United States
Department of
Agriculture

Forest Service

Region 2

Nebraska
National Forest &
National Grassland

Bessey
Ranger District

May 2024

BESSEY RECREATION AREA IRRIGATION IMPROVEMENTS

100% Final Specifications

SECTION 010100
LIST OF DRAWINGS AND SPECIFICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION

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SECTION 010150
GENERAL REQUIREMENTS

PART 1 – SUMMARY OF WORK

1.1 DESCRIPTION

A. The intent of this section is to provide a general outline of the work required under this contract and identify special project conditions and/or requirements. It is not intended to provide detailed specifications for materials, labor, and workmanship. These are covered in other sections of these specifications.

B. The Bessey Recreation Area (Bessey) has seen some recent improvements to the nursey portion of the site. However, the public facing day-use developed recreation site has not been so fortunate. This project covers irrigation system automation and improvements as well as addressing much needed deferred maintenance.

1.2 LOCATION

A. Bessey is located west of the town of Halsey, Nebraska
   a. Address – 40637 River Loop, Halsey, Nebraska 69142
   b. Bessey coordinates: 41° 54' 02.64"N, 100° 17' 54.43"W

1.3 SPECIFICATIONS

A. The specifications establish the construction procedures and materials to be employed throughout.

1.4 GENERAL SITE CONDITIONS AND WEATHER

A. The elevation of the site is approximately 2,720 feet above mean sea level. The site generally experiences moderate to high temperatures in the summer and cold, windy, and snowy conditions in the winter. The average annual temperatures range from 56 degrees F to 86 degrees F in summer and 7 to 34 degrees F in the winter. This area sees approximately 23.3 inches of rain per year, which is about 60% of the national average.

1.5 SITE ACCESS

A. Directions from North Platte, NE: Travel approximately 64.8 miles north on US-83. Turn east (right) onto NE-2 and travel east approximately 15.3 miles. Turn south (right) onto NE-86B and travel south approximately 0.2 miles. The Bessey Day-Use project site and Ranger Station facility will be on your east (left).

1.6 USE OF FACILITIES AND UTILITIES

A. Water should be available on-site.

B. There is cell phone coverage in this area.

C. Restrooms will be available for contractor use at the site during the project.

D. Electrical service is available at this site and can be utilized for the project.

1.7 STAGING AREA

A. An area at or near the project site will be made available for use as a staging area. Staging areas shall be approved by the Contracting Officer (CO) prior to use. Camping may be available on-site at the campground or location approved by CO. Security and clean-up of this area shall be the responsibility of the Contractor.

1.8 WORK RESTRICTIONS

A. Nonsmoking Buildings: Smoking is not permitted within the buildings or within 25 feet (8 m) of entrances.

1.9 SCHEDULE

A. Pre-work conference shall be conducted virtually with the Forest Service and the Prime.

B. The Contractor shall not work on weekends, federally recognized holidays, or holiday weekends.

C. See Section 13200 Construction Progress Documentation for "Project Schedule General Requirements."

1.10 PROTECTION OF PUBLIC

A. Bessey will likely remain open during construction and every precaution shall be taken to protect the public.

B. Install and maintain suitable barriers to ensure the protection of the public, employees, and facilities.
   1. Fence, barricade, or otherwise block off the immediate work area to prevent unauthorized entry to the work area.
   2. Erect and maintain barricades and warning signs in accordance with ANSID6.1.
   3. Material may be new or used but shall be suitable for intended purpose.
   4. Fences and barriers shall be structurally adequate and neat in appearance.

1.11 CONTRACTOR'S RESPONSIBILITIES

A. Confine storage of materials to areas as approved by the CO.

B. Provide adequate signing and barricades and take necessary safety measures to protect the public during all construction operations. Minimize disturbance of all undisturbed areas.

C. The Contractor at the Contractor's expense shall repair Existing Forest Service roads and parking areas disturbed by construction activities. Repair includes any work needed to

return the roads and parking areas to their existing condition before construction began and shall include replacing road aggregate if necessary.

D. All areas where the existing grass vegetation is removed or damaged, or destroyed due to construction activities, shall be decompacted, regraded, and revegetated. Contractor shall apply all provided seed in accordance with specifications. Seed shall be provided by the Forest Service.

E. The Contractor shall be responsible for all damage that results from the Contractor's action during completion of the project work. Any damage that occurs due to action of the Contractor shall be repaired at the Contractor's expense.

F. Protect trees, tree root zones, and vegetation within project area from damage unless otherwise directed by CO.

1.12 UTILITY LOCATIONS

A. There are a number of utilities known to exist at the project site, including but not limited to buried power lines, 6” water main pipes, irrigation pipes, sewer lines and manholes. The Contractor shall be responsible for hiring a locating service to locate all utilities. A copy of the utility locates map shall be provided to the Forest Service.

1.13 CONSTRUCTION WASTE DISPOSAL FACILITIES

A. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.

1.14 SITE CLEANUP AND DISPOSAL AREA

A. The Contractor shall cleanup construction debris at the completion of each day’s work. Disposal of construction debris shall be at an established Sanitary Landfill, with all permits and related costs of disposal being the responsibility of the Contractor. The Contractor and the CO shall mutually agree to the frequency of disposal. The Contractor shall not use existing on-site trash receptacles for disposal or interim storage of construction debris. Burning of construction debris shall not be allowed on lands administered by the Forest Service.

1.15 FIELD VERIFICATION

A. Verify in the field, all new and existing dimensions affecting the work of this contract before ordering products.

B. Contractor shall visit the project site and appraise themselves of conditions prior to submitting a bid package.

1.16 PERMITS

A. Obtain any applicable permits required by County, State, or Federal laws or regulations.

PART 2 – DEFINITION OF ITEMS AND PAYMENT

2.1 DESCRIPTION

A. This section explains what is and what is not included in each pay item; the limits or cut-off points where one item ends, and another begins; and basis of payment for work items listed in the Schedule of Items.

B. Payment: For each individual item listed here and in the Schedule of Items (SOI), payment shall be full compensation for all work related to the particular item in accordance with these specifications, and as shown on the drawings.

2.2 SCHEDULE OF ITEMS

A. Schedule of Items: The project SOI includes several sections to organize the work into Base Items and Optional Items.

1. Provide pricing for all items listed in the SOI.
2. Contract award will be made for all Base Items.
3. Optional Items may be awarded based on available project funding.

B. Determination of Quantities:
1. The contractor shall perform, or cause to be performed, all measurement of quantities of materials incorporated into the work processes that are to be measured under the provisions of the contract.
2. Quantity Measurements:
   a. The Contractor shall make all measurements for computation of quantities for all work items except those specified for payment by Actual Quantity (AQ), Designed Quantity (DQ) or Lump Sum Quantity (LSQ).
   b. The contractor shall compute the quantities for periodic progress payments; the Contracting Officer shall compute the quantities for the final payment based on measurements taken by the Contractor.
   c. All Contractor measurements are subject to verification.
   d. The Contractor shall submit all field notes, calculation sheets, and other data used to determine quantities.
   e. The Contractor shall certify in writing as to the accuracy of the measurements and computations submitted.

C. Units of Measurement:
1. Payment shall be by units defined and determined according to U.S. Standard measure and by the following:
   a. <u>Designed Quantities (DQ):</u> Estimated quantities which are determined from contract design measurements and determinations.
   b. <u>Actual Quantities (AQ)</u>: Estimated quantities which are determined from actual measurements of completed work.
   c. <u>Linear Feet (LF)</u>: Linear feet measured horizontally.
   d. <u>Square Feet (SF)</u>: Square feet measured horizontally, in two different directions.

e. Lump Sum Quantities (LSQ): These quantities denote one complete unit of work as required by or described in the contract, including necessary materials, equipment, and labor to complete the job. They shall not be measured.
f. Each (EA): One complete unit, which may consist of one or more parts.

D. Base Items (BI):

1. Base Item No. 1 – Mobilization
   a. This base item consists of all preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for all other work and operations that must be performed or that cause costs to be incurred prior to beginning work on the various items on the project site. This base item applies to work included in the base items only.
   b. This base item also consists of all survey work and construction staking necessary to adequately control the work and set horizontal and vertical alignments. Contractor shall establish control points and perform all surveying and staking necessary to locate the irrigation system as shown on the drawings and described in the specifications. The Contracting Officer shall approve all alignments and layouts before construction begins.
   c. Payment shall be made at the contract lump-sum price.

2. Base Item No. 2 – Demolition, Clearing & Grubbing
   a. This base bid item consists of all equipment, labor, and associated cost to remove and dispose of brush, weeds, vegetation, and debris within 3-feet of the proposed improvements where noted on the project drawings. Site work also includes associated minor earthwork or grading involved with clearing and grubbing activities. Work includes all associated removal, waste handling and hauling.
   b. This base bid item also includes demolition of existing irrigation components, water well components, water supply piping and valves, concrete valve access box with metal doors, and concrete hardscape. Site work also includes associated minor earthwork or grading involved with demolition activities. Work includes all associated demolition, removal, waste handling and hauling.
   c. Payment shall be made at the contract lump sum price (LSQ).

