
   3. Updating of manufacturer's operations and maintenance manuals and wiring diagrams

B. Work of this Section also includes stipulated man-hours that shall be provided by the **Prime Electrical Construction Contractor** for startup participation of equipment and systems.

1.02 STARTING SYSTEMS

A. The Contractor shall coordinate, schedule, and sequence the start-up of various equipment and systems.

B. Where the start-up of a system or piece of equipment is dependent upon the start-up of other system(s) or equipment, then the Contractor shall schedule and sequence the start-ups to coincide.

C. Notify the Engineer at least 14 calendar days prior to the start-up of each item or system so that he can schedule the startup with the Owner, utilities, and other Prime Contractors.

D. Where applicable, verify that each piece of equipment or system has been checked for proper:
   1. lubrication,
   2. drive rotation,
   3. belt tension,
   4. motor starter heater size,
   5. fuse size,
   6. water pressures,
   7. terminal connections,
   8. control sequence,
   9. for conditions which may cause damage or delay the start-up procedure.

E. Verify that the equipment has been installed in accordance with the manufacturer's requirements.

F. Complete all pre-startup checklists that may be required by the system vendor.
   1. In the event that start-up activities are delayed as a result of the Contractor's failure to properly check the completed installation and a manufacturer's representative is on the job site waiting for corrections to be made, then the Engineer may, at his/her sole discretion, postpone start-up until such time as the corrections have been made without any extra costs.
   2. The Owner may deduct from money due the Contractor the excess cost of engineering associated with having the Engineer present during the start-up.
   3. The deduction shall be equal to the Engineer's effective billing rate times the total number of hours delayed during the start-up activities.

G. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

H. Verify that wiring and support components for equipment are complete and tested.

I. Execute start-up under supervision of applicable Contractor's personnel in accordance with manufacturer's instructions.

J. The Contractor shall have the job site superintendent present during all start-up activities.

K. Provide manufacturer's authorized technician at the site when specified and in accordance with the requirements contained in Section 014500 - Quality Control.

L. Submit manufacturer's start-up reports (MSR's) in accordance with Section 013300.

1.03 STIPULATED STARTUP PARTICIPATION FOR PRIME ELECTRICAL CONSTRUCTION CONTRACTOR

A. The **Electrical Construction Contractor** shall provide the services of the job site foreman or superintendent who shall participate in the startup of equipment or systems that were furnished by others so as to achieve proper and sustained service.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017500

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Submit the following documents to the Engineer before Substantial Completion:
   1. Project Record Documents as specified in Section 017839.
   2. Operations and Maintenance Manuals prepared in accordance with Section 017823 and be updated as a result of start-up activities.
   3. Manufacturer's Start-up Reports (MSR's) for all equipment and systems where manufacturer field time is specified.
      a. Each MSR shall be signed by the field technician(s) who attended the start-up.
      b. If the manufacturer is taking exception to the installation or if the warranty is voided, he shall provide a statement to that effect and provide reasons and justification to explain the company's position.
   4. One binder containing original counterparts of all warranties, guarantees, bonds, or affidavits as specified in the Technical Specification Sections. These documents shall contain the original signatures and be placed in a plastic sheet protector, one document per protector.
   5. Spare parts checklist itemizing all spare parts furnished under the Contract summarized by Section.
   6. Electrical Underwriter's Certificate where the prime construction contract includes electrical construction or where this Contract is for a Prime Electrical Construction Contract.

B. Submit the following items to the Engineer with the final application for payment:
   1. Final Application for Payment prepared by the Engineer for Contractor's execution showing final amount of Contract including change orders.
   2. Maintenance Bond prepared in accordance with the Contract or General Conditions.
   3. Utility company signoffs and inspection approvals, if applicable.
   4. Federal, state, county, City and local signoffs and inspection approvals, where applicable.

C. All documents shall be complete, signed, dated, and notarized (where applicable) and be subject to the Engineer's acknowledgment of receipt or approval.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017800

SECTION 017823 - OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the requirements for Operations and Maintenance Manuals required to be prepared by system suppliers and equipment Manufacturers.

B. The Contractor shall submit Operations and Maintenance Manuals for all equipment.

C. Where the technical specifications call for the submission of manuals, said manuals shall be prepared in accordance with the requirements contained herein. It being understood that manuals shall be submitted for all equipment even if it is not specifically called out in the specifications.

1.02 MANUAL CONTENTS AND FORMAT

A. All paper Operations and Maintenance Manuals shall be as specified hereinafter.

B. The binder shall be 8 1/2" x 11", metal hinge, vinyl, large capacity by National or Equal. It shall show the name of the manufacturer or supplier and project name on the spine of the binder.

C. A cover shall be provided showing the names of the Owner, Engineer, Contractor, and Manufacturer.
   1. It shall show the Contractor's order number and manufacturer's project number.
   2. The address of the manufacturer, service station telephone number, project title, contract number, and year shall also be shown.

D. Provide tabbed color dividers for each separate product and system.
   1. The name of the product shall be typed on the tab.
   2. A separate tab shall also be provided for information such as troubleshooting instructions, spare parts list, etc.

E. An index shall be provided in the back of the binder, with a separate tab, providing a quick way for the operator to find key and important topics contained in the manual.

F. A separate listing for all charts, graphs, tables, figures and shop drawings shall be provided directly following the table of contents.

G. Each manual shall contain one (1) copy of all shop drawings deemed in compliance with the Contract Documents by the Engineer submitted for the equipment or system for which the manual is prepared.
   1. Only these shop drawings shall be included in the manual.
   2. All shop drawings larger than 8 1/2" x 11" shall be folded and placed in a heavy duty, top loading plastic sheet protector with the title of the drawing showing; one (1) drawing per protector page.

H. For systems being furnished with control panels, each manual shall contain a catalog cut for every electrical device installed inside the control panel or motor control center.

I. Where manuals are prepared for treatment systems for water, a process chapter, written in plain language for the operators, shall be prepared by the manufacturer providing the following:
   1. A general discussion regarding the theory of the process.
   2. A specific discussion relating the theory to the project as designed and constructed. Provide capacities, sizes, loading rates, application criteria, design values, and design assumptions.
   3. Provide model numbers for equipment comprising the system.

4. Provide figures, tables, and graphs to assist the operator in understanding the operation of the treatment system.
5. Where operator interfaces are provided, provide step-by-step instructions for changing a process control variable such as set points.
    a. The instructions shall be numbered and written such as "press", "hold" "scroll", etc.
    b. Each operator interface instruction sheet shall be laminated and placed in the binder.
    c. Another laminated sheet shall be provided and placed inside the control panel.

J. Each manual shall contain the following as a minimum:
1. Table of contents
2. Final version of the warranty statement approved by the Engineer
3. Nameplate data of each component, year of installation, contract number and specification number
4. Name, address and telephone number of the manufacturer and the manufacturer's local representative(s)
5. Installation instructions
6. Operation instructions including adjustments, the interrelation of components and the control sequence describing break-in, start-up, operation and shutdown
7. Emergency operating instructions and capabilities
8. Maintenance requirements include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair and reassembly instructions; and alignment, adjusting, balancing, and checking instructions
9. Troubleshooting guide and corrective maintenance (repair) procedures for all electrical and mechanical equipment. These guides shall list the most frequent and common problems, together with the symptoms, possible causes of the trouble, and remedies
10. Drawings (pictures or exploded views) which clearly depict and identify each part, suitable for assembly and disassembly of entire system and each component
11. Wiring and control diagrams, if applicable
12. Panelboard circuit directories including electrical service characteristics, if applicable
13. Part list with current prices; ordering information; and recommended quantities of spare parts to be maintained in storage
14. Charts of valve tag numbers, with location and function of each valve, keyed to the process and instrumentation diagram prepared as part of the Contract Documents
15. Name, address, and telephone number of nearest parts supply house and nearest authorized repair service center.
16. List of recommended spare parts and the recommended number of each per unit and per group of units.

K. All electronic Operations and Maintenance Manuals shall be as specified hereinafter.
1. All files shall be in Adobe PDF format and submitted on compact discs.
2. Files shall be organized by specification section and then by product.
3. An electronic index and list of all charts, graphs, tables, figures, and shop drawings shall be included.
4. All information provided in the paper Operations and Maintenance Manual shall be included in the electronic version.

L. Submit one (1) copy of a preliminary draft manual at least fourteen (14) calendar days prior to the date set for start-up.
1. The Engineer will review the manual for content and compliance with these specifications.
2. Written comments will be provided, but the manual will not be returned.
3. The manual will be used at start-up, to record changes that should be made to the final manual.
4. The manual will be retained on the site until such time as the final, updated manual is provided.

M. Two (2) weeks after the date the unit was placed into service and the Owner has gained beneficial use, submit five (5) paper copies and two (2) electronic copies of the final updated Operations and Maintenance Manual. Refer to Section 017500 - Starting and Adjusting for requirements related to updating the manual(s).

N. Where installation instructions are not included with the manual, they shall be shipped at least ten (10) days prior to the date the equipment is scheduled for installation.

1.03 RETAINAGE

A. The Engineer will retain from payment due the Contractor, for failure to submit manuals as specified, an amount equal to 2% of the scheduled value for the equipment or system for which the manual applies. This Contract requirement only applies when a manual is specified to be provided in the Technical Specifications for a particular system or piece of equipment.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes:
   1. Maintenance of documents
   2. Recording of record information
   3. Submission of record documents

B. Work of this section also includes the furnishing of underground pipeline documentation.

1.02 PLANS AND SPECIFICATIONS FURNISHED TO THE CONTRACTOR

A. One (1) complete set of Contract Documents (plans, specifications and addenda) will be furnished to the Contractor in electronic portable document format (PDF).

1.03 MAINTENANCE OF DOCUMENTS

A. The Contractor shall maintain at the site one (1) set of the following: drawings, specifications, addenda, change orders, approved shop drawings, test reports, operations and maintenance manuals, and shop drawing log.

B. The Contractor shall make these documents available for use by the Owner, Engineer, regulatory agencies and other parties designated by the Owner.

C. Provide a drawing rack for storage of plans.

D. Maintain these documents in a clean, dry, legible condition throughout the entire contract period.

1.04 RECORDING OF RECORD INFORMATION

A. Affix a stamp to each Contract Drawing and Shop Drawing reading as follows: "RECORD DOCUMENT" - "NAME OF PROJECT" - "CONTRACTOR NAME" in 2-inch high printed letters. The stamp shall be specifically prepared for this project.

B. Keep the record documents current as the work progresses. Record information concurrent with construction progress.

C. Do not permanently conceal any work until required information has been recorded.

D. Legibly mark the Contract Plans to record actual construction, including, but not limited to the following:
   1. All as-built work.
   2. All approved field changes and conditions.
   3. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   4. Location of underground conduits, boxes, devices. Wire sizes (AWG) and types installed. Number of active and spare wires in each conduit and conduit size (applicable where work involves electrical construction).
   5. Tied-down location of all underground process lines and buried valves.

E. Shop Drawings: Maintain as record documents. Legibly mark-up to show changes made due to field conditions encountered during construction.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. The General Plumbing Contractor shall on completion of major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction, site work and underground facilities installed as work of Contract P.

C. The Contractor's surveyor site drawings shall also show the location of property line perimeter fence. The property line of the site shall be indicated on the plans.

1.06 SUBMITTAL OF RECORD DOCUMENTS

A. The Contractor shall deliver to the Engineer three (3) full-size sets of drawings and one (1) PDF electronic copy detailing as-built chemical treatment installations, one (1) month prior to the date of startup of the plant site as outlined in the construction schedule. These shall be submitted to the Health Department by the Engineer for certification of installation and inspection. Drawings shall be submitted by the Contractor to the Engineer in accordance with the requirements of this Section.

B. At Substantial Completion, the Contractor shall deliver one (1) preliminary record set of as-built documents to the Engineer with all changes conspicuously ballooned or otherwise emphasized.

C. The work will not be considered substantially complete until such time as the preliminary record documents are delivered and acceptable to the Engineer. Mark this set "Preliminary Record Drawings".

D. Prior to Final Completion, the Contractor shall conform the preliminary record drawings to the comments made by the Engineer. The Contractor shall provide one (1) set of full-scale paper as-built drawings and one (1) electronic copy in portable document format (PDF).

E. As-built drawings shall be the same size as the Contract Drawings, with 1/2-inch margins space on three sides and a 2-inch margin on the left side for binding.

F. Each drawing shall bear in the title box the words "FINAL RECORD DRAWINGS" and the name of the Contractor in heavy black lettering 1/2 inch high and be certified as complete and accurate.

G. As a convenience, Engineer will make available to the Contractor electronic media of the Contract Drawings for the sole purpose of the Contractor preparing as-built drawings.

H. Electronic media made available is without guarantee of compatibility with the Contractor's software or hardware.
   1. If the Contractor wishes to take advantage of this offer, the Contractor will be required to execute an indemnification and hold harmless agreement with the Engineer.
   2. Electronic media will be provided free of charge on disc in a zipped format.
   3. Electronic media shall be returned to the Engineer upon acceptance of the as-built drawings by the Owner.

1.07 RELATED DOCUMENTS

A. Provide certificate of release of liens if requested by the Engineer.

1.08 UNDERGROUND PIPELINE DOCUMENTATION

A. The installing Contractor shall document the location of all underground pipelines by taking digital photographs of the installed pipelines prior to backfilling. At least 3 digital photographs shall be taken of each pipe section before it has been backfilled.

B. The Contractor shall provide each pipe installation crew with a digital camera capable of a 3 mega-pixel quality picture using Smart Media, Compact Flash Media, or Memory Stick cards as the media within the camera.

C. At the end of each day that pipe has been installed, the crew foreman shall hand deliver to the Engineer the removable media.
   1. The Engineer will then download the photographs and delete the photographs from the media.
   2. The media will be returned to the crew foreman within two working days from the date it was delivered.
   3. The Contractor shall have at least three (3) 256 MB media cards available for this purpose to be used on a rotating basis.

D. Installed work will not be eligible for payment until documentation is provided.

E. In addition, the underground piping shall be marked with construction grade spray paint before the photos have been taken to indicate the pipelines in the pictures.
   1. The Contractor shall assign a separate paint color to each line to be shown in the picture.
   2. The paint color, once selected by the Contractor, shall be used for the entire run of piping.
   3. The marks shall be large and long enough to be visible in the picture. Where practical, spray paint the name of the contents that will be conveyed in the pipe, e.g. "POTABLE WATER", "BACKWASH EFFL.".
   4. This requirement is necessary so that the pipe lines shown in the pictures can be easily named and referenced at a later date.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017839

SECTION 017843 - SPARE PARTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Section includes the requirements for delivering spare parts specified to be furnished under the provisions of the Contract Documents.

1.02 QUALITY ASSURANCE

A. Spare parts shall be delivered as complete assemblies direct from the manufacturer such that the part is fully functional and ready to be installed.

1.03 DELIVERY, STORAGE AND HANDLING OF SPARE PARTS

A. Comply with the requirements of Section 016500 for packing, delivery, storage and handling requirements for all parts delivered to the site of the work.

B. All spare parts required to be furnished under a Section of the Specifications shall be packaged in one separate box, crate or container with the words "SPARE PARTS" lettered on all sides of the container.

C. The equipment name or system name for which the spare parts are being provided shall also be lettered on the container.

D. A separate packing list for the spare parts shall be included in the container.

E. The Contractor shall store all spare parts indoors immediately upon delivery of the spare parts to the site. Spare parts will not be accepted by the Owner/Engineer if the spare parts have been stored outdoors for more than 8 hours upon delivery to the site.

F. The storage location shall be secure.

1.04 TURN OVER OF SPARE PARTS

A. Spare parts shall be turned over to the Owner/Engineer approximately two (2) weeks prior to the Engineer's preparation of the Final Punch List.
   1. Spare parts will not be accepted until this time.
   2. The Certificate of Substantial Completion will not be issued until all spare parts are delivered.

B. The following procedure shall be followed:
   1. The Contractor shall provide a formal letter of transmittal listing the name or description of the part, part number, model number, manufacturer (or supplier), and system component name and the Section where it was specified to be provided.
   2. Two (2) counterparts of the letter shall be provided.
   3. The Contractor shall turn each part individually over to the Owner/Engineer.
   4. The Owner/Engineer will initial next to the part description on each counterpart of the transmittal letter.
   5. The initials represent that the part was received.
   6. One transmittal counterpart will be returned to the Contractor.

SECTION 017843 - SPARE PARTS

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017843

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work of this Section includes the requirements for demonstrating and training of installed systems, equipment, and products.

B. Manufacturer field services and the credit for unused service time is also included herein.

1.02 MANUFACTURER'S FIELD SERVICES

A. When specified in individual specification sections require field services to be provided, said services shall be provided by qualified, authorized and factory trained representative(s) of the manufacturer (supplier).

B. Field services shall generally consist of:
   1. installation supervision,
   2. verify terms of the manufacturer's warranty,
   3. equipment and system calibration,
   4. startup supervision,
   5. and operation and maintenance instructions to the Owner's employees.

C. Such services do not include service time to correct a factory fault, correct problems resulting from a factory wiring or control logic error, or errors caused by poor or improper installation by the Contractor.

D. Sale representatives are not acceptable.

E. The time specified to be provided under the specification sections shall be exclusive of travel time to and from the facility or site. For the purposes of this Contract, one (1) day shall be defined as eight (8) hours exclusive of breaks or mealtime.

F. The times specified to be provided by the manufacturer does not relieve the manufacturer from providing sufficient service time to place the equipment or systems into satisfactory operation and to obtain the specified performance. The manufacturer shall provide, as a minimum, the times specified in the Specification Sections.

G. Where manufacturer services are specified for control panel or control center startup, the representative shall be experienced and trained to work on and field rewire such devices.
   1. Field representatives for control panel startup shall understand the control sequence specified and, in the case of programmable logic controllers, are able to make revisions to the factory program using handheld programming devices or laptop computers.
   2. The time spent by the representative to correct a PLC program shall not be included in the time specified for startup.

H. Submit Manufacturers' startup reports (MSR's) in accordance with the requirements contained in Section 013300 - Submittals.

1.03 SUBMITTALS

A. The Contractor shall prepare a list of all manufacturer specified field time required by the technical specifications. Compile this summary listing and submit it to the Engineer for review in accordance with the requirements contained in Section 013300.

B. Manufacturer's Startup Reports

1.04 QUALITY CONTROL

A. The Contractor shall adhere to all instructions provided by the manufacturer's authorized representative.

B. All verbal instructions necessary to satisfy performance of the equipment or the system shall be immediately provided by the Contractor. The manufacturer shall document all verbal orders in writing at a time suitable to the Contractor.

C. All written instructions provided in operation, maintenance, and installation guides and manuals, provided by the manufacturer of such equipment and or system, shall be complied with by the Contractor.

D. The Contractor shall comply with all manufacturer requirements such that written or implied warranties remain in full force during the time period so specified elsewhere in the technical specifications.

E. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

F. Actions and/or non performance by the Contractor that may void manufacturer warranties shall not constitute a release of the specified warranty, and all warranty claims made by the Owner shall be paid for by the Contractor as if the manufacturer's warranty was still in effect.

1.05 SCHEDULING - FIELD SERVICES

A. The Contractor shall arrange field service on dates acceptable to the Owner and Engineer.

B. The service visits shall be scheduled at least 2 weeks in advance so that the Owner and Engineer can adequately staff the date.

C. Operator training will not be allowed until such time as the Manufacturer's Operation and Maintenance Manuals have been supplied and approved by the Engineer.
   1. The field service technician shall review the contents of the manual with designated employees of the Owner.
   2. Field services will not be deemed provided until the MSR is provided.

1.06 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel prior to date of Substantial Completion.

B. Utilize manufacturer's and vendor's Operation and Maintenance Manuals as basis for instruction. Review contents of the manual with the Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of the equipment or of the system.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

E. The Contractor shall arrange to have the manufacturer's Operation and Maintenance Manuals updated with information that has been added during start-up activities.

F. The final manual shall contain the most recent information and reflect all operational and maintenance aspects of the final installed and functioning system or equipment component of the system.

G. Any changes to control panel wiring diagrams or interconnection wiring schematics shall be made and new prints provided as an update to previously approved manuals.

H. Manufacturer field time shall be as specified in individual Sections of the Technical Specifications.

I. For control panels, explain the control sequence, timing structure, and safety precautions when working inside the panel, terminal wiring system, PLC program, if applicable, operator interface(s) and control logic.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 017900

SECTION 033000 - CAST-IN PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Slabs-on-grade.
   3. Building frame members.
   4. Underslab vapor retarder.
   5. Insulation.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 ACTION SUBMITTALS

A. The contractor shall comply with the requirements of Division 01 Specification of the Project Manual, Section 013300 - SUBMITTALS.

B. Product Data: For each type of product indicated.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.
   2. Submit mix design mixtures for each type of concrete to be used on the Project at least 30 calendar days prior to the first scheduled concrete pour. The Contractor's testing laboratory shall develop concrete mix designs and test all materials and mixes for conformance with ACI 301 and these specifications. The costs associated with development of the design mix and testing of samples shall be included in the bid price.
   3. Submit the following:
      a. Name, address, and telephone number of Contractor's laboratory.
      b. Mix proportions.
      c. Source of cement, type, brand, and certified copies of mill reports, including physical and chemical analysis.
      d. Sources of fine aggregates and results of test made in accordance with ASTM C33/C33M and ASTM C40.
      e. Source of coarse aggregates and results of tests made in accordance with ASTM C33/C33M.
      f. Catalog cuts of all admixtures.
      g. Furnish test results of slump, air entrainment and water-cement ratio for each mix design.
   4. For each mix proposed, make and cure four (4) standard 6 inch concrete test specimens to the laboratory in accordance with ASTM C192/C192M. Furnish compression test results made in accordance with ASTM C39/C39M. Break two (2) cylinders at seven (7) days and two (2) at 28 days.

5. If the concrete is intended to be pumped, design mix accordingly and submit certification that it has been tested for pumping.
6. If adopted mix fails to produce concrete meeting the requirements for strength and placibility, the Engineer may order additional cement or adjustments to mix proportions at no extra cost to the Owner.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, spacing, locations, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement including steel bars and wire fabric.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer licensed in the state where the project is located; detailing fabrication, assembly, and support of formwork. Shop drawings shall bear the signature and seal of the same licensed Professional Engineer.
1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal
2. Shop drawings shall indicate formwork dimensioning, materials and arrangement of joints and ties.
3. Manufacturer's instructions: Indicate installation procedure and interface required with adjacent work

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Engineer, if not shown on the drawings.

G. Samples: For waterstops and vapor retarder.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, provided by Manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Bonding agents.
7. Adhesives and Vapor retarders.
8. Semi rigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

G. Furnish transit-mix delivery slips to Owner's Representative.

1.06 QUALITY ASSURANCE

A. Comply with Referenced Standards specified in Division 01 Section "References" in addition to ACI 301.

B. Perform testing under the provisions of Division 01 Section "Quality Requirements" and the "FIELD QUALITY CONTROL" Article of Part 3 listed in this specification.

C. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. The contractor shall provide an adequately sized, insulated curing box to house concrete cylinders at the discretion of the Engineer, for the 48-hour period between concrete pour and sample collection pick-up by the Testing Laboratory (ASTM C31/C31M). As directed by the Engineer, the contractor shall cure additional cylinders in the same fashion as the in-place concrete.
   2. Curing box shall be located away from the main construction area and shall be blocked up off the ground.
   3. A log sheet shall be provided in a waterproof sheet protector to log in the placement and removal of the concrete test samples by the testing laboratory.
   4. Minimum information to be logged for each pour date shall include: date of pour, date of pick-up, weather conditions at the time of pour, testing

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer. To further insure consistency, coloration, finish and quality; all aggregates, cement, water and other ingredients shall each be secured from the same source for the duration of the project.
   1. The batching plant and raw materials may be subject to inspections and test performed by the Engineer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

H. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete", Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
   3. ACI 304R - "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

J. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Store cement off the ground in a dry, weatherproof, adequately ventilated structure with provisions to prevent the absorption of water.

C. Transport dry concrete batches from the central plant to the site in approved truck mixers conforming to the requirements of the Truck Mixer Manufacturer’s Agitating Standards. Each truck shall contain a plate stating the capacity, drum speeds and be provided with a revolution counter.

D. Packaged material shall be delivered and stored in the original packages until ready for use. Packages or materials showing evidence of water or other damage shall be rejected.

E. Protect all materials from freezing.

1.08 COORDINATION

A. Coordinate work under provisions of Division 01 Specification of this Project Manual.

B. The Contractor shall provide at least five (5) working days advance notice prior to formwork closure to the Engineer.

C. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Notify Engineer a minimum of three (3) working days prior to commencement concrete pours.

1.09 REGULATORY REQUIREMENTS

A. Conform to ACI 304R and all applicable codes for placement of concrete and related work.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when the ambient temperature is below 40 deg. F. or when the concrete temperature exceeds 85 deg. F. Under certain circumstances, the Engineer may approve the placement of concrete under the above conditions, provided that the procedures of ACI 305R and ACI 306R are strictly adhered to.

B. Do not place concrete when the conditions may adversely affect the placing, curing or finishing of concrete, or its strength.

C. Comply with the requirements contained in Section 016500 - PRODUCT DELIVERY, STORAGE AND HANDLING.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Steel forms: Minimum 16 gage thick, stiffened to support weight of concrete with minimum deflection.
   3. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. Douglas Fir Species, solid one side grade and sound

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form-Release Agent: Commercially formulated, colorless, water based, non-toxic, V.O.C. compliant, environmentally safe material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete. Agent shall not be detrimental to the environment.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. For Concrete Tanks: Furnish snap-ties with 1 inch plastic cone and waterseal washer.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Galvanized Reinforcing Bars: ASTM A615/A615M, Grade 60; ASTM A706/A706M, deformed bars; ASTM A767/A767M, Class II zinc coated after fabrication and bending.

C. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60 ; ASTM A706/A706M, deformed bars, assembled with clips.

D. Deformed-Steel Wire: ASTM A 496.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. Provide load bearing pad on bottom to prevent vapor barrier puncture.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C150/C150M, Type IA, gray. Supplement with the following:
      a. Fly Ash: ASTM C618, Class F or C.
      b. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
   2. Silica Fume: ASTM C1240, amorphous silica.
   3. Normal-Weight Aggregates: ASTM C33/C33M, No. 57 or 67 crushed stone coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
      a. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
      b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
   4. Lightweight Aggregate: ASTM C330/C330M, 3/4 inch, nominal maximum aggregate size.
   5. Water: ASTM C94/C94M, clean and not detrimental to concrete.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C33/C33M for fine aggregates.

2.06 CURING MATERIALS

2.07 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, 1/2" asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: three-component, solvent-free, moisture tolerant, epoxy modified cementitious product.
   1. Product: Armatec 110 EpoCem as manufactured by Sika Corporation or specifically approved equal.
   2. Types I and II, non-load bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Non-Shrink Grout: Premixed compound, free of chlorides, with non-metallic aggregate, cement water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi at 48 hours and 7000 psi at 28 days. Grout shall be suitable for contact with potable water. For equipment bases and pipe supports, use non-shrink grout by Master Builders, Embeco 636, Unisorb V-1 or equal.

E. Reglets: Fabricate reglets of galvanized-steel sheet not less than 26 gauge material; in the longest lengths possible with alignment splines for joints; secure to formwork; Type CO as manufactured by Fry Reglet or approved equal. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inches (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

G. Extrudable Strip Waterstop: One part polyurethane, extrudable swelling waterstop to create a compression seal; SikaSwell S-2 as manufactured by Sika Corp. or specifically approved equal.

H. Field Applied Waterstop Grout: Krystol Waterstop Grout, crystalline grout to be applied in accordance with the manufacturer's specifications at joints and penetrations. Manufacturer: Kryton International Inc. (800)267-8280 or approved equal.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109/C109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Ground Granulated Blast-Furnace Slag: 50 percent.
   4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or Pozzolan not exceeding 25 percent.
   5. Silica Fume: 10 percent.
   6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   8. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: Pier, Mat and Spread Footings; foundation walls, slab on grade and slab on metal deck: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.50 for all concrete building elements.
   3. Slump Limits (Conventional Mix):
      a. Slabs: 3 inches plus or minus one inch.
      b. Piers, Foundation Walls and Footings: 4 inches plus or minus one inch.
   4. Slump Limits (Pump Mix):
      a. Final slump (Slabs): 6 1/2 inches plus or minus one inch.
      b. Final Slump (Foundation, walls and footings): 7 1/2 inches plus or minus one inch
   5. Air Content:
      a. Piers, Mats and Spread Footings: 5.5 percent, plus or minus 1.0 percent. at the point of delivery.
      b. Slabs: 3 percent, plus or minus 1.0 percent at point of delivery. Do not allow air content of trowel finished concrete floors to exceed 3 percent.
   6. Large Aggregates: 3/4" crushed stone; ASTM C33/C33M, No. 67.
   7. Use Admixtures only when approved by the Engineer.
   8. Mix Grout in accordance with the manufacturer's instructions and specifications.

B. All concrete for the clear-well and backwash waste tank construction shall include Krystol Internal Membrane (KIM)® integral water repellent admixture as manufactured by Kryton or specifically approved equal. Admixture shall be added at a rate as recommended by the approved manufacturer.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM

C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and measurements before proceeding with formwork. Ensure that dimensions agree with the plans.

B. Inspect the formwork and reinforcing that it has been properly set and secured and that all items to be embedded, built-in or pass through concrete are at their proper locations and elevations.

C. The General Construction Contractor shall verify that all other prime contractors have installed concrete inserts, sleeves, and embedded elements of the project, such as conduit, and their work has been totally completed and inspected by the Engineer.

D. Ensure that all points of contact with new grout are free from oil, grease and scale.

3.02 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.
    a. Hand trim sides and bottom of earth forms and remove loose soil to the satisfaction of the Engineer.
    b. Remove water from forms and excavations and divert water flow to avoid washing over, under or though freshly placed concrete.

D. Construct forms tight enough to prevent loss of concrete mortar. Align form joints.

E. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coatings that may be affected by the agent.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer: Provide 3/4" inch chamfer on all exterior horizontal and vertical corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coatings that may be affected by the agent.

N. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-metallic/ non-shrink grout.

O. Prepare previously placed concrete by cleaning with steel brush and apply a Bonding Agent in accordance with the manufacturer's specifications and instructions.

3.03 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.
   4. Ensure that all inserts and embedded items are not disturbed during concrete placement.

3.04 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or

otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.05 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars. Use reinforcing splices at minimum of locations and only at locations of minimum stress. Review locations of splices with Engineer. Splice locations shall be approved during shop drawing review phase. Rebar splice overly shall be the minimum length as per ACI 318.
   1. Weld reinforcing bars according to AWS D1.4/D1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced t minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Take necessary measures to ensure that reinforcement is not disturbed during the placement of concrete.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated or at 20' o.c. maximum. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction / Control Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 3/16"-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 - JOINT SEALANTS are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

F. Ensure joint fillers and devices are not disturbed during placement of concrete.

G. Install all joint fillers and devices in accordance with the manufacturer's instructions and specifications for floor and wall finish.

H. Install joint device anchors. Maintain correct position to allow joint cover flush with floor and wall finish.

I. Install joint covers in one-piece length when adjacent construction activity is complete.

J. Apply sealants in joint devices in accordance with the manufacturer's specifications and instructions.

3.08 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
   2. Place concrete with the aid of mechanical vibrators which are capable of transmitting to the concrete not less than 3,000 impulses per minute. Maintain at least three (3) vibrators in good working condition, ready for use when concrete placement begins in any one area.
   3. Do not interrupt successive placement. Do not permit cold joints to occur.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and ACI 305R and as follows:

1. Maintain concrete temperature below 95 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
3. Maintain records of concrete placement. Record date, locations, quantity, air temperature and test samples taken.
4. In areas with floor drains, maintain floor elevations at walls; pitch surfaces uniformly to the drains maintaining a 1% slope.
5. Cure floor surfaces in accordance with ACI 308R.
6. Apply curing compound in accordance with the manufacturer's specifications and instructions in two (2) coats with the second coat at right angles to the first.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch 6 mm in one direction.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, and ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F (F) 30; and of levelness, F (L) 20; with minimum local values of flatness, F (F) 24; and of levelness, F (L) 15; for suspended slabs.
   3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. This surface shall be used for interior and exterior walking surfaces unless noted otherwise. Finish edges of exterior walkway flags with steel tooled radius edge.
   2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, equipment pads, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
   1. Uniformly spread 25 lb. /100 sq. ft. of dampened slip-resistive over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
   2. After broadcasting and tamping, apply float finish.
   3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. All exposed horizontal and vertical wall and slab corners shall have a ¾” wide chamfered edge.

D. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 6 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.

3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 12 inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt inserts into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

F. Grout: Install grout in accordance with the manufacturer's specifications and instructions. Moisten concrete and grout surfaces and allow drying until damp. Remove all standing water. Pump or inject grout into tight spaces to ensure intimate contact with the existing grout. Cure grout with an appropriate membrane in accordance with the manufacturer's specifications and instructions.

3.13 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 and ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308R and ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

F. Liquid sealer/hardener to be applied on exposed concrete cured with moisture retentive or absorptive covers. The following materials provide varying levels of protection, sealant and hardness. Review products for project appropriateness.
   1. Euclid: Euco Diamond Hard (Liquid Sealer and Hardener)
   2. L&M Construction Chemicals: Seal Hard (Liquid Sealer and Hardener)
   3. Curecrete Chemical Company: Ashford Formula (Liquid Sealer and Hardener)
   4. Midwest Floor Care: Structure Formula (Liquid Sealer and Hardener)
   5. Or approved equal.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least three month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Immediately remove all rust spots that have developed during the construction period as soon as directed by the Engineer. Remove all rust spots that have formed by the use of temporary handrails.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and/or qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Contractor is responsible to notify the Owners representative at least 72 hours prior to the scheduled work that requires inspection / testing. The presence of the Inspector engaged by the Owner does not relieve the contractor of Quality Control Requirements.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Steel reinforcement placement.
   2. Headed bolts and studs.