3. Base Item No. 3 – Well, Well Pump, Pressure Tank, and Controllers – Day-Use Site
   a. This base item consists of all materials, personnel, equipment and supplies to replace the existing well pump, pitless adapter, all galvanized steel piping, install a new water pressure tank, install new pump controller with pressure switch, and install an irrigation clock with weather sensors for the day-use area as shown on the drawings and described in the specifications. Work includes all associated earthwork, trenching, backfill, plumbing, fittings, and all associated electric.
   b. Payment shall be made at the contract lump sum price (LSQ).

4. Base Item No. 4 – Irrigation Mainline & Valves (Zones #1-9 & Cistern) – Day-Use Site
   a. This base item consists of all materials, personnel, equipment, and supplies to install the 2" diameter irrigation mainline, 2" remote control valves, 2" manual ball valves for zones #1-9, and connection to the cistern piping, as shown on the drawings and as described in the specifications. Work includes all associated earthwork, excavation, trenching and backfill, plumbing, piping, fittings, wiring, and all associated electrical work.
   b. Payment shall be made at the contract lump sum price (LSQ).

5. Base Item No. 5 – Irrigation Lateral Lines (Zones #1-9) – Day-Use Site
   a. This base item consists of all materials, personnel, equipment and supplies to install 2" diameter irrigation piping and insert fittings, sprinkler heads, sprinkler nozzles for zones #1-9 in the day-use area as shown on the drawings and described in the specifications. Work includes all associated earthwork, trenching with backfill, sleeving, pipe fittings, pipe laying, piping, sprinkler head and nozzle installation, pressure testing with adjustments, as shown on the drawings, and as described in the specifications.
   b. Payment shall be made at the cost per linear foot of the designed quantities (DQ).

E. Optional Bid Items (OBI):

1. Option Item No. 1 – Irrigation Mainline & Valves (Zones #10-11) – Day-Use Site
   a. This option item consists of all materials, personnel, equipment, and supplies to install the 2" diameter irrigation mainline, and 2" remote control valves for zones #10 and #11 as shown on the drawings and as described in the specifications. Work includes all associated earthwork, excavation, trenching and backfill, plumbing, piping, fittings, wiring, and all associated electrical work.
   b. Payment shall be made at the contract lump sum price (LSQ).

2. Option Item No. 2 – Irrigation Lateral Lines (Zones #10-11) – Day-Use Site
   a. This option item consists of all materials, personnel, equipment and supplies to install irrigation piping, sprinkler heads, sprinkler nozzles for zones #10 and #11 in the day-use area as shown on the drawings and described in the specifications. Work includes all associated earthwork, trenching with backfill, sleeving, pipe fittings, pipe laying, piping, sprinkler head and nozzle installation, pressure testing with adjustments as shown on the drawings, and as described in the specifications.
   b. Payment shall be made at the cost per linear foot of the designed quantities (DQ).

3. Option Item No. 3 – Irrigation Mainline & Valves (Zones #12-14) – Day-Use Site

a. This option item consists of all materials, personnel, equipment, and supplies to install the 2" diameter irrigation mainline, and 2" remote control valves for zones #12-14 as shown on the drawings and as described in the specifications. Work includes all associated earthwork, excavation, trenching and backfill, plumbing, piping, fittings, wiring, and all associated electrical work.
b. Payment shall be made at the contract lump sum price (LSQ).

4. Option Item No. 4 – Irrigation Lateral Lines (Zones #12-14) – Day-Use Site
   a. This option item consists of all materials, personnel, equipment and supplies to install irrigation piping, sprinkler heads, sprinkler nozzles for zones #12-14 in the day-use area as shown on the drawings and described in the specifications. Work includes all associated earthwork, trenching with backfill, sleeving, pipe fittings, pipe laying, piping, sprinkler head and nozzle installation, pressure testing with adjustments as shown on the drawings, and as described in the specifications.
   b. Payment shall be made at the cost per linear foot of the designed quantities (DQ).
5. Option Item No. 5 – Well, Well Pump, Controllers, Pressure Tank, Mainline, Valves, and Enclosure - Group Site
   a. This option item consists of all materials, personnel, equipment and supplies to replace the existing well pump, pitless adapter, all galvanized steel piping, install a new water pressure tank, install new pump controller with pressure switch, install an irrigation clock with weather sensors, 2" irrigation mainline, 2" remove control valves, and construct a storage shed for the group site as shown on the drawings and described in the specifications. Work includes all associated earthwork, trenching, backfill, plumbing, fittings, pressure testing, carpentry, and all associated electric.
   b. Payment shall be made at the contract lump sum price (LSQ).
6. Option Item No. 6 – Irrigation Lateral Lines (Group Site)
   a. This option item consists of all materials, personnel, equipment and supplies to install irrigation piping, sprinkler heads, sprinkler nozzles for the group site zones as shown on the drawings and described in the specifications. Work includes all associated earthwork, trenching with backfill, sleeving, pipe fittings, pipe laying, piping, sprinkler head and nozzle installation, pressure testing with adjustments as shown on the drawings, and as described in the specifications.
   b. Payment shall be made at the cost per linear foot of the designed quantities (DQ).

PART 3 – ACCIDENT PREVENTION

3.1 DESCRIPTION

A. This section consists of establishing an effective accident prevention plan and providing a safe environment for personnel and visitors.

3.2 SUBMITTALS

A. Traffic Plan: Before on-site work begins, submit a plan to handle vehicular and pedestrian traffic for each of the project sites. Submittal shall also include a schedule.

B. Accident Prevention and Safety Plan: Before on-site work begins, submit a company approved accident prevention plan. This plan will be posted in the contract file. Design the plan to address Federal, State, and Local Occupational Safety and Health requirements that apply to this project. No progress payments will be processed until the plan is received. As a minimum the plan shall include:

1. Name, position title and contact information of company executive responsible for approving the Accident Prevention Plan.
2. Name and contact information of supervisor responsible to carry out the plan.
3. Outline of each phase of the work, the hazards associated with each major phase, and the methods proposed to ensure property protection and safety of the public, government personnel, and the Contractor's employees. Identify the work included under each phase by reference to specification section or division numbers.
4. Contingency plans for emergency situations such as medical, fire, hazard material spills and other contract assessed hazard prevention and abatement requirement needs that apply to this project.

C. Certificates: Provide certificates from a mechanic that all mechanical equipment has been inspected and meets OSHA requirements.

D. Submit a copy of test reports, as required by OSHA, for personnel working with hazardous materials.

E. Submit a brief report of safety meetings and of inspections.

F. Upon request, submit proof of employees' qualifications to perform assigned duties in a safe manner.

3.3 QUALITY ASSURANCE

A. Clauses entitled "Accident Prevention" and "Permits and Responsibilities" of the General Provisions: In case of conflicts between Federal, state, and local safety and health requirements, the most stringent shall apply. Equipment or tools not meeting OSHA requirements will not be allowed on the project sites. Failure to comply with the requirements of this section and related sections may result in suspension of work.

B. Qualifications of Employees: Ensure employees are physically qualified to perform assigned duties in a safe manner.

3.4 ACCIDENT REPORTING

A. Reportable Accidents: A reportable accident is defined as death, occupational disease, traumatic injury to employees or the public, property damage by accident in excess of

$100, and fires. Within 7 calendar days of a reportable accident, fill out and forward to the CO a CA-1 form, which may be obtained from CO.

B. All Other Accidents: Report all other accidents to the CO as soon as possible and assist the CO and other officials as required in the investigation of the accident.

3.5 FIRST AID FACILITIES

A. Provide adequate facilities for the number of employees and the type of construction at the site.

3.6 PERSONNEL PROTECTIVE EQUIPMENT

A. Meet requirements of NIOSH and MSHA, where applicable, as well as ANSI.

B. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair, as appropriate, personal items before issuing them to another individual.

C. Inspect and maintain other protective equipment and devices before use and on a periodic basis to ensure safe operation.

3.7 EMERGENCY INSTRUCTIONS

A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at the work site.

3.8 SAFETY MEETINGS

A. As a minimum, conduct weekly 15-minute "toolbox" safety meetings. These meetings shall be conducted by a foreman and attended by all construction personnel at the worksite.

3.9 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

A. The CO will designate a hard hat area. Post the hard hat area in a manner satisfactory to the CO.

B. It is the Contractor's responsibility to require, at all times, that all those working on or visiting the site to wear hard hats and other necessary personal protective equipment. As a minimum, provide two hard hats for use by visitors. Change liners or clean and disinfect before reissuing hats.

3.10 TRAINING

A. First Aid: Provide adequate training to ensure prompt and efficient first aid.

B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage. Hazardous materials are defined as

explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.

PART 5 – EXECUTION REQUIREMENTS

5.1 DESCRIPTION

A. This section consists of general procedural requirements governing execution of the Work including, but not limited to, the following:

1. General installation of products.
2. Progress cleaning.
3. Protection of installed construction.
4. Correction of the Work.

5.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly.

B. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to CO. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

5.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

B. Comply with manufacturer's written instructions and recommendations for installing products.

C. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

5.4 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

D. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

5.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

5.6 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

PART 6 – CLOSEOUT PROCEDURES

6.1 DESCRIPTION

A. This section consists of administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Final cleaning.

6.2 SUBSTANTIAL COMPLETION

A. Definition of Substantial Completion: The Date certified by the Contracting Officer when construction is sufficiently complete, in accordance with the Contract Documents, so the Government can occupy or utilize the Work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

B. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Contracting Officer (CO) of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, final certifications, and similar documents.

4. Obtain and submit releases permitting Government unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Government. Label with manufacturer's name and model number where applicable.
7. Complete startup testing of systems.
8. Submit changeover information related to Government occupancy, use, operation, and maintenance.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

C. Inspection: Submit a written request for inspection for Substantial Completion at least 24 hours before inspection is needed. On receipt of request, CO will either proceed with inspection or notify Contractor of unfulfilled requirements. CO will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by CO, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

6.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit certified copy of CO's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by CO. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
3. Instruct Government personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance at least 24 hours before inspection is needed. On receipt of request, CO will either proceed with inspection or notify Contractor of unfulfilled requirements. CO will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

6.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit one electronic copy of the list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

6.5 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for CO's reference during normal working hours.

B. As-Built Drawings: Maintain and submit, upon contract completion, two physical sets and one electronic copy of As-Built Contract Drawings and Shop Drawings.
   1. The contractor shall keep and maintain current red-lines on-site and shall be regularly monitored. Monthly progress payments shall be withheld if as-built drawings are not being maintained.
   2. Electronic as-built drawings shall be in both PDF and AutoCAD 2018 DWG formats.
   3. As-built drawings shall show the actual construction or installation where construction or installation varies from that shown originally. Require individual or entity who obtained the data, whether individual or entity is installer, subcontractor, or similar entity, to prepare the as-built drawings.
      a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
      b. Record data as soon as possible after obtaining it. Record and check the as-builts before enclosing concealed installations.
   4. Mark as-built sets to clearly distinguish between changes for different categories of the Work at the same location.
      a. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

6.6 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

C. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Remove tools, construction equipment, machinery, and surplus material from Project site.
3. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Government property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 010200
CONTROL OF MATERIALS

PART 1 - GENERAL

1.01 HANDLING MATERIALS

A. All materials shall be transported and handled to preserve their quality and fitness for the work.

B. Aggregates shall be stockpiled, loaded, and transported in a manner that will preserve specified gradation and avoid contamination. Stockpiles of aggregate having different gradations shall not be intermingled.

C. Soils or soil amendments shall be stockpiled, loaded, and transported in a manner that will preserve the integrity and avoid contamination.

1.02 SAMPLING & TESTING

A. For contractor-furnished sources, the contractor shall submit test results and a Certificate of Compliance that states that the aggregate meets the contract requirements.

1.03 MATERIAL SOURCES

A. Designated Sources. Specific government designated sources are not available.

B. Contractor-Furnished Sources shall be non-Forest Service sources supplied from a commercial rock source.

C. Quality testing in conformance with applicable requirements and acceptable to the CO to establish the equivalency of the product shall be the responsibility of the contractor. Test results shall be furnished to the CO.

END OF SECTION 010200

SECTION 010250
MEASUREMENT & PAYMENT

PART 1 – GENERAL

1.01 MEASUREMENT & PAYMENT

A. Measurement and payment for contract work will be made only for and under those payitems included in the SCHEDULE OF ITEMS. All other work and materials will be considered as included in the payment for items shown.

1.02 DETERMINATION OF QUANTITIES

The following measurements and calculations are used to determine contract quantities.

A. For individual construction items, longitudinal and lateral measurements for area computations will be made horizontally or corrected to horizontal measurement unless otherwise specified. Measurements for seeding, mulching, geotextiles, netting, and erosion control blankets will be along slope lines.

B. The average end area method will be used to compute volumes of excavation or embankment. However, if in the judgment of the CO, the average end area method is impractical, measurement will be made by volume in hauling vehicles or by other three-dimensional methods.

C. Structures will be measured according to neat lines SHOWN ON THE DRAWINGS or as altered by the CO in writing to fit field conditions.

D. For items that are measured by the linear foot, such as irrigation pipe, pipe culverts, fencing, guardrail, and underdrains, measurements will be made parallel to the base or foundation upon which the structures are placed. Pipe and pipe arch culverts shall be measured along center of invert and arches shall be measured at spring line.

E. For standard manufactured items identified by gauge, weight, section dimensions, and so forth, such identifications shall be considered the nominal weights or dimensions. Unless controlled by tolerances in cited specifications manufacturer's tolerances will be accepted.

1.03 UNITS OF MEASUREMENT

A. Payment will be by units defined and determined according to U.S. Standard measure and by the following:

a. Lump Sum. Do not measure directly. The bid amount is complete

payment for all work described in the contract and necessary to complete the work for that item.

b. Linear Feet (LF). One linear foot measured horizontally.

1.04 METHODS OF MEASUREMENT

A. One of the following methods of measurement for determining final payment is DESIGNATED on the SCHEDULE OF ITEMS for each pay item:

a. Designed Quantities (DQ). These quantities denote the final number or units to be paid for under the terms of the contract. They are based upon the original design data available prior to advertising the project. Original design data include the preliminary survey information, design assumptions, calculations, drawings, and the presentation in the contract. Changes in the number of units SHOWN in the SCHEDULE OF ITEMS may be authorized under any of the following conditions:

i. As a result of changes in the work authorized by the CO.

ii. As a result of the CO determining that errors exist in the original design that cause a pay item quantity to change by 15 percent or more.

iii. As a result of the contractor submitting to the CO a written request showing evidence of errors in the original design that cause a pay item quantity to change by 15 percent or more. The evidence must be verifiable andconsist of calculations, drawings, or other data that show how the designed quantity is believed to be in error.

b. Actual Quantities (AQ). These quantities are determined from measurements of completed work. The contractor shall be responsible for measuring all "AQ" items.

c. Lump Sum Quantities (LSQ). These quantities denote one complete unit of work asrequired by or described in the contract, including necessary materials, equipment, and labor to complete the job. They will not be measured.

END OF SECTION 010250

SECTION 013200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Daily construction reports.
3. Field condition reports.

B. See Division 1 Section "Price and Payment Procedures" for submitting the Schedule of Values.

1.2 SUBMITTALS

A. Contractor's Cost Loaded Construction Schedule: Submit one electronic copy of initial schedule.

1. Include type of schedule (Initial or Updated) and date on label.

B. Daily Construction Reports: Submit one electronic copy at weekly intervals.

C. Field Condition Reports: Submit one electronic copy at time of discovery of differing conditions.

1.3 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Cost Loaded Construction Schedule with the list of subcontracts, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of workers, including subcontractors, at Project site.
2. Summary of work completed.
3. Equipment at Project site.
4. Material deliveries.
5. High and low temperatures and general weather conditions.
6. Accidents.
7. Stoppages, delays, shortages, and losses.
8. Meter readings and similar recordings.
9. Orders and requests of authorities having jurisdiction.
10. Services connected and disconnected.
11. Equipment or system tests and startups.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

3.2 PROJECT SCHEDULE GENERAL REQUIREMENTS

A. Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Subcontractors and suppliers working on the project must also contribute to developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

B. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 60 days of date established for the Notice of Award.

3.3 BASIS FOR PAYMENT AND COST LOADING SCHEDULE

A. The schedule is the basis for determining contract earnings during each update period

and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN or Bid Schedule Item must equal the value of the CLIN or Bid Schedule Item.

B. Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

C. Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial, or periodic schedule updates and subsequent rejection of payment requests until compliance is met. In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

3.4 PROJECT SCHEDULE DETAILED REQUIREMENTS

A. Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

1. Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non- procurement activities may have Original Durations (OD) greater than 20 workdays or 30 calendar days.

2. Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

B. Contract Milestones and Constraints: Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited. Mandatory constraints that ignore or effect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case-by-case basis.

1. The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

2. The last activity in the schedule must be a finish milestone titled "End Project."

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path.

3. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

4. Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

5. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

   a. Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

   b. Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.5 SCHEDULE UPDATES

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

   3. As the Work progresses, indicate Actual Completion percentage for each activity.

   4. Schedule updates and agreement to schedule item percentages complete will precede applications for partial payment.

B. Distribution: Distribute copies of approved schedule to Contracting Officer, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

   1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013223
CONSTRUCTION SURVEYING AND STAKING

PART 1 – GENERAL

1.1 SUMMARY OF WORK

A. This work shall consist of the construction staking of the project by the methods specified herein, or another acceptable coordinate geometry method. The items to be surveyed and staked include trails and pathways, drainage features, culverts, dumpster pad and enclosures, irrigation, underground utilities, and other related site work shown on the drawings, from coordinates and control points shown on the drawings. The work includes furnishing all labor, equipment, instruments, stakes, materials, transportation, and other incidentals necessary to complete the construction staking in accordance with these specifications and acceptable engineering practices. The work shall also include setting grade-finishing stakes and/or red and blue tops for surfacing and concrete forming.

B. Construction staking shall be accomplished under the direction of a Colorado Registered Professional Engineer or Land Surveyor. The Professional Engineer or Land Surveyor will be closely associated and familiar with the construction staking; periodic visits to the project site are required.