3. Steel reinforcement welding.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
      a. Frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
      b. One (1) additional test cylinder shall be taken during cold weather and be cured under the same conditions as the concrete it represents.
   2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C173/C173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   6. Compression Test Specimens: ASTM C31/C31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure two Insert number sets of two standard cylinder specimens for each composite sample.
   7. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
      b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   10. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28-day tests.
   11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E1155 within 72 hours of finishing.

SECTION 099744 - MECHANICAL PIPING COATING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Exterior coating.

C. Piping, Valves and Fittings.

1.02 RELATED SECTIONS

A. Section 013300 - Submittals

B. Section 016100 - Basic Product Requirements

C. Section 016500 - Product Delivery, Storage and Handling

D. Section 402323 - Large Piping and Fittings

E. Section 402324 - Valves and Valve Accessories

1.03 REFERENCES

A. ANSI/NSF 61 - Drinking Water System Components - Health Effects

B. AWWA - C115 - Standard for Flanged Pipe

C. NACE No. 2/SSPC SP10 - Near-white Blast Cleaning.

D. NACE No. 3/SSPC SP6 - Commercial Blast Cleaning.

E. SSPC PA - 1 - Shop, Field, and Maintenance Painting of Steel

F. SSPC PA 2 - Method for Measuring of Dry Paint Thickness with Magnetic Gages

G. SSPC VOL 1 - Good Painting Practices - 2002 4th Edition latest edition

H. SSPC VOL 2 - Systems and Specifications - 2005 Edition latest edition

I. SSPC SP 3 - Power Tool Cleaning

J. SSPC SP 2 - Hand Tool Cleaning

K. SSPC VIS 1-89 - Visual Standard for Abrasive Blast Cleaned Steel.

L. ASTM D4417–03 – Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

M. ASTM E1216-99(2005) - Standard Practice for Sampling for Particulate Contamination by Tape Lift

N. NACE SP0188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Provide material data sheets (MDS) and material safety data sheets (MSDS), issued by the manufactures, for all materials and accessories that are to be used.

C. Samples: Provide a color chart for paint color selection by the Owner and Engineer for approval prior to all aspects of painting.

D. Manufacturer's instructions: Indicate surface preparation and paint application.

E. Submit a detailed plan on the method(s) to be employed to protect adjacent equipment and surfaces including, but not limited to, the following:
   1. Method of surface preparation.
   2. Method of paint application.
   3. Quality Control Plan for all phases of construction operations.

F. Submit detailed daily reports weekly, to include the following:
   1. The daily work location, date, start time and finish time, ambient conditions including wet bulb temperature, dry bulb temperature, and steel surface temperature, including hold point inspection observations.
   2. All surface preparation operations including location, date, start time and finish time.
   3. The date, start time and finish time for all painting operations, including location, wet bulb temperature, dry bulb temperature, and steel surface temperature, of the each coat applied.
   4. The name, type, batch numbers, manufacturer's name and amount of coatings used for each application.

G. The Contractor shall submit to the Engineer letters from Manufacturers certifying that the paint being supplied for this project conforms completely to specifications.

1.05 REGULATORY REQUIREMENTS

A. All coatings shall comply with VOC regulations as promulgated by the Ozone Transport Commission, effective January 2005.

1.06 CERTIFICATES

A. The Contractor shall submit to the Engineer, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces.

B. Certification shall make reference to the square footage figures provided to the manufacturer by the Contractor.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to the site under provisions of Sections 016100 and 016500.

B. All materials furnished by the Contractor shall be brought to the job site in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer.

C. Every container of coatings materials shall have the batch number imprinted on the can, as well as the Federal Specification Number. Colors, where not specified, shall be as selected by the Engineer or Owner.

D. Store all materials as recommended by the manufacturer. Any materials stored improperly shall be removed from the site immediately. Maintain storage location and temperature log at storage site available for inspection.

E. The Contractor shall supply the Owner with two (2) one gallon paint kits of each of the exterior, intermediate and finished coats in each color.

1.08 WARRANTY

A. Provide a 1-year labor and manufacturer's materials warranty for the coating systems.

B. Warranties are to be submitted in writing to the Engineer prior to product delivery.

C. Any defects, failures, breakdowns, or discrepancies of the paint or coatings, that reveal themselves within the 1-year warranty period after acceptance of work shall be promptly repaired at no additional cost to the Owner.

D. Touch up procedures shall be issued by the engineer for areas of coating defects, breakdowns, or discrepancies to be repaired, only if the accumulative areas are less than five square feet, or if the engineer permits.

E. Remove the entire coating in the area where failure occurs. Touch-up work will not be permitted. The surface is to be prepared as originally scheduled.

PART 2 - PRODUCTS

2.01 COATING REQUIREMENTS

A. All coating systems submitted for use shall be new for the project described. Two component coating materials shall be mixed in accordance with the manufacturer's data sheet. No partial kits shall be permitted to be used.

B. All coating systems submitted for use shall conform and meet the minimum requirements specified by the Engineer for:
   1. Adhesion - ASTM-D-3359 and 4541
      a. Minimum 900 psi as measured with a Type 2 tester
   2. Hardness - ASTM-D-3363, 2583, and 2240
      a. Exterior Finish Coating - No gouging or scratching with an 8H or less pencil
   3. Flexibility - ASTM-D-522 and FED-STD-6221
      a. Exterior Finish Coating - No less than 34% elongation, average of three tests
      b. Impact Resistance - ASTM-D-2754
      c. Exterior Coating - No visible cracking or delamination of film after 34 inch pounds or less direct impact.
   4. Abrasion Resistance - ASTM-D 968 and 4060
      a. No More than 100 mg loss after 1000 cycles

2.02 MANUFACTURERS

A. SHERWIN WILLIAMS

B. Coating substitutions shall be permitted only after receiving written approval from the Engineer prior to bid.

2.03 MATERIALS - DUCTILE IRON PIPING

A. TNEMEC Paint System - Two full coats, one stripe coat.
   1. Tnemec Series 27FC Typoxy, 4.0 - 6.0 mils DFT
   2. Tnemec Series 27FC Typoxy Stripe Coat (Contrasting Color)
   3. Tnemec Series 72 Low VOC Acrylic Urethane, 3.0 - 5.0 mils DFT

B. SHERWIN-WILLIAMS Paint System - Two full coats, one stripe coat
   1. Sherwin-Williams Macropoxy 646, 4.0 - 6.0 mils DFT
   2. Sherwin-Williams Macropoxy 646 Stripe Coat (Contrasting Color)
   3. Sherwin-Williams Acrolon 218HS, 3.0 - 5.0 mils DFT

2.04 MATERIALS - PVC & COPPER PIPING (CHEMICAL PROCESS)

A. TNEMEC Paint System - Two full coats
   1. Tnemec Series 115 Uni-bond, 2.0 - 4.0 mils DFT
   2. Tnemec Series 1028 or 1029 Enduratone, 2.0 - 3.0 DFT

B. SHERWIN-WILLIAMS Paint System - Two full coats
   1. Sherwin-Williams DTM Primer/Finish, 2.5 - 5.0 mils DFT
   2. Sherwin-Williams DTM Acrylic Semi-Gloss, 1.5 - 2.5 mils DFT

2.05 ACCESSORIES

A. Seam Sealer/Caulk: Shall be as recommended by the coating manufacturer.

2.06 TESTING

A. The Engineer shall have the right to take random samples of paint from the painter's bucket as it is being applied to the steel structure, tank or mechanical piping. These samples will be sent to the paint manufacturer for analysis to determine constituents and type of coating.

B. No material of any kind shall be used until it has been inspected and accepted by the Engineer. All materials rejected shall be immediately removed from the work and not again offered for inspection.

2.07 ACCESSORY MATERIALS

A. Provide all required ladders, scaffolding, drop cloths, maskings, scrapers, tools, sandpaper, cleaning solvents, and remove waste as required to perform the work to achieve the results specified herein. Materials not specifically indicated but required to achieve the finishes specified shall be of commercial quality and as recommended by the manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall verify existing ambient condition and substrate conditions prior to proceeding with any work and submit to Engineer/representative prior to requesting

Engineer's/representative's verification.

B. Contractor shall verify substrate is properly prepared, properly cleaned, and or properly coated in accordance with project specifications prior to proceeding with any additional work and prior to requesting Engineer's/representative's verification.

C. Should the contractor request verification from Engineer/representative and work is not in conformance with requirements contractor shall pay $500 per occurrence to cover the costs to the owner.

3.02 PREPARATION - GENERAL

A. Surface Preparation Schedule:
   1. Ductile Iron: All damaged primer and or connections shall be cleaned to SSPC SP-3 (Power Tool Cleaning)
   2. Galvanized Steel: Shall be cleaned in accordance with SSPC SP-1 (Solvent Cleaning) and may also require SSPC SP-7 (Brush off Blasting) as deemed necessary by the engineer or owner.
   3. Copper & PVC: Shall be cleaned in accordance with SSPC SP-1 (Solvent Cleaning) and SSPC SP-2 (Hand Tool Cleaning) to achieve a uniformly scarified surface.

B. Cleaned surfaces, when viewed without magnification, shall be free of all visible paint oil, grease, dirt, mill scale, rust, oxides, corrosion products and other foreign matter as noted in Chapter 2, SSPC Painting Manual Volume 2.

C. Pit filler shall be applied to all voids that are greater than ¼ of the original steel surface thickness.

D. The pit filler shall be applied prior to the application of the first coat and in accordance with manufacturer's instructions. If the manufacturer's instructions differ from the project specifications, the more stringent will apply.

E. All areas shall be cleaned prior to any coating application. All surfaces to be painted shall be dry.

F. Weld projections or irregular portions of welds, or any steel defects that would interfere with the proper coating shall be ground smooth, as directed.

3.03 APPLICATION

A. Apply coating in strict conformance with the manufacturer's instructions and requirements. If the manufacturer's instructions differ from the project specifications, the more stringent will apply.

B. Before coating is applied to surfaces, steps shall be taken, either by circulation of dry air or by the application of heat, to dry the metal surfaces completely.

C. No coatings shall be applied when the surface temperature is less than 5 degrees Fahrenheit (3 degrees Celsius) above the dew point.

D. No coatings shall be applied when the relative humidity is above 85% or as recommended by manufacturer.

E. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer. Do not apply exterior coatings when unfavorable weather conditions are forecast within 24 hours of application.

F. No surfaces shall be coated that are not in compliance with SSPC surface preparation standards or any other part of the project specifications.

G. All coatings shall be applied at the rate specified. Deficiencies in film thickness shall be corrected with the proper surface preparation and application of an additional coating or as directed by the Engineer. Coatings in excess of the specified range shall be corrected at the direction of the Engineer.

H. All coating applications shall be inspected and approved by the Engineer prior to the application of any succeeding coats. All coats shall be applied to the dry film thickness specified.

I. The minimum and maximum total dry film thickness shall be as indicated in this section. The Mil Gauge shall be calibrated in accordance with the National Institute of Standard and Technology. The Contractor shall have available on the job site a satisfactory magnetic type Mil Gauge for measuring film thickness.

J. A brush applied stripe coat, of different color, shall be applied to all weld seams, edges, seams, or any non conforming surfaces deemed necessary by the Engineer. The stripe coat shall be applied after the first coat but prior to the second coat.

K. The coating shall be applied as a continuous film of uniform thickness. Any holidays or areas missed in the application shall be recoated within the maximum re-coat time or be corrected with the proper surface preparation and cleaning prior to the application of the subsequent coating.

L. All coatings that are specified shall only be acceptable in the number of coats specified in the contract documents.

M. Color Coding of Process Piping shall be in accordance with Ten States Standards as follows:

Service	**Color**
Raw Water	Olive Green
Potable Water	Dark Blue

Lime	Light Green
Blowoff/Waste	Light Brown
Chlorine	Yellow
Drainage and Waste	Dark Gray
Orthophosphate	Light Green w/red band

3.04 CLEANING

A. All surfaces shall be free of all dirt, oil, debris, or any other foreign matter prior to the application of any coating.

B. The Contractor shall maintain his work area in a neat, orderly fashion. Accumulation of debris, muck, rust, scale, etc., shall be frequently (not to exceed 1 week) cleaned up and removed from the site. Thinners used to clean equipment shall be held in sealed containers and removed from the site to an approved disposal area by the Contractor. Provide certificates from the disposal site indicating that the material has been properly disposed of.

C. Upon completion of the work, all excess material, rigging, empty containers, cables, tarps, etc., shall be removed from the site. Buildings and grounds shall be left in as good condition as when work was started.

3.05 FIELD QUALITY CONTROL

A. The Engineer will inspect the painting as it is being performed.

B. The Engineer reserves the right to accept each phase of the work before further work may be conducted, to halt all Work deemed to be improper or not in compliance with project specifications, and to require the contractor to promptly correct all improper practices or deficient work. Contractor shall notify the Engineer's/representative's 24 hours minimum prior to the following:
   1. Prior to the start of work
   2. Immediately following surface preparation
   3. Immediately prior to each coating or lining application
   4. Following the application of each coat
   5. Following the curing of the coating or lining

C. The Engineer reserves the right to conduct any testing, both destructive and nondestructive, at any time for inspection or evaluation purposes.

D. Any expenses incurred for corrective measures required as the result of improper practices and/or defective or deficient work shall be borne by the contractor and the extent of these corrective measures shall be at the discretion of the engineer.

E. The contractor shall provide safe access to all areas, including but not limited to, equipment, containers and spaces for inspection at any time as deemed necessary by the engineer or his representative

F. Sufficient lighting shall be provided to ensure proper safety conditions and permit inspection.

G. All manholes and other tank openings shall remain open as necessary during cleaning, painting and curing operations.

END OF SECTION 099744

SECTION 220529 - HANGERS AND SUPPORT FOR PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe hangers for various installed pipe systems.

1.02 SUBMITTALS

A. Submit under provisions of Section 013300

1.03 REFERENCES

A. Underwriters Laboratories - UL Listing.

B. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

C. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

D. ASTM A653 - Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process

E. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (Formerly ASTM A570)

F. MSS SP58 - Manufacturers Standardization Society: Pipe Hangers and Supports- Materials, Design, and Manufacture

G. MSS SP69 - Manufacturers Standardization Society: Pipe Hangers and Supports- Selection and Application

H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.04 QUALITY ASSURANCE

A. Hangers and supports used in fire protection piping systems shall be listed and labeled by Underwriters Laboratories.

B. Steel pipe hangers and supports shall have the Manufacturers name, part number, and applicable size stamped in the part itself for identification.

C. Hangers and supports shall be designed and manufactured in conformance with MSS SP 58.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Anvil International (Grinnell)

B. Cooper B-Line, Inc.

C. Carpenter and Patterson

D. Fee and Mason

E. Hilti

F. Elcen

G. Piping Technology and Products, Inc.

H. Or Approved Equal

2.02 MATERIALS

A. Pipe Hangers & Supports:
   1. All pipe hangers and supports for stainless steel piping systems shall be of stainless steel construction.
   2. All pipe hangers and supports for copper tubing piping systems shall be of stainless steel construction. Provide dielectric/isolation wrapping or pipe insulation where dissimilar metals meet.
   3. All pipe hangers and supports for black iron piping systems shall be of stainless steel construction. Provide dielectric/isolation wrapping where dissimilar metals meet.
   4. All pipe hangers and supports for PVC piping systems shall be of galvanized steel construction, except where piping is used for chemical treatment.
   5. All pipe hangers and supports for chemical lines including calcium hypochlorite and lime shall be of stainless steel construction.
   6. All pipe hangers and supports for chemical lines including brine solution and regenerate piping shall be of stainless steel construction.
   7. All pipe hangers and supports for Rigid galvanized piping systems shall be of galvanized steel construction.

B. Trapeze Hangers: Where three or more non-chemical lines of pipe run parallel, support them with galvanized trapeze hangers, Grinnell Figure 46. Trapeze to be supported by a minimum of two galvanized rods with Figure 60 washer plates. For top loading only.

C. Concrete Inserts: Anvil International Figure 282, MSS SP-58 (Type 18), galvanized, universal concrete inserts, adequately sized and correctly positioned to support full load operating systems.

D. C-Clamps: Anvil International Figure 86, MSS SP-58 (Type 23) galvanized with set screw and lock nut. Use these for attaching hangers to steel beams. Welding hanger rods to steel members is not permitted. Provide retaining clip for C-Clamps.

E. Malleable Beam Clamps: Anvil International Figure 218, MSS SP-58 (Type 30), galvanized. Use these for attaching hangers to bar joists. Provide retaining clip for all beam clamps.

F. Clevis Hangar (4" diameter Piping or Less): Anvil International Figure 67, MSS SP-58 (Type 5), galvanized. Use these for attaching hangers to bar joists, column or wall.