C. Measurement shall be lump sum for surveying and staking the project through all phases of construction.

PART 2 – PRODUCTS

2.1 STAKES

A. Identification stakes and hubs shall be of sufficient length and width (nominal size of 1”x2”x18”) to provide and solid set in the ground and to provide space for marking above ground when applicable. Other dimensions and materials may be used, such as steel reinforcing bars, wire flagging and markers, and metal pins, if approved in writing by the Contracting Officer (CO). The top 2 inches of all slope, guard, reference, clearing, and structure stakes shall be painted or marked with plastic flagging. Colors used on stakes or for flagging shall be as follows:

1. Miscellaneous Items - Blue/White Striped
2. Roadway/Parking Lot Centerline - Red
3. Roadway Centerline Reference Points - Red and White
4. Temporary Benchmarks - Yellow
5. Slope Stakes - Orange
6. Drainage Structures - Blue
7. Slope Stakes Reference Points - Orange and White
8. Drainage Structures Reference Points - Blue and White

9. Cross-Section Alignment - Orange wire flag
10. Clearing Limits - Yellow
11. Archaeological Sites - Pink/Black Striped Flagging

B. And others as agreed to by the Contracting Officer.

2.2 SURVEY NOTE PAPER AND BOOKS

A. Paper for survey notes shall be moisture-resistant paper. Notes shall be contained in books with covers that will protect the contents and retain the pages in numerical sequence during field use. Field notebooks or note paper shall be furnished by the contractor. All notes shall become the property of the Government.

B. Upon completion of a portion of any staking involving grading, a cut sheet shall be prepared showing, at a minimum, point number or station, offset (if any) stake elevation, proposed grade and cut or fill. The Contractor shall submit one (1) copy of the cut sheets to the Contracting Officer in addition to any copies required by the Contractor's work crews.

C. At the conclusion of construction, a set of construction drawings reflecting the actual locations and elevations of all contract features, as constructed, shall be submitted to the Contracting Officer.

2.3 GOVERNMENT-FURNISHED DOCUMENTS

A. The Contractor shall be furnished electronic and/or hardcopy drawings, location, and coordinates of control points, if available.

PART 3 - EXECUTION (SURVEY REQUIREMENTS)

3.1 SURVEY NOTES

A. The Contracting Officer shall approve format for submitted slope stake notes. A sample format will be supplied upon request from the Contractor.

B. Manually recorded survey notes shall be printed in characters at least 0.15 inches height and shall be legible at a distance of 2.5 feet. Errors shall be deleted by lining out. Date, crew names, and positions, instrumentation, and weather shall be recorded in the notes at the beginning of each day's work. The party chief shall sign or initial each page of the notes immediately after the last entry for each day's work.

C. Electronically recorded survey notes shall be consecutively numbered and headed to identify the contents. The notes shall be supported and accompanied by a bound Day Book that records the project name and for each day identifies date, crew names and positions, instrumentation, weather, type of survey, stationing of sections between which survey was performed, and survey data or sketches that cannot be electronically recorded. The party chief shall sign or initial the electronically recorded note and Day Book immediately after the last entry for each day's work.

3.2 MARKING STAKES

A. All stakes shall be legibly marked in a format approved by the Contracting Officer. A sample format will be provided upon request from the Contractor. Marking shall conform to the nomenclature below:

PI .....Point of Intersection of tangents
PC.....Point of Curvature
POC.....Point on Curve
PT .....Point of Tangency
POT .....Point on Tangent
RP.....Reference Point
P .....P-Line (Preliminary location line)
L .....L-Line (Final location line)
BM .....Benchmark
TBM.....Temporary Benchmark
BT.....Begin Taper (any)
ET.....End Taper (any)
BFTO .....Begin Full Turnout
EFTO.....End Full Turnout
BFEW.....Begin Full Extra Widening
EFEW.....End Full Extra Widening
DD.....Drain Dip
C .....Cut
F .....Fill
CL.....Centerline
D.....Ditch
W.....Width

3.3 PRECISION AND ACCURACY REQUIREMENTS

A. Reestablishing Centerline, Traverse, and Level Circuits

1. Minimum Position Closure: 1/1000
2. Angular Accuracy: 2 sets, direct/reverse, 20” rejection limit
3. Centerline Tangent Control Points: 0.1’ (accuracy of offset measurements)
4. Vertical Closure: 0.01 ft/sta

B. Cross-Sections and Slope-Stakes

1. Allowable deviation of cross section line projection from a true perpendicular to tangents, a true bisector of angle points, or a true radius of curves = ±3°.
2. Cross section topography measurements shall be taken so that variations in ground from a straight line connecting the cross-section points will not exceed 1.0 ft.
3. Horizontal and vertical accuracy for cross sections in feet or percentage of horizontal distance measured from traverse line, whichever is greater = 0.15 ft or 0.6%.

4. Horizontal and vertical accuracy for slope stake, slope stake references, and clearing limits in feet or percentage of horizontal distance measured from centerline or reference stake; whichever is greater:
   a. Slope reference stakes and slope stakes = 0.15 ft or 0.6%.
   b. Clearing limits = 1.0 ft.

C. Maximum allowable deviation from construction stakes and drawings:

1. Base Course Width = +0.2 feet
2. Sub Grade Elevation = +0.05 feet
3. Centerline and Offset Alignments = +0.1 feet
4. Slopes and Earthwork (Percent Slope) = +3%
5. Curbs, Gutters, Sidewalks, Drainage, and Other Structures
   a. Elevation = +0.1 feet
   b. Horizontal = +0.1 feet
6. Utilities
   a. Elevation = +0.1 feet
   b. Horizontal = +0.1 feet

3.4 SURVEY CONTROL POINTS AND BENCHMARKS

A. In the process of preparing the topographic map of the project site, prior to design, a network of survey control points/benchmarks has been established on the ground. The coordinates and elevations of these physical markers, and their locations, are shown on the drawings, and form the basis for construction staking. All horizontal and vertical control shall be generated from these control points. Depending upon the layout of the proposed project, control points may be required in additional and/or alternative locations. It is the responsibility of the Contractor to maintain existing control points and set supplemental points as required for proper staking.

B. Physical standards for new and replacement markers:

1. Markers set in ground shall be rebar or pipe at least 1/2 inch in diameter and 18 inches in length, with a metallic cap at least 1.5 inches in diameter.
2. Markers set in existing pavement or other hard surfaces may be 40 penny or greater nails or "PK" nails with a metallic disc or washer at least 1.5 inches outside diameter.
3. At a minimum, the cap or washer will be stamped with the unique identifying point number. This number is typically the next unused number in the series indicated by the existing control points provided by the Forest Service. Other markings may include "CP" and "USFS" or the name of the firm setting the point. If the Contractor's surveyor has similar markers with prestamped markings, these may be used. However, some markings must be added or deleted to indicate that the marker is not a property or land boundary monument.

C. Method of survey for new survey control points:

1. New control points will be set by traversing through the new points and two (2) existing control points and measuring the closing angle at the second existing point. If ratio of closure meets the precision and accuracy standards defined in paragraph 3.3 above, the coordinates of the new points will be adjusted by any standard traverse adjustment method.
2. Where single control points are added between two (2) existing points, the new point may set as in C.1. above, or by locating the new point from two (2) existing points. If the error circle for the two different coordinate positions meets the precision and accuracy standards defined in paragraph 3.3 above, the coordinates of the new point will be the mean of the two observed positions.
3. Conventional differential levels or three-dimensional traverse ("trig. levels") may be used to determine elevations as long as closures meet the precision and accuracy standards defined in paragraph 3.3 above.

3.5 DISCREPANCIES AND ADJUSTMENTS

A. The Contractor shall compare the staked centerline horizontal and vertical alignment with the design data. Differences between previously recorded and observed elevations of benchmarks shall be referred to the Contracting Officer. Differences exceeding 1 degree in angle from the alignment data shown on the drawings and the alignment observed on the ground shall be referred to the Contracting Officer. Differences in centerline profile elevations exceeding 1 foot at any two or more consecutive points shall be reported to the Contracting Officer for evaluation and possible revision. Staking of these areas shall be deferred until the Contracting Officer resolves these differences.

B. Simple adjustments such as blending fillet curves to remove overlaps shall be completed by the Contractor by adjusting the radius of the smaller curve. All other necessary adjustments shall be referred to the Contracting Officer.

3.6 CLEARING LIMIT, SLOPE, AND REFERENCE STAKES

A. Clearing limits shall be staked when requested by the Contracting Officer.

1. The clearing limits shall be located on the ground to the dimensions shown on the drawings or specified by the Contracting Officer.
2. The location shall be within the tolerances specified in paragraph 3.3 above.
3. The clearing limits shall be marked with lath, flagged, or other methods approved by the Contracting Officer.
4. Method for recording clearing limit data on stakes shall be approved by the Contracting Officer.

B. Slope-catch points and slope reference stakes shall be established. The position of these stakes shall be determined by methods that will produce on the ground the designed template shown on the drawings to the precisions shown above and specified for this contract.

1. Method for recording slope stake information on stakes shall be approved by the Contracting Officer.

C. The Contractor shall establish slope reference stakes at a minimum horizontal distance of 10 feet beyond the slope catch point (or clearing limits).

1. The elevation and location of slope reference stakes shall be verified for accuracy by differential leveling between slope reference stakes of adjacent sections.
   a. Where the difference in reference stake elevation between that established by slope staking and that observed by differential leveling exceeds the allowed tolerance, the slope stake shall be reset.
2. Record on the reference stakes the horizontal distance to centerline and the vertical distance to the construction grade.
3. The offset from the slope stake catch point and slope stake catch point information shall be recorded on the reference stake and in the slope stake book.
4. Method for recording slope stake information on reference stakes shall be approved by the Contracting Officer.

3.7 MONUMENTS OF PROPERTY BOUNDARIES OR SURVEYS OF OTHER AGENCIES

A. If property boundary or survey monuments, or survey markers of other agencies, are found within or adjacent to the construction limits, the Contractor shall immediately notify the Contracting Officer.

3.8 STAKING DRAINAGE AND OTHER STRUCTURES

A. Stakes shall be set at all drop inlet and manhole locations. A reference stake and hub shall be set on the centerline 10 feet from each end or beyond the clearing limit, whichever is greater. The following shall be recorded on these stakes:

1. Diameter, size, and type of structure.
2. The vertical and horizontal distance from hubs to the centerline invert.

B. The Contracting Officer prior to commencement of construction shall review other structures located in conjunction with site staking. Adjustments necessary for any relocation of said structures shall be furnished to the Contractor. This shall be considered a changed condition.

3.9 GRADE FINISHING STAKES

A. Finishing stakes shall be set. Sub grade finishing stakes shall be blue tops. Base course finishing stakes shall be red tops.

B. Stakes shall be nominal 1-inch by 1-inch hubs and shall be of sufficient length to provide a solid set.

C. Finishing stakes shall be placed at all centerline stations established. Stakes shall be set at Centerline and at the edge of finished surface.

D. Finishing stakes shall be set when sub grade is within 0.5 feet, or base course is within 0.2 feet of final grade. The stakes shall be set to the nearest 0.02 feet of the measured grade line.

3.10 STAKE APPROVAL AND MAINTENANCE

A. Construction work shall not begin within a roadway segment until the Contracting Officer has approved the stakes, marks, and controls established by the Contractor in writing. The minimum segment for approval shall be 2,000 feet or the length of the project; whichever is less.

B. Approval of the construction staking will not relieve the Contractor of the responsibility for maintaining the survey work and for correcting errors, whether the errors are discovered during the actual survey work or in subsequent phases of the project. Stakes within the roadway need not be maintained after clearing operations have started.

END OF SECTION 013223

SECTION 013300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Submittal Descriptions (SD) - The following information communicates different classifications of submittals and a description, list of typical submittals under that classification or other relevant information.

a. SD-01 Preconstruction Submittals - Preconstruction submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

i. Certificates Of Insurance
ii. Surety Bonds
iii. List Of Proposed Subcontractors
iv. List of Proposed Products
v. Baseline Network Analysis Schedule (NAS)
vi. Submittal Register
vii. Schedule Of Prices or Earned Value Report
viii. Work Plan
ix. Quality Control (QC) Plan
x. Environmental Protection Plan

b. SD-02 Shop Drawings

i. Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work.
ii. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.
iii. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

c. SD-03 Product Data

i. Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems, or equipment for some portion of the work.
ii. Samples of warranty language when the contract requires extended product warranties.

d. SD-04 Samples

i. Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a

material or product and establish standards by which the work can be judged.

ii. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

iii. Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

e. SD-05 Design Data

i. Design calculations, mix designs, analyses, or other data pertaining to a part of work.

f. SD-06 Test Reports

i. Report signed by authorized official of testing laboratory that a material, product, or system identical to the material, product, or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

ii. Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

iii. Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

iv. Investigation reports Daily logs and checklists.

v. Final acceptance test and operational test procedure.

g. SD-07 Certificates

i. Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements.

1. Must be dated after award of project contract and clearly name the project.

ii. Document required of Contractor, or of a manufacturer, supplier, installer, or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

iii. Confined space entry permits.

iv. Text of posted operating instructions.

h. SD-08 Manufacturer's Instructions

i. Preprinted material describing installation of a product, system, or material, including special notices and (SDS) concerning impedances, hazards and safety precautions.

i. SD-09 Manufacturer's Field Reports

i. Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions.
    1. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.
ii. Factory test reports.

j. SD-10 Operation and Maintenance (O&M) Data
    i. Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.
    ii. Data required by operating and maintenance personnel for the safe and efficient operation, maintenance, and repair of the item.
    iii. Data incorporated in an operations and maintenance manual or control system.

k. SD-11 Closeout Submittals
    i. Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.
    ii. Submittals required for Guiding Principal Validation (GPV) or Third-Party Certification (TPC).
    iii. Special requirements necessary to properly close out a construction contract.
        1. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2 SUBMITTALS

A. Government approval is required for Action Submittals. Informational Submittals are For Information Only (FIO). When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with this section.

a. SD-01 Preconstruction Submittals Submittal Register - G

1.3 SUBMITTAL CLASSIFICATION

A. Action Submittals for Government Approval

a. Government approval is required for extensions of design, critical materials, deviations, variations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer
b. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS

FOR CONSTRUCTION, submittals are considered to be "shop drawings."

B. Approved Submittals

a. The Contracting Officer's approval of submittals shall not be construed as a complete check but will indicate only that the general method of construction, materials, detailing, and other information are satisfactory.
b. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

C. Disapproved Submittals

a. The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause CHANGES, shall be given promptly to the Contracting Officer.

D. Withholding Of Payment

a. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

E. For Information Only (FIO)

a. Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.4 SUBMITTAL PROCEEDURES

A. General: The following procedure requirements pertain to all submittals regardless of the method utilized for submission.

a. Review each submittal and check for compliance with the Contract Documents. Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
b. Contracting Officer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
c. Submittals not required by the Contract Documents will not be reviewed and may be discarded.
d. Use only final submittals with mark indicating action taken by CO in

connection with construction.

B. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on CO's receipt of submittal.

a. Initial Review: Allow 10 working days for initial review of each submittal.
    i. Allow additional time if processing must be delayed, to permit coordination, with subsequent submittals. CO will advise Contractor when a submittal being processed must be delayed for coordination.
b. If intermediate submittal is necessary, process it in same manner as initial submittal.
c. Allow 10 working days for processing each re-submittal.
d. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

C. Identification: Stamp each submittal with a uniform approval stamp. Place a permanent label or title block on each submittal for identification.

a. Indicate name of firm or entity that prepared each submittal on label or title block.
b. Provide a space approximately 2 by 3 inches on label or beside title block to record Contractor's review and approval markings and action taken by CO.
c. Include the following information on label for processing and recording action taken:
    i. Project name.
    ii. Date.
    iii. Name and address of Contractor.
    iv. Name of manufacturer.
    v. Unique identifier, including revision number.
    vi. Number and title of appropriate Specification Section.
    vii. Drawing number and detail references, as appropriate.
    viii. Other necessary identification.

D. Electronic Submittal Procedures: Utilize electronic submittal procedure.

a. Preparation of Submittals: Use any or all the following options:
    i. Subcontractors and Suppliers provide electronic (PDF) submittals to General/Prime Contractor.
    ii. Subcontractors and Suppliers provide paper submittals to General/Prime Contractor who electronically scans and converts to PDF format.
    iii. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to

PDF format.

b. Before submitting submittals to the Contracting Officer, apply electronic approval stamp certifying the submittal complies with the requirements of the Contract Documents including verification of manufacturer/product, dimensions, and coordination of information with other parts of the work.

c. Transmit or e-mail each submittal to the Contracting Officer.

d. Government review comments will be provided electronically to the General/Prime Contractor upon completed review.

e. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the General/Prime Contractor. Use only final submittals with mark indicating action taken by Contracting Officer in connection with construction.

f. Submit two sets of paper copies, in addition to all electronic submittals, of reviewed submittals at project closeout for record purposes in accordance with "Closeout Procedures" in this section.

g. Internet Service and Equipment Requirements:
   i. Email address and Internet access at Contractor's main office.
   ii. Software: Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

1.5 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections. Submit Action Submittals, except for Application for Payment, electronically.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   a. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   b. Mark each copy of each submittal to show which products and options are applicable.
   c. Include the following information, as applicable:
      i. Manufacturer's written recommendations.
      ii. Manufacturer's product specifications.
      iii. Manufacturer's installation instructions.
      iv. Manufacturer's catalog cuts.
      v. Wiring diagrams showing factory-installed wiring.
      vi. Compliance with recognized trade association standards.
      vii. Compliance with recognized testing agency standards.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale in electronic format. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

a. Include the following information, as applicable:
   i. Dimensions.
   ii. Identification of products.
   iii. Fabrication and installation drawings.
   iv. Roughing-in and setting diagrams.
   v. Wiring diagrams: Differentiate between manufacturer installed and field installed wiring. Show field-installed wiring, including power, signal, and control wiring.
   vi. Notation of dimensions established by field measurement.