G. Clevis Hanger (4" diameter or Greater D.I. Piping): Anvil International Figure 590, MSS SP-58 (Type 1), galvanized.

H. Pipe saddle support: Pipe saddle with U-bolt and threaded pipe adjuster. Cooper B-Line Figure 318A, MSS SP-69 (Type 37), stainless steel. Pipe stand: Cooper B-Line Figure 316T, stainless steel.

I. All hangers and supports shall be UL Listed. Cooper B-Line Figure 318A & 316T,

J. Provide threaded rod in accordance with manufacturer instruction.

2.03 FINISHES

A. Indoor Finishes
   1. Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper®. Additional PVC coating of the epoxy painted hanger shall be used where necessary.
   2. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited epoxy finish.
   3. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish.

B. Outdoor and Corrosive Area Finishes (Chemical Room)
   1. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
   2. Hangers, strut, and clamps located in corrosive areas shall be type [304] [316] stainless steel with stainless steel hardware.
   3. Provide dielectric/isolation wrapping in systems of dissimilar metals.

PART 3 - EXECUTION

3.01 SCHEDULES - HANGER SPACING

A. Copper Pipe
   1. Not more than 10'-0" o.c.

B. Black Iron and Galvanized
   1. 1/4 to 1-1/4 inches - 5'-0" o.c.
   2. 2 to 2-1/2 inches - 8'-0" o.c.
   3. 3-inches and above - 10'-0" o.c.

C. Ductile Iron Piping
   1. As shown on contract drawings

D. PVC Pipe
   1. 1/2 to 1-inch - 4'-0" o.c.
   2. 11/4 to 8-inches - 5'-0" o.c.

3.02 INSTALLATION

A. Support pipes on specified hangers so that equipment, pumps, and fittings do not bear weight of pipe.

B. Do not use perforated metal, strap iron, or band iron.

C. Do not make offsets in hangers.

D. Maximum allowable spacing of pipe hangers for horizontal piping is listed above. Space hangers and brackets at close intervals where necessary to maintain levels, slopes, and drainage, or to prevent sagging.

E. Place hangers within 12 inches of each horizontal elbow.

F. Use hangers with 1-1/2 inch minimum vertical adjustment.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Allow for forces imposed by expansion joints, satisfy structural requirements and maintain proper clearances with respect to adjacent piping, equipment and structures. Hangers for insulated pipes shall be sized to accommodate insulation thickness.

I. Support cast iron pipe under each section and at each hub.

J. Keep the different types of hangers to a minimum and provide hangers that are neat, without complicated bolting and with the number of parts of each hanger and its anchor kept to a minimum.

K. Make accurate weight balance calculations to determine the required supporting forces at each hanger or support location and the pipe weight load at each equipment connection.

L. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.

M. All hangers and supports that are not galvanized shall be painted or shop primed.

N. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non adhesive isolation tape- B-Line Iso-pipe. Galvanized felt isolators sized for copper tubing may also be used, B-Line B3195CT.

O. Support horizontal cast iron pipe adjacent to each hub.

P. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.

Q. Place a hanger within 12 inches of each horizontal elbow.

R. Support Provide neoprene protection where dissimilar metals come into contact.

S. Maximum allowable spacing of pipe supports for vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

T. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to schedule in section 3.01B.

U. Do not support piping from other pipes, ductwork or other equipment that is not building structure.
   1. Where horizontal piping movements are greater than 1/2 inch, or where the hanger rod angularity from the vertical is greater than four degrees from the cold to hot position of the pipe, the hanger pie and structural attachments shall be offset in such a manner that the rod is vertical in the hot position.

V. In the part of the building which is steel-framed, attach hangers to the building structural steel beams. Where hangers do not correspond with the building structural steel beams, provide supplemental steel members continuously welded or bolted to the building structural steel beams.

W. In the parts of the building which is a concrete structure, attach hangers to the concrete structure by installing anchors into the concrete.

END OF SECTION 220529

SECTION 221113 - FACILITY PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Black iron piping, valves and accessories

B. Copper piping, valves and accessories

C. Galvanized piping and accessories

D. PVC piping, valves and accessories

E. Reinforced flexible tubing and accessories

F. Stainless steel piping, valves and accessories

G. Caps

H. Corporation stops

I. Curb stops

J. Pressure regulating valves

K. Relief valves

L. Solenoid valves

M. Vacuum breakers

1.02 RELATION SECTIONS

A. Section 220529 - Hangers and Supports for Piping

B. Section 220553 - Identification for Mechanical Piping and Equipment

C. Section 221119 - Plumbing Specialties

D. Section 312333 - Trenching

E. Section 331140 - Disinfection of Water Facilities

1.03 REFERENCES

A. ASME B16.3 - Malleable Iron Threaded Fittings

B. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings

C. ASME B16.23 - Cast Copper Alloy Solder - Joint Drainage Fittings -DWV

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

E. ASME B31.3 - Process Piping

F. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

G. ASTM A120 - Pipe, steel, black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses

H. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service

I. ASTM A403 - Wrought Austenitic Stainless Steel Fittings

J. ASTM B42 - Seamless Copper Pipe

K. ASTM B88 - Seamless Copper Tube

L. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications

M. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

N. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

O. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

P. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

Q. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)

R. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

S. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing

T. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

U. ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing

V. ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot and Cold-Water Distribution Systems

W. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing

X. AWWA C800 - Underground Service Line Valves and Fittings

Y. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/3" to 3", for Water Service

1.04 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, hydrants and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with the local water utility company requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 016500.

B. Deliver and store items in shipping containers with labeling in place.

1.07 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839.

B. Accurately record actual locations of piping mains, valves, connections and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

D. Provide manufacturer's standard warranty for all applicable items under provisions of Section 017800.

PART 2 - PRODUCTS

2.01 BLACK IRON PIPING, VALVES AND ACCESSORIES

A. Standard weight, Schedule 40, threaded ends, conforming to ASTM A53. Fittings shall be malleable iron, screwed type conforming to ASME B16.3.

B. Transitions from black iron to poly-tubing shall be made with barbed fittings and stainless clamps, or approved equal.

C. Ball Valves: All 316 stainless steel body, ball and retainer, reinforced RPTFE stem, seat and retainer seal, 304 stainless steel lever with vinyl grip, rated for 125 psi minimum working pressure, threaded connections, Series 76F-100-A Apollo Valve as manufactured by CONBRACO INDUSTRIES, INC.

D. Check Valves: All 316 stainless steel construction, including body, tail piece, guide and spring, glass filled RPTFE ball check, rated for 125 psi minimum working pressure, threaded connections, Series 62-100 Apollo Valve as manufactured by CONBRACO INDUSTRIES, INC.

2.02 COPPER PIPING, VALVES AND ACCESSORIES

A. All exposed small copper piping shall be Type "K" hard drawn copper tubing. All underground piping shall be soft annealed Type "K" copper tubing with compression fittings.

B. All brass valves and fittings installed on potable water supply piping shall be made of "low-lead" materials (UNS Copper Alloy C89833 or C89520) and have a maximum lead content of 0.25 percent by weight. All low lead brass fittings shall be stamped or embossed with a mark indicating that the product is manufactured from low-lead alloys.

C. Check valves shall be swing check renewable BUNA-N disc, all bronze, STOCKHAM Figure B-319Y (threaded end) or Figure B-309Y (solder end) - 250 to 300 psi non-shock water.

D. Ball valves for copper piping/tubing and galvanized piping shall be renewable reinforced Teflon seats, adjustable packing gland, non-blowout stem with run port opening. Ball valves shall be STOCKHAM Figure T or S-285 (threaded or soldered ends).

2.03 GALVANIZED PIPING AND ACCESSORIES

A. Galvanized piping shall be standard weight, Schedule 40, seamless, with threaded ends, conforming to ASTM A120. Fittings shall be galvanized cast iron, threaded, conforming to ASME B16.12.

2.04 PVC PIPING, VALVES AND ACCESSORIES

A. This subsection specifies PVC pipe used for pressure piping applications for water and recycled water pressure pipes and for sewage force mains. Unless otherwise specified, PVC pressure pipe shall conform to the following:

Item	Material	Reference Specification/Requirements	
Pipe	Manufacturing Standards	Conform to AWWA C900 for pipe 4"-12" (100 mm-300 mm). Conform to AWWA C905 for pipe 14" (350 mm) and larger.	
	Design Standards	Conform to AWWA M23 using hydraulic design basis below.	
	NSF Certification	NSF 61 certification required for potable water pipe.	
	Material	Virgin rigid poly-vinyl-chloride. Conform to ASTM D1784 Cell Class 12454B or better. Conform to NSF 14. Conform to AWWA C900 Section 4.2 or AWWA C905 Section 4.2 as appropriate.	
	Hydrostatic Design Basis (HDB)	≥ 4,000 psi (27.5 MPa) for water at 73.4ºF (23ºC). Apply 2.5 Safety Factor and use 1,600 psi (11.0 MPa) maximum design stress.	
	Markings (each pipe)	Conform to AWWA C900 or C905 Section 6.1.	
		Mark applicable AWWA standard.	
		Show nominal pipe diameter.	
		Show AWWA pressure class or DR.	
		Show NSF 61 stamp (for potable water service).	
		Show manufacturer and manufacturing date code.	
	Size	As shown on the Plans. Conform to outside diameter of ductile iron pipe unless otherwise shown.	
	Minimum Wall Thickness (Dimension Ratio)	**Design Pressure and Diameter Shown on the Plans**	**Minimum Dimension Ratio**
		0-100 psi (.7 MPa) 4"-48" (100 mm-1200 mm)	DR 18 (Class 235)
		150 psi (1.0 MPa) 4"-12" (100 mm-300 mm)	DR 14 (Class 305)
		150 psi (1.0 MPa) 14"-48" (350 mm-1200 mm)	DR 18 (Class 235)
		200 psi (1.4 MPa) 4"-12" (100 mm-300 mm)	DR 14 (Class 305)
		200 psi (1.4 MPa) 14"-48" (350 mm-1200 mm)	Use DIP or Steel Pipe
		Greater than 200 psi (1.4 MPa)	Use DIP or Steel Pipe
		Pipe with Grooved Couplings	Use DIP or Steel Pipe
	Lengths	Laying lengths shall be 20' with option to supply up to 15% random (minimum length 10') sections.	
Joints	Standard Push-on Style	Conform to ASTM D3139.	
Bell Joint Gaskets	Material	Elastomeric membrane per AWWA C900 Section 4.2.4 (Gaskets and Lubricants) and ASTM F477. Butadiene styrene (SBR or BR) for potable water. Ethylene propylene (EPM or EPDM) for recycled water.	
	Material for Hydrocarbon Applications and Contaminated Soils	Elastomeric membrane per AWWA C900 Section 4.2.4 (Gaskets and Lubricants) and ASTM F477. NBR (Nitrile) (acrylonitrile butadiene), FLUOREL or FKM (Viton) (fluorocarbon).	
	Gasket Age	< 180 Days old or < 2 years old but retested < 60 Days prior to installation	
Fittings	Material	Ductile iron.	
	Standards	Conform to AWWA C110/ANSI 21.10 or AWWA C153/ANSI A21.53.	
	Style	Push-on (standard) or restrained joint (as shown).	
	Marking	Cast letters "DI" or "DUCTILE" into fittings, unless otherwise specified.	
	Exterior Coatings	1 mil (25 µm) petroleum asphaltic coating.	
	Interior Linings	Cement mortar (double thickness).	
	Plastic Film Wrap for Corrosion Protection	Conform to 212-12.1.1. Color per 212-12.2.	

B. Transitions from PVC to poly-tubing shall be made with barbed fittings and stainless clamps, or approved equal.

C. Ball valves shall be double union/double block with PVC body, ball, insert and stainless steel rod and stem with Teflon seats, Tru-Bloc by NIBCO CHEMTROL, SPEARS or approved equal.

D. Check valves shall be of the true union ball check type with a PVC body construction. The valves shall be rated at 150 psi. The valves shall be manufactured by HAYWARD CO., SPEARS or approved equal.

E. Strainers shall be Y type, of size indicated, PVC body with 40 mesh cylindrical stainless steel screen and shall be as manufactured by HAYWARD CO. or approved equal.

F. Pressure relief/backpressure valves shall be molded in-line valves with PVC body construction. Valves shall have a setting range from 5 to 100 psi and be compatible with chemicals in application. Valves shall be as manufactured by PLAST-O-MATIC VALVES, INC., WALLACE & TIERNAN, WALCHEM, or approved equal.

G. Globe valves shall be of thermoplastic construction rated to 150 psi with EPDM seals and flanged connections. Valves shall be as manufactured by ASAHI-AMERICA, NIBCO or approved equal.

H. Unions shall be UL listed, Oring unions with Teflon gaskets by HAYWARD CO. or approved equal.

I. Threads and dimensions: ANSI B1.1 and B18.2.

J. All wetted parts of PVC piping, valves and accessories shall be compatible with treatment chemicals.

K. Thread lubricant: Crane "Formula 425", or equal. (NOTE: Approved Teflon tape may be used).

L. Gaskets: Full face, 1/8-inch thick neoprene rubber.

M. Solvent welded joints for chemical piping shall be made using solvent cement that meets or exceeds ASTM F493, compatible with PVC pipe and fittings. Solvent cement shall be Low V.O.C., Heavy Duty Gray Industrial solvent cement by Oatey; Model EP42 or specifically approved equal.

N. Pressure connections to pressure switches, recorders, and indicating gauges shall be equipped with a snubber.

2.05 REINFORCED FLEXIBLE TUBING

A. PVC tubing with nylon inner braided reinforcing made from FDA approved materials, 65 Durometer, 175 psi working pressure for 1/2 to 1-1/2 inches ID. Install high pressure fittings with double stainless steel clamps for all connections to tubing.

B. HDPE translucent tubing, compatible with chemical transported, minimum 190 psi working pressure at 70F for 1/2" to 3/4" O.D. Install high pressure PVC compression fittings all connections to tubing.

2.06 STAINLESS STEEL PIPING AND ACCESSORIES

A. Standard weight, Schedule 40, two-ferrule type tube fitting connections, conforming to ASTM A269. All tubing, fittings, and valves shall be 316 stainless steel.

2.07 CAPS

A. Vent caps
   1. Mushroom style, pipe size, galvanized cast iron construction with stainless steel no. 24 mesh screen as manufactured by PREFERRED UTILITIES MANUFACTURING CORP. or approved equal.

2.08 CORPORATION STOPS

A. Manufacturers:
   1. MUELLER COMPANY, Model No. H-15000.
   2. FORD METER BOX COMPANY, Model No. FB600

B. Ball valve type, water service bronze body with AWWA standard thread inlet and copper AWWA outlet, complete with straight coupling nuts.

C. All connections greater than 1" shall utilize a threaded saddle with stainless steel bands.

2.09 CURB STOPS

A. All metal parts shall be constructed of water service bronze. The curb stop shall have a combined tee and cap and an inverted tapered key with 1/4-inch hole drilled in cap for attaching a stationary rod. The valve shall open to the left (counterclockwise).

B. All curb stops shall be by MUELLER COMPANY, No. H-15200, or specifically approved equal. Ball valve curb stop shall be by FORD METER BOX COMPANY, No. BH22-233, or specifically approved equal.

C. All curb stops shall be provided with an extension service box.

D. Extension service boxes with stationary rods to be by MUELLER COMPANY, No. H-10314 or approved equal. Cap shall be in accordance with the Owner's standard.

2.10 PRESSURE REGULATING VALVES

A. Manufacturer:
   1. WATTS, Series 263A (3-way).

2. Approved equal.

B. Valves shall be of brass construction with Buna-N disc/diaphragm, inlets/outlet size to match piping, maximum working pressure 300 psi, adjustable range 3 psi to 50 psi.

C. Provide with pressure gauge and slotted adjusting screw.

2.11 RELIEF VALVES

A. Air Release/Vacuum Valves
1. Manufacturer:
a. CRISPIN, "AL" series
b. Approved equal
2. Valve shall comply with ANSI/AWWA C512 Standards.
3. The body and valve shall be constructed of cast iron conforming to ASTM A126, Class B.
4. Spherical stainless steel float shall seal against a renewable Buna-N resilient seat.

B. Pressure relief & Backpressure / Anti-siphon valves
1. Manufacturer:
a. PLAST-O-MATIC VALVES, INC.
b. GRIFFCO, PRG2050P & BPV05OP
c. Approved equal
2. Valves shall be molded in-line type with PVC body construction.
3. Valves shall have a setting range from 5 to 120 psi and be compatible with chemicals in application. Size in accordance with the Plans.

2.12 SOLENOID VALVES

A. Manufacturer:
1. Red Hat II, Series 8210.
2. Approved equal.

B. Provide normally closed valves, 120 volt AC, 304 stainless steel body. The construction material of all wetted parts shall be compatible with the product contained.

2.13 VACUUM BREAKERS

A. Vacuum breaker check valves shall be constructed of PVDF (Kynar), normally-closed, with self-sealing diaphragm. Connectors to match pipe and fittings. As manufactured by PLAST-O-MATIC VALVES, INC., Series VBM, or approved equal.