D. Requests for Information (RFI's): Immediately on discovery of the need for additional information or interpretation of the Contract Documents, prepare and submit an RFI in electronic form.

a. RFI's submitted by entities other than the Contractor shall not be accepted.
b. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
c. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   i. Project name.
   ii. Project number.
   iii. Date.
   iv. Name of Contractor.
   v. Name of Contracting Officer.
   vi. RFI number, numbered sequentially.
   vii. RFI subject.
   viii. Specification Section number and title and related paragraphs, as appropriate.
   ix. Drawing number and detail references, as appropriate.
   x. Field dimensions and conditions, as appropriate.
   xi. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   xii. Contractor's signature.
   xiii. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
      1. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
d. CO's Action: CO will review each RFI, determine action required, and respond. Allow seven (7) working days for CO's response for each RFI. RFIs received by CO after 1:00 p.m. will be considered as received the following working day.

e. CO's action may include a request for additional information, in which case CO's time for response will date from time of receipt of additional information.
f. CO's action on RFIs that may result in a change to the Contract Time, or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Contracting Section "Contract Modification Procedures."
    i. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify CO in writing within 10 days of receipt of the RFI response.
g. On receipt of CO's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify CO within seven (7) days if Contractor disagrees with response.
h. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
    i. Project name.
    ii. Name and address of Contractor.
    iii. Name and address of Contracting Officer.
    iv. RFI number including RFIs that were dropped and not submitted.
    v. RFI description.
    vi. Date the RFI was submitted.
    vii. Date CO's response was received.
    viii. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
    ix. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

E. Contractor Quality Control (QC) Submittals: Provide electronic Quality Control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

a. Certifications: Where other Sections of the Specifications require certification that a product, material or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
    i. Signature: Signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
b. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section "Quality Requirements."

F. Contractor Quality Control Plan: Comply with requirements specified in Division 01 Section "Quality Requirements." Provide in electronic format.

G. Application for Payment: Comply with requirements specified in the Contract Clauses and Division 01 Section "Definition of Items & Measurement and Payment". Provide in electronic format.

1.6 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections. Submit Informational Submittals electronically.

a. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Contractor's Quality Control Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at the site, and submit in electronic format to the CO at weekly intervals:

a. List of subcontractors at the site.
b. Approximate count of personnel at the site.
c. High and low temperatures, general weather conditions.
d. Accidents and unusual events.
e. Meetings and significant decisions.
f. Stoppages, delays, shortages, and losses.
g. Meter readings and similar recordings.
h. Emergency procedures.
i. Orders and requests of governing authorities.
j. Change Orders received, implemented.
k. Services connected, disconnected.
l. Equipment or system tests and startups.
m. Partial Completions, occupancies.
n. Substantial Completions authorized.

C. Cost Breakdown: Following award, provide a cost breakdown schedule listing main types of work with associated costs. Provide in electronic format.

D. Schedule of Values: Comply with requirements specified in the Contract Clauses. Provide in electronic format.

E. Accident Prevention Plan: Comply with requirements specified in Division 1 Section "Accident Prevention." Provide in electronic format.

F. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements. Provide in electronic format.

G. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements. Provide in electronic format.

H. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Provide in electronic format.

1.7 SOURCE DRAWINGS FOR SHOP DRAWINGS

A. Source Drawings

a. The entire set of source drawing files (DWG) will not be provided to the

Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

B. Terms and Conditions

a. Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of, or resulting from the use of these electronic files.

b. These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates, or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials, and dates).

C. Electronic File Format and Hard Copy Requirements

a. Electronic Submittals: Transmit submittals in electronic (PDF) format.

b. Electronic submittal process is not intended for color samples, color-charts, or physical material samples. For these items, submit actual items.

c. Provide submittals in electronic format, except for material samples required for SD-04 Samples items. In addition to the electronic submittal, provide three hard copies of the submittals. Three hard copies shall be provided to the government within 24 hours of transmission of the electronic submittal. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents and coordinate the file naming convention with the Contracting Officer. Electronic files

must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

1.8 QUANTITY OF SUBMITTALS

A. The quantities listed below are in addition to electronic submitted files.

B. Number of SD-01 Preconstruction Submittal Copies

a. Unless otherwise specified, submit four sets of administrative submittals.

C. Number of SD-02 Shop Drawing Copies

a. Submit four copies of submittals of shop drawings requiring review and approval by a QC organization. Submit four copies of shop drawings requiring review and approval by the Contracting Officer.

D. Number of SD-03 Product Data Copies

a. Submit in compliance with quantity requirements specified for shop drawings.

E. Number of SD-04 Samples

a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

F. Number of SD-05 Design Data Copies

a. Submit in compliance with quantity requirements specified for shop drawings.

G. Number of SD-06 Test Report Copies

a. Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.

H. Number of SD-07 Certificate Copies

a. Submit in compliance with quantity requirements specified for shop drawings.

I. Number of SD-08 Manufacturer's Instructions Copies

a. Submit in compliance with quantity requirements specified for shop drawings.

J. Number of SD-09 Manufacturer's Field Report Copies

a. Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

K. Number of SD-10 Operation and Maintenance Data Copies

a. Submit four copies of O&M data to the Contracting Officer for review and approval.

L. Number of SD-11 Closeout Submittals Copies

a. Unless otherwise specified, submit four sets of administrative submittals.

1.9 INFORMATION ONLY SUBMITTALS

A. Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.10 PROJECT SUBMITTAL REGISTER

A. A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register."

B. Submittal Management

a. Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required.

   i. Column (c): Lists specification section in which submittal is required.
   ii. Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.
   iii. Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

C. Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

D. Preconstruction Use of Submittal Register

a. Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

   i. Column (a) Activity Number: Activity number from the project schedule.
   ii. Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.
   iii. Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.
   iv. Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

E. Contractor Use of Submittal Register

a. Update the following fields with each submittal throughout the contract:

   i. Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.
   ii. Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.
   iii. Column (l) Date submittal transmitted. Column (q) Date approval was received.

b. Approving Authority Use of Submittal Register Update the following fields:

i. Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

ii. Column (l) Date submittal was received.

iii. Column (m) through (p) Dates of review actions. Column (q) Date of return to Contractor.

F. Action Codes

G. Delivery of Copies

a. Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.11 VARIATIONS

A. Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction and will be considered where advantageous to the Government.

B. Considering Variations

a. Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation that results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

b. Specifically point out variations from contract requirements in transmittal letters. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

C. Proposing Variations

a. When proposing variation, deliver a written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. Include the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item.

b. Clearly mark the proposed variation in all documentation.

D. Warranting that Variations are Compatible

a. When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible

with other elements of work.

E. Review Schedule Extension

a. In addition to the normal submittal review period, a period of 14 days will be allowed for the Government to consider submittals with variations.

1.12 SCHEDULING

A. Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.
b. Submittals required by the contract documents are generally listed on the submittal register. If a submittal is not listed on the register, but it is required by the contract, then the contractor shall add the submittal to the register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."
c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.
d. Contracting Officer review will be completed within 21 days after the date of submission.

1.13 GOVERNMENT APPROVING AUTHORITY

A. When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received.
b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.
d. Upon completion of review of submittals requiring Government approval,

stamp, and date submittals. 3 copies of the submittal will be retained by the Contracting Officer and 1 copies of the submittal will be returned to the Contractor.

B. Review Notations

a. Submittals will be returned to the Contractor with the following notations:

i. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.

ii. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.

iii. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.

iv. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

v. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

1.14 DISAPPROVED SUBMITTALS

A. Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

B. If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.15 APPROVED SUBMITTALS

A. The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained within each submittal accurately conforms with the requirements of the contract documents.

C. After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.16 APPROVED SAMPLES

A. Approval of a sample is only for the characteristics or use named in such approval and is not construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

B. Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract.

   a. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

C. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

D. Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 13300

SECTION 014420
QUALITY CONTROL AND QUANTITY MEASUREMENT

PART 1 -GENERAL

1.01 DESCRIPTION

A. The work of this section consists of preparing and executing a quality control program.

1.02 SUBMITTALS

A. Quality Control Plan: At the time of the preconstruction conference, submit for approval a written Contractor Quality Control (CQC) plan. If the plan requires any revisions or corrections, the Contractor shall resubmit the plan within 10 days. The Government reserves the right to require changes in the plan during the contract period as necessary to obtain the quality specified. No change in the approved plan may be made without written concurrence by the CO. No work shall begin until the CQC is approved by the CO. The plan shall include:

a. A list of personnel responsible for quality control and assigned duties. Include each person's qualifications.

b. A copy of a letter of direction to the Contractor's quality control supervisor outlining assigned duties.

c. Names and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms.

d. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.

e. Methods of performing, documenting, and enforcing quality control of all work.

B. Submittals: Submit Quality Control Report showing all inspections and tests within 3 days following the date covered by the report.

C. Tests: Submit triplicate copies of complete test results not later than three calendar days after the test was performed. Submit failing test results and proposed remedial actions within four (4) hours of noted deficiency.

D. Off Site Inspection Reports: Submit prior to shipment.

E. Progress Payments: If the CQC plan and Daily Quality Control Reports are not submitted in a timely manner, the CO may retain an appropriate amount of the applicable progress payment.