2.14 DUCTILE IRON PIPE (DIP)

A. This subsection specifies ductile iron pipe used for pressure piping applications for water and recycled water pressure pipes and for sewage force mains. Unless otherwise specified, ductile iron pipe shall conform to the following:

Item	Material	Reference Specification/Requirements	
Pipe	Manufacturing Standards	Conform to AWWA C151/ANSI 21.50 for 3"-64" (75 mm - 1600 mm) pipe.	
	Design Standards	Conform to AWWA C150/ANSI A21.50 and AWWA M41.	
	NSF Certification	NSF 61 certification required for potable water pipe.	
	Material	Ductile iron.	
	Size	As shown on the Plans.	
	Minimum Wall Thickness	3"-12" (75 mm - 300 mm) pipe	Pressure Class 350.
		14"-36" (350 mm - 900 mm) pipe	Pressure Class 250.
		42"-64" (1050 mm -1600 mm) pipe	Pressure Class 200.
		Pipe with grooved couplings	Thickness Class 53.
	Markings	Conform to AWWA C151 Section 4.6.	
	Lengths	18' or 20' (5.5 m or 6.1 m) lengths per AWWA C151/ANSI A21.51. Shorter lengths may be used to facilitate curves or fit horizontal or vertical alignment.	
Interior Lining and Exterior Coating	Buried Exterior Coatings	Shop coat with one prime coat of asphaltic coating approximately 1 mil (25 µm) thick per AWWA C151.	
	Exterior Coatings on Pipe Above Ground and in Vaults	Conform to 212-12.	
	Cement-Mortar Interior Lining (AWWA C104 "Double Thickness")	**Pipe Size**	**Lining Thickness**
		3"-12" (75 mm - 300 mm) pipe	1/8" (3 mm)
		14"-24" (350 mm -0600 mm) pipe	3/16" (5 mm)
		30"-64" (900 mm - 1600 mm) pipe	1/4" (6 mm)
		Conform to AWWA C104 using Type II cement.	
	Fusion-Bonded Epoxy Interior Lining where shown on the Plans	Conform to 212-12.	
	Ceramic Epoxy Interior Lining, where shown on the Plans	Amine cured novalac epoxy lining.	
		Permeability rating of 0.00.	
		Abrasion resistance < 4 mils (100 µm) loss after 1,000,000 cycles on ± 22.5° sliding aggregate slurry abrasion tester using a sharp natural siliceous gravel with particle size between 2 mm and 10 mm.	
Joints	Standard Push-on Style	AWWA C111/ANSI 21.11.	
	Mechanical Joint	AWWA C111/ANSI 21.11.	
	Restrained Style	Special push-on type joint providing longitudinal restraint to full test pressure without relying on thrust block.	
		Boltless, restrained push-on joint design with positive axial locking restrained system capable of deflection after assembly.	
		Use one type of restrained joint exclusively for all Work.	
	Flanged Joint	Conform to AWWA C110/ANSI A21.10.	
	Flanged Joint Threaded Flanges	Conform to AWWA C115/ANSI A21.15.	
Bell Joint Gaskets	Material	Conform to AWWA C111/ANSI A21.11. Vulcanized styrene butadiene rubber (SBR).	
	Material for Hydrocarbon Applications and Contaminated Soils	NBR (Nitrile) (acrylonitrile butadiene), FLUOREL, or FKM (Viton) (fluorocarbon).	
	Gasket Age	< 180 Days old or < 2 years old but retested < 60 Days prior to installation.	
Flange Gaskets	Material	212-2.7.	
Fittings	Material	Ductile iron.	
	Standards	Conform to AWWA C110/ANSI 21.10 or AWWA C153/ANSI A21.53.	
	Style	Push-on (standard) or restrained joint (as shown).	
	Marking	Cast letters "DI" or "DUCTILE" into fittings, unless otherwise specified. Cast "AWWA C110" or "AWWA C153" depending on thickness.	
	Exterior Coatings	Use same coating as adjacent pipe, as specified above.	
	Interior Linings	Use same lining as adjacent pipe, as specified above.	
Ductile Iron Pipe Joint Restraints	Material	Ductile iron.	
	Style	Gripping wedge	
	Design Pressure Rating	3"-16" (75 mm - 400 mm)	350 psi (2.4 MPa)
		18"-64" (450 mm -1600 mm)	250 psi (1.7 MPa)
Pipe Shop Coat	Prime Coat	12 mils (300 µm) MDFT.	
Polyethylene PE Encasement	Polyethylene Film and Tape	Conform to 212-12.1.1. Color per 212-12.2.	
Alternate to Polyethylene Encasement	Pipe Finish Coat	15 mils (375 µm) MDFT field-applied bitumastic coating.	

PART 3 - EXECUTION

3.01 INSTALLATION

A. Clean inside of piping and tubing before installation. Keep installed piping clean and protect ends from foreign matter by capping or plugging.

B. Install piping and tubing so that it does not interfere with opening of doors or apparatus, access to equipment or any portion of electrical equipment.

C. Run piping and tubing in straight lines and square with building. Install rise plumb. Make offsets only where indicated and where necessary.

D. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide offsets and expansion joints as shown on drawings.

E. Provide flanges and unions throughout the piping systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.

F. Support pipe in accordance with provisions of Section 220529.

G. Install non-conducting dielectric connections wherever joining dissimilar metals.

H. Install valves with stems upright or horizontal.

I. Install water service lines in accordance with water utility standards.

J. All copper piping shall be cut square, burrs removed and reamed after cutting. Fitting sockets and tube ends shall be thoroughly cleaned to a bright finish. All solder joints shall be fluxed and soldered using 95-5 tin and antimony solder and water soluble flux.

K. All copper tubing connections shall be compression type.

L. Joints between PVC and Black Iron/Galvanized Pipe (wherever necessary), shall be made with screwed fittings or screwed companion flanges.

M. PVC piping and fittings connections to treatment equipment and at ends of runs shall have screw type joints. In all other locations, solvent welded slip type joints shall be used.

N. Solvent welded joints shall be made using solvent cement that meets or exceeds ASTM F493, compatible with PVC pipe and fittings. Solvent cement shall be Heavy Duty Industrial orange solvent cement by Oatey, or specifically approved equal.

O. Install PVC pipe in such a manner that it is not forced out of line by pipe supports, hangers or other supporting members. Pipe hangers shall be clevis or strap type.

P. Threaded joints where specified shall be made using standard hand or machine pipe threading tools. Dies must be sharp and in good condition to assure a clean and smooth threading operation from start to finish. Threads shall be full cut and perfect. Protective pads of leather, rubber or felt shall be employed to prevent damage to pipe walls by chuck and/or vise jaws. A slightly tapered wood plug shall be tapped snugly into the pipe for the length of thread to prevent distortion of the pipe wall by the die.

Q. Threaded pipe joints shall be made up using Teflon base compounds placed on the pipe

threads. Do not place compound on threads of fittings. NO WICKING WILL BE PERMITTED.

R. All fittings, except couplings, shall be supported and valves shall be braced to resist torque during valve manipulation.

S. All piping shall be free of traps and graded to permit complete drainage.

T. Connect reinforced flexible tubing to transition couplings with stainless steel clamps and/or compression fittings in accordance with tubing manufacturer's installation instructions.

3.02 SERVICE CONNECTIONS AND TAPPING

A. Maintain a 10 foot (3 m) horizontal separation and an 18 inch (460 mm) vertical separation of water main from sewer piping.

B. Thoroughly clean water main to be tapped to remove all dirt and scale.

C. Tap main on the side toward the line to be connected to the tap.

D. Equipment utilized for tapping shall be as recommended by the manufacturer of the corporation stop.

E. Maintain a minimum of 4'-6" (1.4 m) cover over the copper service pipe.

F. Install new copper service pipe in one continuous piece. Splicing will not be permitted.

G. Install parallel lines in neat fashion maintaining a minimum of 8" wall to wall separation. Each service line shall penetrate foundation separate from all other utility penetrations. Record origin of all service lines penetrating foundation.

H. Cuts made in copper service tubing for installation of valves or connection to the building shall be square, reamed and all burrs removed.

I. Solder used for service line fittings shall be lead-free, with a maximum lead content of 0.2 percent.

J. Install curb stop at locations specified and install curb box directly above the curb stop with the cover at or slightly above grade.

K. Connect copper service piping to building service piping with compression fitting.

3.03 FIELD QUALITY CONTROL

A. Flush piping prior to conducting pressure testing.

B. Piping shall be pressure tested with air before piping is concealed. All joints shall be checked for leakage while under air pressure by swabbing, utilizing a soap and water solution, and leaks found shall be repaired and rechecked. Pressure of air during testing shall be at least 50 percent higher than normal working pressure. Piping shall be tested for pressure and leakage in accordance with Section 017550.

C. Before piping and valves are concealed, recheck it for leaks.

D. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking and doping are not permitted.

E. The Contractor shall furnish all labor, materials and equipment necessary to accomplish all testing and repairs.

3.04 VALVE ACCESS

A. Locate shutoff and control valves for easy access and operation. Where valves are located in enclosed spaces provide and install access doors.

3.05 TESTING

A. All small piping shall be tested for pressure and leakage, in accordance with AWWA Specification C600.

3.06 EXTRAS

A. Provide District with three (3) 100-foot sections of poly-tubing (one for each chemical treatment system). Size appropriately, as indicated on the drawings.

END OF SECTION 221113

SECTION 311110 - SITE CLEARING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Remove and dispose of surface debris as required.

1.02 RELATED SECTIONS

A. Section 312213 - Rough Grading.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable local code(s) for disposal of debris.

B. Burning of materials on site is prohibited.

C. Coordinate clearing work with utility companies.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify existing conditions.

B. Identify existing plant life designated to be removed. Verify with Owner and Engineer prior to removal.

C. Verify limits of clearing.

3.02 PROTECTION

A. Locate, identify and protect utilities that are to remain from damage.

B. Protect trees, plant growth and features designated to remain as final landscaping.

C. Protect benchmarks and existing structures from damage or displacement. Any damage to existing structures is to be promptly repaired at no additional cost to the Owner.

3.03 APPLICATION

A. Clear areas required for access to site and execution of work.

B. Remove paving, curbs, debris and sidewalks as required.

C. Remove trees and shrubs designated to be removed. Remove stumps, main root ball, surface rock and perishable debris.

D. Clear undergrowth and dead wood without disturbing subsoil.

E. Remove paving, debris, rock and extracted plant life from site and dispose of in accordance with State and local ordinances.

F. Excavate topsoil from areas to be further excavated, re-landscaped or regraded. Do not excavate wet topsoil.

G. Stockpile topsoil in area designated on site to a height not exceeding 8 feet. Protect from erosion. Remove excess topsoil not being reused from site. Do not remove any topsoil from the site prior to obtaining the approval of the Engineer.

END OF SECTION 311110

SECTION 312213 - ROUGH GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal and storage of subsoil.

B. Cutting, grading, filling and rough contouring the site prior to placement of topsoil

1.02 RELATED SECTIONS

A. Section 312323.13 - Backfilling

B. Section 312333 - Trenching

1.03 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18 inch Drop.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Sieve Analysis: Submit a sieve analysis of all types of fill material to be used.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of utilities remaining, by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subsoil: Reused excavated material, graded, free of lumps, rocks and gravel larger than 3 inches in size, debris and contaminants.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify that survey benchmark and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Identify known underground, aboveground and aerial utilities. Stake and flag locations.

C. Coordinate the removal or relocation of utilities with the necessary utility companies.

D. Protect above and below-grade utilities that are to remain.

E. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

F. Protect benchmarks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

3.03 APPLICATION

A. Excavate subsoil from areas to be further excavated, re-landscaped or re-graded. Do not excavate wet subsoil.

B. Stockpile in area designated on site. Remove excess subsoil not being reused from site.

C. Stockpile subsoil to a height not exceeding 8 feet. Cover to protect from erosion.

D. When excavation through roots is necessary, perform work by hand and cut roots with sharp axe.

E. Place and compact subsoil fill material in continuous layers not exceeding 6 inches compacted depth, compacted to 95 percent maximum dry density in accordance with ANSI/ASTM D1557.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Make grade changes gradual. Blend slope into level areas.

H. Remove surplus fill materials from site.

3.04 TOLERANCES

A. Maximum Variation From Top Surface of Sub-grade: 1 inch.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform tests and analysis of fill material in accordance with ANSI/ASTM D1557.

C. Perform compaction tests at a rate of one for every 10 cubic yards of material placed.

END OF SECTION 312213

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavation for building foundations.

B. Excavation for slabs-on-grade, paving and landscaping.

C. Excavation for site structures.

D. Site excavation.

1.02 RELATED SECTIONS

A. Section 312213 - Rough Grading.

B. Section 312323.13 - Backfill.

1.03 QUALITY ASSURANCE

A. Do not excavate wet or frozen materials without written approval from the Engineer.

B. Provide safety barricades around open excavations.

1.04 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the work are as indicated.

1.05 COORDINATION

A. Coordinate work under provisions of Section 013100.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Identify known underground, above ground and aerial utilities. Stake and flag locations.

C. Notify utility company to remove or relocate utilities, if required.

D. Protect above and below grade utilities which are to remain.

E. Protect plant life, lawns and other features remaining as a portion of final landscaping.

F. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

G. Notify the Engineer prior to commencement of excavation.

3.02 EXCAVATION

A. Underpin adjacent structures that may be damaged by excavation work, including utilities and pipe chases.

B. Excavate subsoil required to accommodate landscaping and construction operations to the limits as indicated on the plans.

C. Machine slope banks to angle of repose or less, until shored.

D. Grade top perimeter of excavation to prevent surface water from draining into excavation.

E. Hand trim excavation. Remove loose matter.

F. Remove lumped subsoil, boulders, and rock.

G. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

H. Correct unauthorized excavation at no extra cost to Owner in accordance with Section 312323.13.

I. Stockpile excavated material in area designated on site and remove excess material not being reused from site.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Provide for visual inspection of bearing surfaces.

3.04 PROTECTION

A. Protect work under provisions of Section 015000.

B. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION 312316

SECTION 312323.13 - BACKFILL

PART -1 GENERAL

1.01 SECTION INCLUDES

A. Site structure backfilling to sub-grade elevations.

B. Site filling and backfilling.

C. Consolidation and compaction.

D. Fill for over-excavation.

E. Environmental testing.

1.02 RELATED SECTIONS

A. Section 312316 - Excavation.

B. Section 312213 - Rough Grading.

1.03 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. Rammer and 18-inch Drop.

B. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Material Source: Submit name of imported material suppliers.

1.05 PROJECT CLOSEOUT SUBMITTALS

A. Submit under provisions of Section 017200.

PART 2 - PRODUCTS

2.01 IMPORTED FILL SOURCE

A. All imported fill materials shall be provided by a certified clean fill source or meet the requirements.

B. Test samples of imported fill in accordance with the following table:

Recommended Number of Soil Samples for Imported Soil			
Contaminant	VOC's	SVOC's, Inorganics & PCB's/Pesticides	
Soil Quantity (cubic yards)	Discrete Samples	Composite	Discreet Samples/Composite
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
>1000	Add an additional 2 VOC and 1 composite for each additional 1000 cubic yards or consult with DER		

C. Provide materials from the same source throughout the work. Change of source requires approval from the Engineer.

2.02 FILL MATERIALS

A. Coarse Aggregate: Angular crushed or natural stone; washed, free of shale, clay, friable material, sand and debris; graded in accordance with ASTM D2487 Group Symbol GW or GP within the following limits

B.

Sieve Size	Percent Passing
1-1/2-inch	100%
1-inch	90-100%
1/2-inch	0-15%
No. 200	0-1%

C. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ASTM D2487 Group Symbol GC or GM, within the following limits:
   1. Minimum Size: ¼ inch.
   2. Maximum Size: 5/8 inch.

D. Sand: Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ASTM D2487 Group Symbol SW or SP, within the following limits:

Sieve Size	Percent Passing
No. 4	100%
No. 14	10-100%
No. 50	5-90%

No. 100	4-30%
No. 200	0%

E. Subsoil: Reused, excavated material, graded, free of lumps, rocks and gravel larger than 3 inches in size, debris and contaminants; no more than 15% passing the No. 200 sieve; no more than 30% retained on the ¾" sieve.

F. Drywell Collar Material: Clean sand and gravel containing less than 15% fine sand, silt and clay. Silt and clay fractions are not to exceed 5%. Native material may be reused if it meets this requirement.

PART 3 - EXECUTION

1.01 EXAMINATION

A. Verify existing conditions and substrate.

B. Verify fill materials to be reused are acceptable.

C. Verify items to be buried during backfilling process have been inspected prior to backfilling.

1.02 PREPARATION

A. Compact subgrade to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

B. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with sand or subsoil and compact to density equal to or greater than requirements for subsequent backfill material.

1.03 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy materials.

C. Place and compact fill material in 12 inch lifts (compacted thickness). Compact to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

D. Employ a placement method that does not disturb or damage structures or other items against which material is backfilled.

E. Backfill against supported structures. Do not backfill against unsupported structures.

F. Backfill simultaneously on each side of structure.

G. Make grade changes gradual. Blend slope into level areas.

H. Remove surplus backfill materials from site.

I. Leave fill material stockpile areas completely free of excess fill materials.

1.04 TOLERANCES

A. Maximum Variation From Top Surface of Backfilling Under Paved Areas: 1/4 inch.

B. Maximum Variation From Top Surface of General Backfilling: 1 inch.

1.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform field tests and analysis of fill material in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Unless additional testing is required by the Engineer, compaction tests shall be taken at the following rates:
   1. Pavement Subgrade: One test per 5,000 square feet of subgrade immediately prior to placing subbase.

END OF SECTION 312323.13

SECTION 312333 - TRENCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavate trenches for piping and utilities.

B. Compacted bedding and backfill around and over piping and utilities to subgrade elevations.

C. Backfilling and compaction.

1.02 RELATED SECTIONS

A. Section 312213 - Rough Grading

1.03 REFERENCES

A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18-inch Drop.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Test Reports: Submit a sieve analysis for backfill to be used.

1.05 QUALITY ASSURANCE

A. Do not excavate wet or frozen materials without written approval from the Engineer.

B. Do not backfill over or with wet or frozen materials.

C. Provide safety barricades around open excavations.

1.06 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the work are as shown on plans.

1.07 COORDINATION

A. Coordinate work under provisions of Section 013100.

B. Coordinate trenching with installation of pipe or conduit.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subsoil: Reused, excavated material, graded, free of lumps, rocks and gravel larger than 3 inches in size, debris and contaminants.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions and substrate.

B. Verify fill materials to be reused are acceptable.

C. Verify items to be buried during backfilling process have been inspected prior to backfilling.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Maintain and protect existing utilities remaining which pass through work area.

C. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic. Any item damaged by the contractor shall be promptly repaired at the contractor's expense.

E. Protect above and below grade utilities which are to remain.

F. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with subsoil fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.03 EXCAVATION

A. Excavate subsoil required for piping.

B. Cut trenches to the dimensions shown on the plans.

C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock.

F. For trenches made in solid rock, excavate to a depth of 1 foot below the proposed pipe invert.

G. Correct unauthorized excavation at no cost to Owner in accordance with Section 312323.13.

H. Stockpile excavated material in area designated on site and remove excess material not being used from site. Remove excavated material from site.

3.04 BACKFILLING

A. Support pipe and conduit during placement and compaction of fill material.

B. For trenches made in solid rock, place an additional 1 foot of fill material under pipe or conduit.

C. Place fill material to the dimensions and limits as shown on the plans.

D. Place and compact fill material in 12 inch lifts (compacted thickness) for depths greater than 2 feet and 6 inch lifts (compacted thickness) for depths less than 2 feet. Compact to 92 percent maximum dry density in accordance with ANSI/ASTM D1557.

E. Place fill material simultaneously on both sides of the pipe or conduit. Backfill to the dimensions and limits shown on the plans with reused subsoil.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

G. Place and compact material in continuous layers not exceeding 6 inches compacted depth.

H. Employ a placement method that does not disturb or damage conduit or pipe.

3.05 TOLERANCES

A. Maximum Variation From Top Surface of Backfilling Under Paved Areas: 1/4 inch.

B. Maximum Variation From Top Surface of General Backfilling: 1 inch.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform field tests and analysis of fill material in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Unless additional testing is required by the Engineer, compaction tests shall be taken at the springline of the pipe and after each lift at 100 foot intervals along the pipe run.

3.07 CLEANING

A. Remove surplus backfill materials from site.

B. Leave fill material stockpile areas completely free of excess fill materials.

3.08 PROTECTION

A. Protect finished work under provisions of Section 015000.

B. Recompact fills subjected to vehicular traffic.

END OF SECTION 312333

SECTION 315000 - EXCAVATION SUPPORT & PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wood and steel sheeting.

B. Sheeting box.

1.02 RELATED SECTIONS

A. Section 312323.13 - Backfilling.

B. Section 312333 - Trenching.

1.03 REFERENCES

A. Occupational Safety and Health Standards - Excavations; Final Rule (29 CFR Part 1926) - OSHA Standards.

1.04 QUALITY ASSURANCE

A. Perform all work of this section in accordance with OSHA Standards and approved shop drawings.

1.05 COORDINATION

A. Coordinate work under provisions of Section 013100.

B. Coordinate work with all other sections requiring temporary sheeting and bracing.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wood Sheeting: Hardwood species of size and dimensions capable of being driven to the required depths and capable of supporting excavation sides and soil pressures when braced; free from wormholes, wind shakes, loose knots, decayed or unsound portions or defects which would impair its strength or tightness; 2 inches (50 mm) thick minimum.

B. Steel Sheeting: Corrugated "Z" shape cross-section; of size and dimensions capable of being driven to the required depths and capable of supporting excavation sides and soil pressures when braced; structurally sound; special shapes for corner construction and transition points.

C. Sheeting Boxes: Steel, of size and dimensions capable of supporting excavation sides and soil pressures; structurally sound.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing substrate and site conditions.

B. Verify elevations and grades are as indicated on the plans.

C. Verify proposed locations of excavations are as indicated on the plans.

3.02 PREPARATION

A. Excavate to a depth no greater than 4 feet (1.2 m) from existing grade.

B. Assemble and drive the sheeting in accordance with approved shop drawings.

3.03 INSTALLATION - SHEETING

A. Drive sheeting in place to thoroughly support both sides of the excavation using a sheeting hammer. Use a steam or pneumatic hammer for steel sheeting.

B. Water jetting of sheeting will not be permitted. Do not loosen adjacent ground which might result in collapse.

C. Install walls and braces or shores tight and in accordance with approved shop drawings.

3.04 INSTALLATION - SHEETING BOX

A. Place box in trench utilizing a means which will not damage structural integrity of the box.

B. Excavate ahead of the sheeting box only enough to advance the sheeting box and only immediately prior to moving the sheeting box.

C. Backfill on both sides of the sheeting box as it is moved.

3.05 REMOVAL OF SHEETING

A. Remove sheeting only as backfilling progresses.

B. Carefully remove sheeting such that compacted backfill is not displaced. Add additional backfill to the areas vacated by the sheeting.

C. All sheeting is to be removed from the site once its use is no longer required.

3.06 CLEANING

A. Clean site of any debris from work of this section

END OF SECTION 315000

SECTION 321123.16 - RECYCLED CONCRETE AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Recycled concrete aggregate base course.

1.02 RELATED SECTIONS

A. Section 312213 - Rough Grading.

B. Section 312323.13 - Backfilling.

C. Section 312333 - Trenching.

1.03 REFERENCES

A. ANSI/ASTM C88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

B. ANSI/ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.

C. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb Rammer and 18-inch Drop.

D. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Test Reports: Submit a sieve analysis for the aggregate base course used.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products to the site under provisions of Section 016500.

B. Do not handle aggregate in any manner which will cause segregation of large or fine particles.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aggregate Base Course: At least 95% by weight, of angular, crushed, recycled concrete; free of organic matter and deleterious material; graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Percent Passing
2-inch	90-100%
1/4-inch	30-65%
No. 40	5-40%
No. 200	0-10%

B. The material may contain up to 5% by weight of asphalt and/or brick.

C. Material retained on the 1/2 inch sieve is coarse aggregate.

D. Coarse aggregate shall not have more than 10 percent by weight of flat or elongated pieces. A flat or elongated piece is defined as being three times greater in the largest dimension as compared to its least dimension.

E. The portion of the aggregate base course which passes the No. 40 screen shall have a plasticity index of one as tested in accordance with ASTM D4318.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate.

B. Verify elevations of subgrade are as indicated on the plans.

C. Verify that subgrade is properly compacted and ready to receive work of this section.

D. Beginning work of this section means acceptance of existing conditions.

3.02 PREPARATION

A. Fine grade and compact subgrade to 95 percent maximum dry density in accordance with ANSI/ASTM D1557.

3.03 AGGREGATE PLACEMENT

A. Spread course aggregate over prepared subgrade to a total compacted thickness as indicated on the plans.

B. Place aggregate in 3 inch layers and compact by roller.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Compact placed aggregate materials to achieve 95% maximum dry density in accordance with ANSI/ASTM D1557. Maintain optimum moisture content to attain required density.

F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.

H. New pavement must be placed on the properly compacted aggregate base course within 24 hours of final compaction. If aggregate base course is left open for more than 24 hours, re-compact and retest in accordance with ANSI/ASTM D1557.

3.04 TOLERANCES

A. Maximum Variation From Flatness: 1/4 inch measured with 10 foot straight edge.

B. Maximum Variation From Scheduled Compacted Thickness: 1/4 inch.

C. Maximum Variation from True Elevation: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Perform compaction testing in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

D. Frequency of Tests: One test per 500 sq ft. immediately prior to paving.

END OF SECTION 321123.16

SECTION 323613 - SITE BOLLARDS

PART 1 - GENERAL

SECTION INCLUDES

2.01 BOLLARDS.

2.02 FOOTINGS AND FOUNDATIONS.

A. REFERENCES
   1. ASTM A36 - Structural Steel.
   2. ASTM C33 - Concrete Aggregates.
   3. ASTM C150 - Portland Cement.
   4. ASTM C260 - Air-Entraining Admixtures for Concrete.
   5. ASTM C330 - Lightweight Aggregates for Structural Concrete.

B. SUBMITTALS FOR REVIEW
   1. Section 01330 - Submittals PART 2 - PRODUCTS

C. MATERIALS
   1. A-36 structural steel tubing.

D. BOLLARDS
   1. Formed Steel Tubes: 1/4" thick, 6" diameter galvanized steel, concrete filled.
   2. PVC Bollard Cover: Manufactured by ULINE, Model H-3719Y. Color: Yellow.
   3. Quantity: As indicated on plans.

PART 3 - EXECUTION

INSTALLATION

4.01 INSTALL UNITS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, WITHOUT DAMAGE. REPLACE OR REPAIR DAMAGED UNITS.

4.02 INSTALL UNITS IN ALIGNMENT WITH ADJACENT WORK.

4.03 INSTALL BOLLARDS IN FOOTINGS. BOLLARDS SHALL BE INSTALLED IN LOCATIONS AS PER LIPA REQUIREMENTS OR IN LOCATIONS AS DIRECTED BY ENGINEER.

4.04 INSTALL BOLLARD COVER. DRILL AND TAP STEEL BOLLARD TO ACCEPT TWO (2) GALVANIZED SCREWS TO ATTACH BOLLARD COVER AT 4" AFG.

END OF SECTION 323613

SECTION 331140 - DISINFECTION OF WATER FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Disinfection of potable water piping, valves, pumping and treatment units.

1.02 REFERENCES

A. ANSI/AWWA B300 - Standard for Hypochlorites

B. ANSI/AWWA B301 - Standard for Liquid Chlorine

C. ANSI/AWWA C651 - Standard for Disinfection of Water Mains

D. ANSI/AWWA C652 - Standard for Disinfection of Water Storage Facilities

E. ANSI/AWWA C653 - Standard for Disinfection of Water Treatment Plants

1.03 SUBMITTALS

A. Submit proposed method for introducing disinfectant into the treatment unit. If media must be disinfected, obtain method for disinfecting from supplier.

B. Test Reports: Indicate results comparative to specified requirements.

C. Certificate: Certify that cleanliness of filter tanks, towers and clearwell meets or exceeds specified requirements.

1.04 PROJECT RECORD DOCUMENTS

A. Prepare and submit a disinfection report containing the following:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test and injection locations.
   4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.

B. Prepare and submit complete water analysis results with the following information:
   1. Date issued, project name and testing laboratory name, address and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24-hour disinfectant residuals in ppm.
   6. Coliform bacteria and chemical test results.
   7. Certification that water conforms or fails to conform to California State Drinking Water Standards.
   8. Laboratory Director's signature and authority.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ANSI/AWWA C651, ANSI/AWWA C652 and ANSI/AWWA C653.

1.06 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three (3) years experience.

B. Testing Firm: City of Corcoran approved laoratory, Pace Analytical Labs

C. Testing Firm: Laboratory specializing in testing potable water systems, approved by the California State Department of Health.

1.07 REGULATORY REQUIREMENTS

A. Conform to Recommended Standards for Water Works and applicable codes or regulations for performing the work of this Section.

B. Water quality to conform to California State Drinking Water Standards after completion of disinfection.

C. The Kings County Department of Health Services will be notified of the date of water quality testing to allow sampling by the Health Department. Provide Engineer three (3) days advanced notification of proposed sampling date.

PART 2 - MATERIALS

2.01 DISINFECTION CHEMICALS

A. ANSI/AWWA B300, Hypochlorite

B. ANSI/AWWA B301, Liquid Chlorine

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that all piping systems and treatment units have been cleaned, inspected and pressure tested.

3.02 EXECUTION

A. Provide required equipment to perform the work of this Section. The Owner will provide the water required for the initial disinfection and filling of the piping, and valves, etc. The Contractor shall pay for the water required for any subsequent filling of these systems based on the Owner's retail water rate.

B. Disinfect system in accordance with Section 4.1 or Section 4.3 of AWWA C651.

C. The sampling schedule below has been produced in accordance with the California State Department of Health, for the convenience of the Contractor. It is the responsibility of the Contractor to perform sampling in accordance with the most recently released Kings County Department of Health Services sampling requirements. Conflicts between the schedule below and the most recent sampling requirements should be brought to the attention of the Engineer immediately, and resolved prior to sampling.

D. Collect samples 48 hours after flushing disinfectant and refilling with potable water. Samples shall not be collected if chlorine residual is greater than 0.1 mg/L, or greater than distribution system residual, if chlorinated system water is used for testing.

E. Chemical tests shall include bacteriological, inorganic chemicals, volatile halogenated organics, non-volatile organics, heavy metals and any other tests required by the state

F. If water quality in system does not meet the bacteriological requirements of the Kings County Department of Health Services for potable water, the Contractor, at no additional cost to the owner, shall re-chlorinate or take other steps necessary to provide acceptable water quality. Samples shall be collected and analyzed after each attempt. All costs associated with subsequent sampling shall be borne directly by the Contractor.

G. Neutralize residual chlorine to less than 1 mg/l with a suitable quantity of sodium bisulfite, sodium sulfide or sodium thiosulfate prior to disposal.

H. For this project, a minimum of two (2) sets of bacteriological samples for plant/site distribution water main will be required. Take samples at the appropriate time intervals as required by the state water board. Verify sampling location with the Engineer.

3.03 QUALITY CONTROL

A. Provide analysis and testing of treated water in towers and clearwell.

B. Test samples in accordance with ANSI/AWWA C652 and C653

END OF SECTION 331140

SECTION 331411 - WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Utility Pipe

B. Special Castings; Mechanical Joint Fittings

C. Buried Valves & Valve Boxes

1.02 RELATED SECTIONS

A. Section 312333 - Trenching

B. Section 312323.13 - Backfilling

C. Section 331140 - Disinfection of Water Facilities

1.03 REFERENCES

A. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

B. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Pipe Systems

C. ANSI/AWWA C110 - Ductile Iron and Grey Iron Fittings.

D. ANSI/AWWA C111- Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

E. ANSI/AWWA C150 - Thickness Design of Ductile Iron Pipes

F. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast for Water Service.

G. ANSI/AWWA C153 - Ductile-Iron Compact Fittings for Water Service.

H. ANSI/AWWA C509 - Resilient Seated Gate Valves for Water Supply Service.

I. ANSI/AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.

J. ANSI/AWWA C900 - pvc

1.04 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of water mains, valves, connections, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with the local water utility company requirements.

B. The tone-out, mark-out, locating and verification of existing utilities on private property and within public Right-of-Ways are the responsibility of the contractor. All known utilities and facilities shall be verified by test holes or other means prior to commencing water main installation. No compensation will be paid to the contractor for lost time due to improper or inadequate utility investigation.

C. The contractor shall conform to the standard traffic requirements of the California State Manual of Uniform Traffic Control Devices for work in Public Roadways.

D. Valves: Manufacturer's name and pressure rating marked on valve body.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to ensure they are kept free from damage.

B. Store piping and valves to ensure that their interiors are kept free of debris, organics or animals.

C. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.01 WATER UTILITY PIPING

A. Cement-Lined Ductile Iron Pipe
   1. Approved Manufacturers:
      a. US PIPE
      b. McWANE DUCTILE
   2. Cement-Lined Ductile Iron Pipe meeting AWWA C150/C151 :
      a. Special Class 52 for all pipe 14 inches and smaller.
   3. Interior lining shall be double-thick cement with a minimum thickness of 1/8" (125 mils) in accordance with AWWA C104.
   4. Exterior of pipe shall have an exterior bituminous coating measuring 1 mil in thickness and be marked with the manufacturer name, date of casting and pressure class.