1.03 QUALITY ASSURANCE

A. General: Except for tests or other items of work specified to be performed by the Government, the quality of all work shall be the responsibility of the Contractor. Inspect and test all work often enough to ensure that the quality of materials, workmanship, construction, finish, and functional performance is in compliance with applicable specifications and drawings.

B. Quality Control Staff: The Contractor's job supervisory staff may be used for quality control, supplemented as necessary by additional technicians. The Contractor's designated Quality Control Supervisor shall be employed full time at the project site whenever contract work is in progress.

C. Submit certified independent testing laboratory to perform sampling and testing approved by CO.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 OFF-SITE CONTROL

A. Items that are fabricated or assembled off-site shall be inspected for quality control at the place of fabrication.

3.02 ON-SITE CONTROL

A. Notify the CO at least 24 hours in advance of the initial and follow-up phases.

B. Preparatory: Perform before beginning each feature of work.

a. Review control submittal requirements with personnel directly responsible for the quality control work.

b. Ensure that provisions have been made for field control testing.

C. Initial: As soon as work begins, inspect, and test a representative portion of a particular feature of work for quality of workmanship. Review control testing procedures to ensure compliance with contract requirements.

D. Follow-Up: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.

3.03 DOCUMENTATION

A. Maintain Daily Quality Control Reports of quality control activities and tests. Daily Quality Control Reports may not be substituted for other written reports required under the General Provisions, such as Disputes, Differing Site Conditions, or Changes.

3.04 ENFORCEMENT

A. The Contractor shall stop work on any item or feature pending satisfactory correction of any deficiency noted by the quality control staff or the CO. Construction shall not proceed on any feature of work containing uncorrected work.

PART 4 – MEASUREMENT

4.01 METHOD

A. The method of measurement, as described in Section 01025, will be designated in theSCHEDULE OF ITEMS. Quality control shall include all incidental items, includingbut not limited to travel, per diem, transport of samples, testing of samples, and lab supplies.

PART 5 - PAYMENT

5.01 BASIS

A. The accepted quantities will be paid at the contract unit price for each pay item shown in the SCHEDULE OF ITEMS. Payment to the contractor for work completed will not be made until the applicable inspection report(s), indicating compliance with the contract specifications, have been submitted to the Government and accepted by the CO.

Payment will be made under:

Pay Item	Pay Unit

Payment is incidental to individual line items.

END OF SECTION 014420

SECTION 015050
MOBILIZATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This work shall consist of preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for all other work and operations that must be performed or that cause costs to be incurred prior to beginning work on the various items on the project site.

PART 4 - MEASUREMENT

4.01 METHOD

A. The method of measurement, as described in Section 010250, will be DESIGNATED in the SCHEDULE OF ITEMS.

PART 5 - PAYMENT

5.01 BASIS

A. Mobilization will be paid for at the contract unit price for the item as shown in the SCHEDULE OF ITEMS.

B. Progress payments will be made as follows:

a. When 5 percent or more of the original contract amount is earned from other pay items, 50 percent of the amount for mobilization, or 5 percent of the original contract amount, whichever is less, will be paid.

b. When 10 percent or more of the original contract amount is earned from other pay items, 100 percent of the amount for mobilization, or 10 percent of the original contract amount, whichever is less, will be paid.

c. Upon completion of all work on the project, any unpaid amount for mobilization will be paid.

The total of all payments, including bonding, shall not exceed the original contract amount for this item.

Payment will be made under:

Pay Item	Pay Unit

Payment is incidental to individual line items.

END OF SECTION 015050

SECTION 016440
GOVERNMENT-FURNISHED MATERIALS (GFM)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section applies to materials that shall be provided by the Government and utilized by the Contractor. Contractor shall be responsible for labor, equipment, and incidentals necessary to acquire these materials and for placement in accordance with the plans and specifications.

1.2 INSPECTION

A. The Contractor shall notify the Contracting Officer (CO) at least 5 calendar days prior to picking up or returning Government-furnished materials (GFM).

B. The Contractor and the Contracting Officer shall jointly inspect all materials during the loading operation at the storage area and at the project site.

1.3 LIABILITY

A. The Contractor's liability for Government-furnished material shall start at the time they accept the materials at the storage area and shall terminate upon completion and final acceptance of the work.

1. It shall be implied that the Contractor has accepted Government-furnished materials prior to the materials being loaded and ready for transportation from the storage area to the worksite.
2. The Contractor shall provide all labor, equipment, and incidentals necessary to load, unload, and transport Government-furnished materials between the worksite and the specified storage area.

1.4 REPLACEMENT AND/OR SUPPLEMENTAL MATERIALS

A. Any defective materials discovered prior to the Contractor's acceptance of the materials will be replaced by the Government.

B. If the quantity of Government-furnished material accepted by the Contractor is insufficient to complete the specified work, supplemental materials complying with these specifications shall be provided by the Government at no expense to the Contractor.

C. The Government shall not replace any materials that, in the opinion of the Contracting Officer, are damaged or lost due to the Contractor's negligence after the Contractor accepts the materials. Such materials shall be replaced at the Contractor's expense.

1.5 SURPLUS MATERIAL

A. After completion and final acceptance of the work, surplus Government-furnished materials shall be returned to the specified storage area in the same mechanical and physical condition as originally accepted.

B. Damaged surplus materials shall be replaced at the Contractor's expense.

C. The Contractor's liability for surplus materials shall terminate upon unloading at the storage area.

PART 2 – PRODUCTS

2.1 GOVERNMENT-FURNISHED MATERIALS

A. Contractor shall verify all GFM makes and models. Contractor shall notify government if material makes or models are different than specified below.

B. Government-furnished materials shall be limited to:

1. Forest Service locks and keys for gates and buildings.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation and testing of Government-furnished materials shall comply with the applicable contract specifications covering work requiring the use of such materials.

B. Unless otherwise shown on the drawings, signs shall be installed at the locations designated by the Government and as staked on the ground.

END OF SECTION 016440

SECTION 016000
MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section consists of the general procedures for handling, storing, and protecting materials and equipment.

1.02 TRANSPORTATION AND HANDLING

A. Arrange deliveries of materials in accordance with construction schedules; coordinate to avoid conflict with work and conditions at the site. Deliver materials in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Contractor is encouraged to obtain materials in biodegradable or recyclable/reusable packaging which uses the minimum amount of packaging possible.

1.03 STORAGE AND PROTECTION

A. Store materials in accordance with manufacturer's instructions, with seals and labels accessible for inspection.

B. Interior Storage: Maintain temperature and humidity within the ranges required by manufacturer's instructions.

C. Exterior Storage:

a. Store products subject to damage by the elements in weathertight enclosures.

b. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining.

c. Cover products subject to damage or deterioration with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

d. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

D. Protection After Installation: Provide adequate coverings as necessary to protect installedmaterials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

1.04 NOXIOUS WEED PREVENTION

A. Contractor shall ensure that prior to moving on the project that all equipment is free of noxious weeds, is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds.

B. Contractor shall clean equipment prior to moving on the site and utilize whatever cleaning methods deemed necessary to ensure the equipment is free of noxious weeds. Equipment shall be considered free of soil, and other debris when a visual inspection does not disclose such material. Disassembly of equipment components or specialized tools will not be required.

C. Contractor shall certify in writing that such equipment is free of noxious weeds prior to start-up.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

NOT APPLICABLE

END OF SECTION 016000

SECTION 017100
CLEAN UP AND DISPOSAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work shall include removing and disposing of recreation site amenities including but not limited to old piping, irrigation piping, water valves, valve boxes, etc.

1.02 CLEAN UP

A. The contractor shall keep the work site free from accumulation of waste materials and rubbish resulting from the work.

B. Before final acceptance of the project by the Government, the contractor shall remove from the site all waste materials and rubbish resulting from this work.

1.03 DISPOSAL

A. Site waste shall become the property of the contractor, and may be salvaged, if desired. If not salvaged, then it shall be disposed of to an approved sanitary or recycling facility or landfill.

B. Washing waste material down sewers or into waterways will NOT be permitted. Administrative action WILL BE taken if waste material is consciously washed into waterways.

C. If contaminated soil is discovered, it shall be removed to a depth of 24 inches below the surface of the contaminated ground. Excavated material shall be removed and disposed of to an approved sanitary facility or landfill.

END OF SECTION 017100

SECTION 024119
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Removal and disposal of irrigation components as shown on the drawings.

2. Removal and salvaging of irrigation components as shown on the drawings.

3. Removal and disposal of concrete elements as shown on the drawings.

1.2 DEFINITIONS

A. Remove and Dispose: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Government's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Government's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Government's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Contracting Officer, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

E. Abandon: Remove items indicated that are visible above ground. Below ground utility lines may remain in place. Utility lines that interfere with construction shall be removed to the limit required for new construction or as indicated on the drawings. Beyond those limits items are to be abandoned in place. Existing water lines crossing trenches shall be cut flush with the excavated trench wall.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Government's property, demolished materials shall become the Contractor's property and shall be removed from the site and disposed of in accordance with Section 010510 or Section 024119 Part 3.7.