B. Pipe Accessories:
   1. Joints: ANSI/AWWA C111, vulcanized rubber gaskets for push-on pipe; mechanical joint with rods and retainer glands for fittings.
   2. Field lock gaskets by US Pipe Model 350 shall be utilized on the last push-on joint of all dead-end mains, where a bell falls within 10 feet of a mechanical joint connection or as indicated on the plans or as directed by the Engineer.
   3. Gaskets shall be free from porous areas, foreign materials and visible defects. No reclaimed rubber shall be used
   4. Lubricant for Joints: Nontoxic, NSF-61 certified, shall not support the growth of bacteria, and shall have no deteriorating effects on the gasket or pipe material.
   5. Wedges: Bronze, installed at each push-on joint. (CLDIP only)
   6. Electro-Magnetic Marking Tape: (PVC only)

2.02 SPECIAL CASTINGS

A. Manufacturers:
   1. US PIPE

2. SIGMA CORP.
3. TYLER UNION
4. APPROVED EQUAL

B. Material:
1. Fittings shall be in accordance with ANSI/AWWA C153 (compact).
2. Fittings shall be ductile iron.
3. Ductile iron fittings shall have a pressure rating of 350 psi.
4. Fittings shall be cement lined.

C. All fittings shall be manufactured domestically with the United States.

D. Mechanical Joint fittings shall be used with "push-on" joint pipe with the joint conforming to AWWA Specifications.

E. Rubber gaskets shall be used at each pipe connection. Rubber gaskets shall be vulcanized rubber that is free of porous areas, foreign materials and visible defects. No reclaimed rubber shall be used. The size, mold number, gasket manufacturer's mark, the letters "MJ" and the year of manufacture shall be molded in the rubber.

F. Wedge type restraining glands shall be required at all mechanical joints.
1. Manufacturer:
a. EBAA IRON WORKS
b. FORD METER BOX CO.
c. SIGMA CORPORATION
d. TYLER UNION
e. US PIPE
f. Approved equal
2. Wedge type restraining glands shall be secured to fittings using alloy steel T-head bolts and hex-head nuts.

2.03 BURIED VALVES

A. Resilient Wedge Gate Valves (up to 12”)
1. Acceptable Manufacturers:
a. MUELLER COMPANY; A-2362
b. CLOW VALVE COMPANY; Model 2639
c. KENNEDY VALVE CO.; Fig. 8571
2. All vertical gate valves up to and including 12-inch diameter shall conform to AWWA Specification C509 or latest revision, and shall be specified as follows:
a. Select from below as required:
b. Material: Iron body, bronze mounted.
c. Pressure: 250 psi minimum working pressure.
d. Wedge: Cast iron wedge with urethane rubber coating (encapsulated). The rubber/metal bond shall be tested to meet ASTM D429.
e. Stem: Forged bronze, non-rising stem with two "O" ring seals.
f. Wrench Nut: Two-inch square (at base) wrench nut opening to the left or counterclockwise.
g. Mechanical Joint Ends: Mechanical joint ends complete with all joint accessories including rubber gaskets.
h. Painting: The body and bonnet shall be coated with a fusion coating both interior and exterior to meet AWWA Standard C550.
i. Markings: Markings shall be cast on the bonnet or body of each valve, and shall show the manufacturer's name or mark, the year the valve casting was made, the size of the valve, and the designation of working water pressure for 4 to 12-inch valves.

j. Affidavit of Compliance: The Contractor shall have the manufacturer provide an affidavit directly to the Engineer that all valves supplied on this project comply with all applicable provisions of AWWA Specification C509, and that each valve was subjected to and passed the 500 psi hydrostatic test without leakage. No final payment for valves will be made until this Affidavit of Compliance is received by the Engineer.

B. Valve Boxes
1. Manufacturer:
a. CHRISTY OLDCASTLE
b. SIGMA CORPORATION
c. TYLER UNION
2. Valve boxes shall be three piece, sliding type with 8" x 5-1/4" cast iron flanged bottom section, 9" x 6-1/8" ductile iron top section and 7" ductile iron drop lid with "WATER" cast on cover.

PART 3 - EXECUTION

3.01 INSTALLATION - PIPE

A. Remove scale and dirt, on inside and outside, before assembly.

B. Bevel plain ends of cut pipe at push-on joints.

C. Excavate pipe trench in accordance with Section 312333 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

D. Place bedding material at trench bottom; level fill materials in one continuous layer not less than 6 inches compacted depth; compact to 95 percent maximum dry density.

E. Maintain optimum moisture content of bedding material to attain required compaction density.

F. The Contractor shall be responsible for verifying the location of the existing water mains and other utilities along the entire route of the project.

G. The Contractor must have experienced personnel in his employ to perform the cut-ins and connections to the existing water mains and have available equipment necessary for cutting ductile iron, cast iron, asbestos cement and miscellaneous piping in the existing distribution system.

H. Suitable facilities shall be available for proper dewatering, drainage and disposal of water removed from dewatered lines and excavations, without damage to adjacent properties. Exposed ends of the water main shall never be submerged either partially or fully.

I. Maintain a 10 foot horizontal and 18 inch vertical separation of water main from all storm and sanitary sewer facilities. The Contractor shall install the water main with the minimum cover indicated in the Contract Documents. The Contractor shall verify the depth of any existing service laterals to the structures prior to crossing of same.

J. Pipe trenches shall be of minimum width and allow six (6) inches on each side of the bell with sufficient width to allow straight alignment of pipe and provide sufficient room for joint-ing as required and to allow the backfill to be placed as specified.

K. Only new full-lengths of pipe shall be delivered to and utilized on this project. Field cut pieces with bell ends shall be a minimum of 5 feet in length. Smaller pieces shall not be permitted for use and shall be removed from site.

L. Pipe shall be laid with the bell end facing in the direction of laying. Where pipe is laid on a grade of 10% or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe up gradient.

M. Install pipe to indicated elevation to within tolerance of 1/2 inch.

N. Clean bell end of pipe prior to placing gasket. Apply lubricant to both gasket and plain end of pipe.

O. Do not field cut pipe within 24 inches of bell or 8 inches of spigot end. Verify the pipe diameter of cut end.

P. Route pipe in straight line where possible. Joint deflections are permitted as outlined in ANSI/AWWA C600.

Q. Install and test ductile iron piping and fittings to ANSI/AWWA C600.

R. For installation of CLDIP, at each joint, two serrated silicon bronze wedges shall be driven into the rubber gasket after the pipe is pushed into place. The wedges shall be installed on opposite sides of the joint on a horizontal plane. Both wedges shall be started in together and driven with a hammer with blows on alternate sides so as not to displace the spigot end to one side of the pipe.

S. For installation of PVC main, install marking up.

T. Establish elevations of buried piping to ensure not less than 4 feet of cover unless otherwise indicated on plans or specifically approved by Engineer or Owner in field.

U. Trench widths shall not exceed the following authorized widths prior to cut-back:
   1. Less than 12-inches diameter mains: 30 inches
   2. 12-inch & 16-inch diameter mains: 36 inches

V. Pavement removal shall be kept to a minimum and not exceed the preceding authorized widths. Sawing, drilling or chipping shall be used to ensure the breakage of pavement along straight lines. Final restoration limits shall include a 12-inch cut-back on all sides of the trench.

W. Backfill trench in accordance with Section 312323. Backfill around sides and to top of pipe with fill, tamped in place and compacted to 95 percent maximum dry density.

X. The contractor shall restore, replace and/or reposition all decorative lawn ornaments, and miscellaneous items disturbed during water main installation including but not limited to the following: stones, brick driveway pavers, fences, signs, sprinklers, shrubs and trees.

3.02 DISINFECTION AND BACTERIA SAMPLING OF WATER UTILITIES

A. Flush and disinfect system in accordance with Section 331140.

3.03 PRESSURE TESTING

A. Perform hydrostatic pressure testing after disinfection, but prior to bacteria sampling.

B. Expel all air from piping system, including pipe, valves and appurtenances. All new water mains shall be pressure tested to a minimum of 150 psi or 1.5 times line pressure, whichever is greater. The pressure test shall be held for a minimum of two hours with no leakage.

C. Remove and replace any defective pipe, fittings, valves, and appurtenances. Repeat pressure test until satisfactory to Engineer.

3.04 INSTALLATION - SPECIAL CASTINGS

A. Tighten glands in accordance with Manufacturers direction.

B. Ensure that fittings are free of dirt and debris prior to installation.

C. Support fitting with solid blocking in areas of over excavation. Wood wedges, blocking and supports are prohibited.

D. The contractor shall install a minimum of two ¾-inch steel tie rods on mechanical joint fittings. Additional tie-rods may be requested on vertical pipe or by Engineer in areas of high pressure.

E. Steel tie rods shall be secured to fittings using 3/4" steel eye-bolts, washers and nuts. The use of ductile iron "Duc-Lugs" is prohibited. Steel tie rods shall be secured to pipe using half-moon pipe clamps, restraints, washers and nuts.

F. Bell ends of pipe shall not be installed within 5 feet of a mechanical joint assembly without being further restrained by locking gaskets and tie rods.

G. Concrete blocking shall be applied on all pipe lines 4-inch in diameter and larger at all hydrants, tees, plugs, caps, and at bends deflecting 22-1/2 degrees or more. Blocking shall be placed between solid ground and the fitting to be anchored. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. Size of blocking and minimum bearing area shall be in accordance with the Bearing Area Table within this specification section.

H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe.

BEARING AREA TABLE

Pipe Size	Dead End of Tee	90 Degree Bend	45 Degree Bend	22½ Degree Bend
4 in	1 ft2	1 ft2	3/4 ft2	½ ft2
6 in	2 ft2	3 ft2	2 ft2	1 ft2
8 in	4 ft2	5½ ft2	3 ft2	1½ ft2
10 in	6 ft2	8½ ft2	4½ ft2	2½ ft2
12 in	9 ft2	12 ft2	6½ ft2	3½ ft2
>16 in	15 ft2	22 ft2	12 ft2	6 ft2

I. Concrete for Thrust Blocks: Portland Cement Concrete; 2,000 psi minimum strength at 28 days. Solid precast concrete blocking meeting the compressive strength requirement shall also be acceptable for use. When solid blocking is utilized, the contractor shall fill all annular spaces with cement or mortar. The use of wood wedges or blocking is not permitted.

3.05 INSTALLATION - VALVES

A. Set valves on solid bearing.

B. Contractor is responsible for ensuring that all valve boxes are plumb and centered over the operating nut until after final asphalt restoration is complete.

C. Contractor shall adjust boxes prior to final restoration. The use of "Rite-Hite" type adapters is not permitted on new construction.

3.06 NOTIFICATIONS

A. The Engineer and local water utility shall be notified at least 24 hours in advance and immediately prior to any of the following:
   1. Commencing work or starting again after more than a 72-hour shutdown.
   2. Admitting water to a new section.
   3. Flushing or blowing off water mains.
   4. Chlorination of water mains.
   5. Shutting down water mains or service to consumers. Consumers should also be informed at least 24 hours in advance and immediately prior to shutting down service.
   6. Disinfection and reconnection of house services.
   7. The permanent shutting down of existing water mains or house services.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with Owner requirements.

B. Leakage testing shall be in accordance with ANSI/AWWA C600.

C. Compaction testing shall be in accordance with ANSI/ASTM D1557.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

END OF SECTION 331411

SECTION 402323 - POTABLE WATER PROCESS PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Large interior piping systems.

1.02 RELATED SECTIONS

A. Section 331140 - Disinfection of Water Facilities

1.03 REFERENCES

A. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings

C. ANSI/AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids

D. ANSI/AWWA - C115/A21.15 - American National Standard for Flanged Ductile Iron Pipe with Threaded Flanges

E. ANSI/AWWA C150/A21.50 - American National Standard for Thickness Design of Ductile Iron Pipe

F. ANSI/AWWA C600 - Installation of Ductile Iron Water Mains and Appurtenances

G. ANSI B18.2.1 - Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

H. ANSI B18.2.2 - Square and Hex Nuts (Inch Series)

I. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

1.04 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Product Data: Provide data on pipe material, pipe fittings, and accessories. Provide manufacturer's catalog information.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

A. ANSI/AWWA C151/A21.51; double thickness cement lining minimum 3/16" in accordance with ANSI/AWWA C104/A21.04, bituminous coating inside; and epoxy primer outside; flanged joint for exposed pipe, thickness Class 52 minimum for all pipe diameters.
   1. Fittings: ANSI/AWWA C110, Ductile iron, standard thickness.
   2. Flanged Joints: ANSI B16.1, Class 125 with full face, 1/8" thick rubber gaskets.
   3. Bolts: ANSI B18.2.1 and ASTM A307 Grade B.
   4. Nuts: ANSI B18.2.2 and ASTM A307 Grade B.
   5. Lubricant for Joints: Nontoxic; shall not support growth of bacteria; shall have no deteriorating effects on gasket or pipe material.
   6. Manufacturer: TYLER UNION, SIGMA, U.S. PIPE & FOUNDRY CO., GRIFFIN PIPE PRODUCTS or specifically approved equal.

B. Flanged Adapters: Dresser Industries, Inc., Style 127 for plain end steel or cast iron pipe with all bolts, rings, gaskets and accessories.

C. Restrained Flange Adapters: EBAA Iron Inc., Style 2100 Megaflange.

D. Couplings: Dresser Industries, Inc., Style 38 for plain end steel or cast iron pipe with all bolts, rings, gaskets and accessories.

E. Piping extending outside buildings shall be mechanical joint.

2.02 PIPE ACCESSORIES

A. Joint Restrainers: Joint restrainers shall be Style 442 with tiebolts for flanged piping as manufactured by STAR NATIONAL PRODUCTS.

B. Pipe Supports: Pipe supports shall be manufactured by MATERIAL RESOURCES:
   1. Pipe Saddle Support: Standon Model S92. Minimum Quantity: Two (2)/10'
   2. Pipe Flange Support: Standon Model S89. Minimum Quantity: Two (2)/10'

PART 3 - EXECUTION

3.01 INSTALLATION

A. Clean inside of pipe before installation. Keep installed piping clean and protect ends from foreign matter by capping or plugging.

B. Install pipe so that it does not interfere with opening of doors or apparatus, access to equipment or any portion of electrical equipment. Group piping whenever practical at common elevations.

C. Run pipes in straight lines and square with building. Install rise plumb. Make offsets only where indicated and where necessary.

D. Install pipes so that expansion and contraction will not cause undue stress or strain to pipes or equipment. Provide loops, offsets and expansion joints as shown on drawings. If, in contractor's opinion, inadequate loops or offsets are shown, contact Engineer for instructions.

E. Provide flanges and unions throughout the pipe systems to make installation and removal of piping and equipment convenient. Make provisions for servicing and removal of equipment without dismantling piping.

F. Label piping after testing.

G. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

H. Install valves with stems upright or horizontal, not inverted.

I. Core drill through existing walls and floors to provide clearance around pipe to be installed and install link seals.

J. Install ductile iron piping and fittings to ANSI/AWWA C600.

K. Install flanged adapters and couplings in accordance with manufacturer's installation instructions. Drawings show minimum required adapters and couplings. Contractor shall install additional coupling and adapters as required for installation and disassembly of the piping systems.

L. Install pipe saddle supports and pipe flange supports to brace piping systems in locations shown on contract plan or as directed by Engineer. Installation shall be in accordance with manufacturer's installation instructions.

3.02 PIPE JOINTING

A. Preparing pipe ends: Cut pipe ends square with pipe cutters only. Do not use hacksaws or torch. Ream pipe ends, after cutting, to full diameter. Where pipe is to be threaded, die-cut right hand, pipe stand, clean cut full depth, taper threads. Make threaded joints so that they will be leak proof without caulking. Apply a thin coat of approved pipe lubricant to make threads only.

B. Bracing joints: Provide braces and bridle rods as required to reinforce joints. Where large pipes underground are subject to shock because of sudden changes in liquid flow rate, provide concrete "kicker" blocks at joints, fittings and changes of pipe direction.

C. Flanged ductile iron pipe joints: Clean face of flange of all sand, grease, grit or other foreign matter. Center gasket before assembling joints. After alignment has been completed insert bolts and hand tighten nuts. Keep gap between flanges approximately uniform while tightening. Tighten bolts to required torque in several steps, alternating from one side to the other.

3.03 RECHECKING AND REPAIRING

A. Before piping is concealed, recheck it for leaks.

B. Rework or replace defective and leaking joints, and joints which are otherwise unsatisfactory. Peening, caulking and doping are not permitted.

END OF SECTION 402323

SECTION 402324 - VALVES AND VALVE ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Butterfly Valves & Actuators

B. Check Valves

C. Hydraulic Control Valves

D. Static Mixers

E. Sight Glass

1.02 RELATED SECTIONS

A. Section 099744 - Mechanical Piping Coating Systems

B. Section 331140 - Disinfection of Water Facilities

C. Section 402323 - Potable Water Process Piping

1.03 REFERENCES

A. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. ASME/ANSI B16.34 - 2004 Valves Flanged, Threaded and Welding End

C. ASTM A126 - Grey Iron Castings for Valves, Flanges and Pipe Fittings

D. ASTM A536 - Ductile Iron Castings

E. AWWA C504 - Standard for Rubber Seated Butterfly Valves

F. AWWA C508 - Swing Check Valves for Waterworks Service, 2 inches (50 mm) through 24 inches (600 mm) NPS

G. AWWA C509 - Resilient Seated Gate Valves for Water Supply Service

H. AWWA C540 - Power Actuating Devices for Valves and Slide Gates

I. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates

J. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants

K. AWWA C800 - Swing - Check Valves for Waterworks Service, 2 inches (50 mm) through 24 inches (600 mm) NPS

L. ANSI/NSF Standard 61, Drinking Water System Components

M. AWWA C530 - Pilot Operated Control Valves

1.04 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Submit the following:
   1. Technical descriptive data for the valves showing model number, size, capacity, weight, materials, accessories and other similar information. Catalog cuts are acceptable if they contain the necessary information.
   2. Storage, handling and installation instructions for the valves.
   3. Warranty Certificate prepared in accordance with paragraph 1.03 herein.

D. Operations and Maintenance Manuals prepared in accordance with the requirements contained in Section 017823 - Operating and Maintenance Data shall be provided.

1.05 PROJECT RECORD DOCUMENTS

A. Submit product data under provisions of Section 017839.

B. Accurately record actual locations of valves, connections, and invert elevations.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with the local water utility company requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. All brass valves and fittings installed on a potable water supply line shall be made of "low-lead" materials and have a maximum lead content of 0.25 percent by weight. All low lead brass fittings shall be stamped or embossed with a mark indicating that the product is manufactured from low-lead alloys.

D. Consideration will only be given to suppliers who can demonstrate that their valve complies with these specifications having had successful and documented experience of the size, quality, performance and reliability to that specified, and who can successfully demonstrate this criteria to the Engineer.

E. Each manufacturer shall have at least ten (10) years of experience in the design and manufacture of the specified valve.

1.07 WARRANTY

A. Provide a Warranty Certificate typed on company letterhead and signed by an authorized officer of the manufacturer.

B. The instrument manufacturer shall guarantee all components to be furnished under this section to be free from defects in design, materials and workmanship for a period of twenty-four (24) months commencing on the date the instrument was placed in permanent and consistent operation.

C. During the guarantee period, if any part or equipment component is defective or fails to perform when operating at design conditions and if the equipment has been installed and is being operated and maintained in accordance with the written instructions provided by the manufacturer; the manufacturer shall repair or exchange at the discretion of the Owner such defective part(s) free of any and all charges. The cost of labor and all other expenses resulting from the repair or replacement of the defective part(s) and from installation of part(s) furnished by this Warranty shall be borne solely by the manufacturer.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Sections 016100 and 016500.

B. Deliver and store valves in shipping containers with labeling in place.

1.09 FIELD SERVICES

A. Supply and credit to the Owner field services as specified in Section 014500 - Quality Control.

B. Provide the following field services:
   1. One (1) day totaling eight (8) hours for the pressure relief - pressure sustaining valve manufacturer. During these visits, the representative shall check the installation, make all necessary adjustments, and otherwise place the specified valve into permanent operation as specified in Section 017500 - Starting and Adjusting. As part of startup activities, the representative shall check the terminal connections and the specific work of the Contractor. Before substantial completion, provide operation and maintenance instruction to the Owner. A complete review of the Operations and Maintenance Manual for the pressure relief - pressure sustaining valve shall be presented at this time.

1.10 SERVICE CONDITIONS

A. All components of the control instruments shall be designed for continuous duty.

B. Provisions shall be made for adjustments or replacements of all parts.

PART 2 - PRODUCTS

2.01 BUTTERFLY VALVES (FLANGED TYPE)

A. Manufacturers:
   1. PRATT, Model 2FII
   2. Mueller, Lineseal III
   3. GA Industries, Series 800
   4. Approved equal.

B. Flanged end butterfly valves shall be of the rubber-seated, tight closing type, with cast body and disc. Valves shall conform to the requirements specified in the governing Standard for Rubber-Seated Butterfly Valves, AWWA C504.

C. Valve body shall be cast iron per ASTM A-126, Class B, with integrally cast hubs for shaft bearing housing, and 125 class flanged ends faced and drilled in accordance with ANSI B16.1, Standard for Cast Iron Flanges. Rated for 150 psig working pressure.

D. Valve disc shall be symmetrical about the shaft axis with no external ribs, cast of alloy cast iron per Military Specification MIL 6-858a, Class I. Valve shaft shall be of a solid one-piece design of centerless ground 18-8 stainless steel or high strength steel (70,000 psi) completely isolated from line fluid.

E. Taper pins, lock washers and nuts shall be 18-8 stainless steel. Valve seat shall be of molded natural rubber, recess mounted, bonded and mechanically secured to the valve body or disc. Sleeve type bearings of self-lubricating material shall be installed in the hubs of the valve body, designed for maximum load of 2,500 psi or one-fifth the compressive strength of the material, whichever is highest.

F. A shaft seal shall be provided in the valve body hub where the shaft extends through same. The one-piece cast gland follower studs and nuts shall be bronze. Packing shall be self-adjusting split "V" type, or triple "O" ring.

G. Manual Valve Operators
   1. Manual operators shall be of the worm and gear type and shall be self-locking. The gear operators shall be permanently lubricated, totally enclosed, with adjustable stops for the open and closed position, and valve disc position indicator. The operator shall be designed so that a pull of not more than 80 pounds will produce an output torque sufficient to operate the valve under actual line pressures and velocities.
   2. Valves shall be equipped with hand wheels and position indicators.
   3. Provide manual valve operator wheel.

H. Electric Valve Actuators
   1. Manufacturers: AUMA motor operator, Model SQXX.2 Auma Matic for 3” valves and larger.
   2. Electric Valve Actuator operator shall conform to AWWA C504 and AWWA C540. Valve shall be electric motor actuated. The electric motor operator shall be designed to move the valve from fully open position to fully closed when electrical power is applied, and hold the valve in any intermediate position between full open and fully closed without creeping or fluttering. Valve, reducer, electric motor operator and accessories shall be furnished complete, ready for installation, from a single manufacturer. Electric motor enclosure shall meet NEMA 4 construction.
   3. Electrical control housing shall be heavy cast aluminum and fully gasketed to meet NEMA 4, watertight construction.
   4. Heavy duty motor shall operate from 120 VAC (nominal) single phase input source. Thermal cut-out switches shall be provided in case of motor overload. Internal heaters shall be provided to prevent damage from condensation within housing.
   5. Gears and gear shafts shall be alloy steel and heat treated for hardness. All shafts shall mount in friction reducing bearings. Gear box housing shall be grease filled and sealed. No lubrication shall be required for the life of the unit.
   6. Two (2) internal limit switches shall be preset at the factory and furnished for each extremity of valve disc travel. Adjustment of each limit switch within one-half degree of disc travel shall be possible. Two (2) additional external limit switches shall be furnished for signal or auxiliary control for both open and closed valve positions. Manual operation shall be available and shall be accomplished by means of a shaft, equipped with a flat wrench that extends through a sealed opening in the housing. A hand wheel for manual operation shall be supplied.
   7. For each motorized butterfly valve, provide automatic and local valve controls which will include an open-close-automatic remote selector switch and timer that will open the valve and then close the valve as directed. Two (2) indicator lights shall be provided to indicate the OPEN (green) and CLOSED (red) positions.
   8. Provide position indication by means of an indicator dial in full step at all items with valve travel during both powered and manual operation.
   9. Provide manual valve operator wheel.

2.02 CHECK VALVES

A. Horizontal Swing Arm with limit switch
   1. Manufacturers:
      a. GOLDEN ANDERSON, Figure 350
      b. CLOW, Model 206
   2. Quiet closing, outside lever and weight with adjustable air cushion chamber, ASTM A126 C1.B cast iron body and valve disc, stainless steel shaft, bronze seal and gate rings, watertight on closing, horizontal, resilient seat ring. AWWA C508, full flow area not less

than the area of a circle with a diameter equal to the nominal pipe size, flanged ends, Class 125, working pressure of 250 psi.
3. Valve shall be provided with a mounted plunger actuated limit switch.
4. SCADA compatible, Nema-4 heavy duty limit switch with DPDT contacts shall be provided.

2.03 HYDRAULIC CONTROL VALVES

A. Pressure Relief - Pressure Sustaining Valves - Sustaining
1. The pressure sustaining control valves shall be the CLA-VAL model 650-01, reduced port, hydraulically operated, pilot actuated automatic control valve, or approved equal. Approved alternate Manufacturers include Watts and Ross. The control valve sizes shall be as indicated on the drawings.
2. The valve shall be designed to maintain a predetermined minimum upstream pressure (setpoint), to sustain pressure downstream and permit flow to system.
3. Pressure sustaining valves shall close quickly when upstream pressure drops below the predetermined setpoint, but open gradually to prevent surges, should the downstream pressure increase above the setpoint.
4. Each main valve shall consist of three (3) components: ATSM A536 ductile iron body with seat; ATSM A536 ductile iron cover and bearings; and nylon reinforced Buna-N diaphragm and assembly including stainless steel stem, nut, and spring.
5. Valves shall fail in the open position.
6. Pilot and Accessories
   a. Pilot tubes shall be copper with bronze fittings.
   b. Pilot valve shall be ASTM B62 bronze.
   c. Pressure Adjustment Range 20 to 200 psi.
7. Each valve shall have the following attributes and accessories:
   a. Globe style
   b. Epoxy coated.
   c. Stainless Steel trim
   d. 150 lb. flanged connections
   e. Isolation ball valves
   f. Pressure gauge upstream and downstream: 4 1/2" glycerin-filled, 316SS bourden tube, Ashcroft, type 1379 or equal, two (2) required per valve.
   g. Check feature

2.04 STATIC MIXERS

A. Manufacturer:
1. KOFLO Corporation, Series 512
2. Approved equal.

B. Size: 12-inch diameter, 60” length

C. ANSI/AWWA C115 Class 53, cement-lined ductile iron body with 150 lb. flanged ends and high solids epoxy exterior coating.

D. Mixing elements shall be manufactured of 316L stainless steel corrugated plates. The mixing elements will consist of intersecting plates and channels. Elements shall be capable of mixing low viscosity liquids for pH control and disinfection under turbulent flow operating conditions.

E. The body shall include two (2) type 316 stainless steel injection fittings.

F. The mixer body and plate materials shall be suitable for handling potable water at the rate of 2,200 gpm, a velocity ranging from 3 to 8 ft/s and 150 psi.

2.05 SIGHT MIXER

A. Manufacturer:
   1. Receonics or approved equal.

B. 2" NPT Sight Glass

C. NSF61 certified

PART 3 - EXECUTION

3.01 GENERAL

A. Install control valves and components in accordance with the written and/or verbal instructions provided by the manufacturer.

B. All components shall be fully tested and verified for service by the manufacturer. Each manufacturer shall provide a MSR as specified in Section 017500 - Starting and Adjusting.

3.02 INSTALLATION

A. All valves, valve accessories and static mixers shall be installed by workers thoroughly experienced in such work and all valve work shall be properly supported and aligned and present a neat and workmanlike appearance. All other required temporary or permanent supports for the valves shall be included in this contract to the approval of the Engineer.

B. Secure all floor stands to support members using stainless steel hardware. Field touchup floor stands after installation.

C. Plug valves shall be installed with the pressure side correctly placed.

D. Set valves in a plumb or level position, as applicable.

E. Install check valves for proper direction of flow. Adjust cushion chamber check valve to prevent water hammer at service conditions.

F. Assemble flanged joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

G. All flanged valves shall be furnished and installed with a Style 128 flange adapter by Dresser Industries, Inc. or equal.

H. Paint all installed valves and piping in accordance with Section 099744.

I. Before each valve is installed, pipe lines should be flushed of all chips, scale, and foreign matter.

J. Properly use dielectric fittings and gaskets with dissimilar metals to insure that galvanic and/or electrolytic action does not take place.

K. Coordinate with Electrical Contractor for wiring of solenoid valves and transmitters.

L. Limit switch shall be wired by Contract E.

3.03 INSPECTION, HANDLING AND STORAGE

A. Inspection - All valves and accessories are subject to inspection by the Engineer at the point of delivery for manufacturer, direction of opening, freedom of operation, tightness of pressure-containing bolt, cleanliness of valve ports and especially seating surfaces, handling damage, cracks and any other damage.

B. Valves found to be either defective or damaged shall be rejected and immediately removed from the job site.

C. Handling - All valves shall be loaded and unloaded by lifting with hoists or skidding under control with ropes in order to avoid shock or damage. Under no circumstances shall valves and boxes be dropped.

D. Storage - Valves, joint accessories and other appurtenances, if stored, shall be kept safe from damage. The interior of the valve and the joint accessories shall be kept free from dirt or foreign matter at all times.

E. Perform operating tests on valves as per the Manufacturers recommendations as required to determine they are in satisfactory operating condition and do not leak. All valves upon completion of the work shall be checked to determine they are in an open position, unless otherwise indicated.
   1. Electronic controller shall be installed and wired by Contractor E. Contract G shall provide manufacturer's representative to provide field start-up services for programming and calibrating the electronic control which shall receive a remote 4-20mA set point (desired flow) as an input to the electronic controller.

END OF SECTION 402324

SECTION 43 22 63 – SAND SEPARATOR

PART 1 – GENERAL

1.01 SUMMARY

A. Sand separator and accessories installed or relocated as indicated on Drawings.

1.02 SUBMITTALS

A. Contactor to submit for Engineer's Approval. Contractor to coordinate sand separator model with final water well discharge rates. See General Provisions Submittals.

B. Submit shop drawings detailing dimensions and elevations.

C. Submit manufacturer data sheets for all equipment and components.

D. Contractor shall submit the manufacturer's stamped and signed footing design, including structural calculations.

E. Submit testing plan with test logs.

1.03 QUALITY ASSURANCE

1.04 WARRANTY

A. At least one year from the date of delivery. Five years for the sand separator, one year all other components

1.05 DELIVERY, STORAGE, AND HANDLING

PART 2 – PRODUCTS

1.01 MANUFACTURERS

A. Lakos PWC Sand Separator (Contractor to submit for Engineer's approval)

B. Or approved equal.

1.02 MATERIALS

A. Install centrifugal sand separator in a vertical profile with an automatic purge valve, inspection/drainplug, ANSI 61 inlet/outlet flanges with pressure gauges and petcock valves, and hand-hole inspection port to provide access to the collection chamber.

1.03 Contractor shall coordinate with the City after final well development to ensure sand separator model is compatible with actual well parameters before model selection.

PART 3 – EXECUTION

1.01 INSTALLATION

A. Install sand separator and all components per manufacturer's instructions at the location and grade as shown on Drawings.

B. Where the existing sand separator is to be relocated, install at the new location and grade as shown on Drawings. The contractor shall verify that the existing Well 8B sand separator and components are in good working condition.

C. Construct footing per manufacturer's design. The design shall be stamped and signed.

1.02 FIELD QUALITY CONTROL

A. Perform start-up, testing, and adjusting services per Section 01 75 00 STARTING AND ADJUSTING.

END OF SECTION 43 22 63

SECTION 43 22 64 – PRESSURE MEASUREMENT DEVICES

PART 1 – GENERAL

1.01 SUMMARY
- A. Pressure measurement devices to be installed or relocated

1.02 SUBMITTALS
- A. Contactor to submit for Engineer's Approval. See General Provisions Submittals.
- B. Submit manufacturer data sheets for all equipment and components.
- C. Submit Operation and Maintenance Manuals

1.03 QUALITY ASSURANCE

1.04 WARRANTY
- A. At least one year from the date of delivery.

1.05 DELIVERY, STORAGE, AND HANDLING

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Allen Bradley
2. Dwyer Instruments
3. Emerson Process Management
4. Honeywell Process Solutions
5. Omega Engineering
6. Wika Instrument Corporation
7. Approved equal

PART 3 – EXECUTION

1.01 INSTALLATION
- A. Install devices according to manufacturer's instruction.
- B. Calibrate all analog sensors.
- C. The use of Lead base pipe or Tefon tape is not acceptable.

1.02 FIELD QUALITY CONTROL
- A. Devices to be tested, calibrated, and adjusted to a operating condition.

END OF SECTION 43 22 64

SECTION 432265 ELECTROMAGNETIC FLOW METERS

PART 1 – GENERAL

1.01 SUMMARY
A. This section covers electromagnetic flow meter devices to be installed or relocated

1.02 SUBMITTALS
A. Contactor to submit for Engineer’s Approval. See General Provisions Submittals.
B. Submit manufacturer data sheets for all equipment and components.
C. Submit Operation and Maintenance Manuals

1.01 QUALITY ASSURANCE

1.04 WARRANTY
A. At least one year from the date of delivery.

1.05 DELIVERY, STORAGE, AND HANDLING

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Siemens.
2. McCrometer.
3. Badger.
4. Approved Equal.

PART 3 – EXECUTION

1.01 INSTALLATION
A. Install devices according to manufacturer’s instruction.
B. Calibrate

1.02 FIELD QUALITY CONTROL
A. Devices to be tested, calibrated, and adjusted to a operating condition.
B. Furnish installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for start-up and testing.

END OF SECTION 43 22 65