1.4 PROJECT CONDITIONS

A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work. If any materials suspected of containing hazardous materials are encountered, do not disturb the materials. Immediately notify the Contracting Officer.

PART 2 – PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Excavation and backfill shall be as specified in Section 312250.

B. Excessive settlement or other evidence of improper backfill shall be corrected by reopening the excavation to the depth required for proper refilling and compaction.

3.2 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate, and measure the nature and extent of the conflict. Promptly submit a written report to the Contracting Officer.

3.3 UTILITY SERVICES

A. Electric and phone utilities are known to exist at the site.

3.4 ITEMS TO BE REMOVED

A. As shown on drawings.

3.5 ITEMS TO BE SALVAGED

A. As shown on drawings.

3.6 ITEMS TO BE REMOVED AND REINSTALLED

A. As shown on drawings.

3.7 DISPOSAL

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do NOT burn demolished materials.

C. Disposal of debris shall comply with Section 010150.

END OF SECTION 024119

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Equipment installation requirements common to equipment sections.
3. Supports and anchorages.

1.2 DEFINITIONS

A. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

E. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION 220500

SECTION 220523.12

BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. PVC ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water valves intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified to be in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.34 for flanged and threaded end connections

C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Type:
1. Hand Lever: For quarter-turn valves smaller than NPS 4 (DN 100).

2.2 PVC BALL VALVES

A. PVC Union Ball Valves:
   1. Standard: MSS SP-122.
   2. Pressure Rating and Temperature: [125 psig (860 kPa) 150 psig (1035 kPa) at 73 deg F (23 deg C).
   3. Body Material: PVC.
   4. Body Design: Union type.
   5. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
   6. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Detachable union with socket or threaded.
   7. Ball: PVC; full port.
   8. Seals: PTFE or EPDM-rubber O-rings.
   9. Handle: Tee shaped.

B. PVC Non-Union Ball Valves:
   1. Standard: MSS SP-122.
   2. Pressure Rating and Temperature: [125 psig (860 kPa) 150 psig (1035 kPa) at 73 deg F (23 deg C).
   3. Body Material: PVC.
   4. Body Design: Non-union type.
   5. End Connections: Socket or threaded.
   6. Ball: PVC; full or reduced port.
   7. Seals: PTFE or EPDM-rubber O-rings.
   8. Handle: Tee shaped.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.

B. Provide support to piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position to allow full valve actuation movement.

F. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

G. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, provide the same types of valves with higher CWP ratings.

END OF SECTION 220523.12

SECTION 220523.14

CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze, swing check valves.
2. Iron, swing check valves.
3. PVC ball check valves.

1.2 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water piping check valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372, or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.22 for wrought copper solder joint.

C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.2 BRONZE SWING CHECK VALVES

A. Bronze, Swing Check Valves with Bronze Disc, Class 125:
   1. Description:

      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 200 psig (1380 kPa).
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.
      f. Disc: Bronze.

B. Bronze, Swing Check Valves with Nonmetallic Disc, Class 125:
   1. Description:

      a. Standard: MSS SP-80, Type 4.
      b. CWP Rating: 200 psig (1380 kPa).
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.
      f. Disc: PTFE.

C. Bronze, Swing Check Valves with Bronze Disc, Class 150:
   1. Description:

      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 300 psig (2070 kPa).
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.
      f. Disc: Bronze.

D. Bronze, Swing Check Valves with Nonmetallic Disc, Class 150:
   1. Description:

      a. Standard: MSS SP-80, Type 4.
      b. CWP Rating: 300 psig (2070 kPa).
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.
      f. Disc: PTFE.

2.3 IRON, SWING CHECK VALVES

A. Iron, Swing Check Valves with Metal Seats, Class 125:
   1. Description:

      a. Standard: MSS SP-71, Type I.
      b. CWP Rating: 200 psig (1380 kPa).

c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flange or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Iron, Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
1. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flange or threaded. See valve schedule articles.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE.
j. Gasket: Asbestos free.

2.4 PVC BALL CHECK VALVES

A. Description:

1. Pressure Rating and Temperature: **125 psig (860 kPa)**.
2. Body Material: PVC.
3. Body Design: Union-type ball check.
4. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket or threaded.
5. Ball: PVC.
6. Seals: EPDM- or FKM-rubber O-rings.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. Install valves so that stems are horizontal or slope upward from centerline of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

H. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.

I. Adhere to manufacturer's installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 (DN 50) and Smaller: Bronze, swing check valves.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded, soldered, or press-end connections.

END OF SECTION 220523.14

SECTION 221116
DOMESTIC WATER PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building, under the building and to the well.
2. Specialty valves.
3. Flexible connectors.

1.2 SUBMITTALS

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

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components.

C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 – PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B, Standard Weight. Include ends matching joining method.

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
3. Flanges: ASME B16.1, Class 125, cast iron.

2.3 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.

1. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.

2.4 PIPING JOINING MATERIALS

A. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

C. PVC Union Ball Valves:

1. Description:

2. Standard: MSS SP-122.

a. Pressure Rating 125 psig.
b. Body Material: PVC.
c. Body Design: Union type.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
e. Ball: PVC; full port.
f. Seals: PTFE or EPDM-rubber O-rings.

g. Handle: Tee shaped.

2.6 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Plastic-to-Metal Transition Fittings:

1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

C. Plastic-to-Metal Transition Unions:

1. Description: PVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.7 WATER METERS

A. Displacement-Type Water Meters:

1. Description:
2. Standard: AWWA C700.

a. Pressure Rating: 150-psig (1035-kPa) working pressure.
b. Body Design: Nutating disc; totalization meter.
c. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility.
d. Case: Bronze.
e. End Connections: Threaded.

PART 3 – EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

G. Install domestic water piping in buildings level and plumb.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping adjacent to equipment and specialties to allow service and maintenance.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. thermometers.

3.3 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

B. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

C. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water PipingNPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings.

3.6 WATER METER INSTALLATION

A. Rough-in domestic water piping [**for water meter installation**] [**, and install water meters**] according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6, utility company's requirements, and the following:

D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

E. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

F. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

3. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

   a. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

4. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
5. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 CLEANING

A. Clean water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, **NPS 2 (DN 50) and smaller**, shall be the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. PVC, schedule 40 and schedule 80 pipe and socket fittings; and solvent-cemented joints.

3.11 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. PVC valves matching piping materials may be used.

END OF SECTION 221116

SECTION 221119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:
1. Hose bibbs.
2. Drain valves.
3. Hydro-pneumatic pressure tank.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 – PRODUCTS

2.1 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.

5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: None.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Operation for Equipment Rooms: Wheel handle or operating key.
10. Operation for Service Areas: Wheel handle.

2.2 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7.

2.3 HYDROPNEUMATIC TANK

1. Minimum Water Volume Capacity: 20 gal.
2. Pressure Rating: 125 (860).
3. Air Precharge: See VFD pump controller installation manual.
4. Model WM-6 as manufactured by Pentair Wellmate, or an approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.2 FIELD QUALITY CONTROL

A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION 221119

SECTION 221120

SUBMERSIBLE WELL PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes furnishing and installing a submersible well pump, the discharge pipe, a pitless unit, and a sanitary well cap.

B. Related Sections include the following:

1. Section 260100 “Common Work Results for Electrical.”

1.2 SUBMITTALS

A. Product Data: Submit performance curves and rated capacities of selected well pumps and furnished specialties for each type and size of well pump indicated.

1.3 QUALITY ASSURANCE

A. All work is to be completed according to applicable Federal, State and Local codes. This work includes, but is not limited to, materials, installation, testing and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.

D. All products in contact with potable water shall comply with NSF 61 Annex G. All pipes, fittings, fixtures, solder, and flux shall meet the 0.25% maximum lead content rules for all wetted components.

1.4 MINIMUM SYSTEM REQUIREMENTS

A. Unless otherwise noted, the minimum working pressure for piping and specialties shall be 125 psig.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE PUMP AND MOTOR

A. Pump

1. Capacity: 55 GPM
2. Rated Power: 3 HP
3. Rated Voltage: 230V., 60 Hertz, 3-phase

4. Model 55GS30, as manufactured by Goulds Water Technology, or an approved equal.

B. Motor: Capable of continuous operation under water, with protected submersible power cable.

C. Pump Bowls: Made of polycarbonate and free of blow holes, sand holes, and other detrimental defects. Capable of withstanding a hydrostatic pressure equal to twice the head at rated capacity or 1-1/2 times the shutoff head, whichever is greater. Each bowl equipped with replaceable stainless steel wear rings on both sides of the impeller.

D. Impellers: Closed type and statically balanced. Securely fastened to the impeller shaft with splines, keys, taper bushings, locknuts, or setscrews.

1. Impeller Material: Stainless steel

E. Pump-to-Motor Coupling: Solid stainless steel, Capable of transmitting the total torque and thrust of the unit in either direction.

2.2 DISCHARGE PIPE

A. PVC: ASTM D 1785, Schedule 80; threaded ends meeting ASME B1.20.1.

1. Fittings: PVC, threaded, Schedule 80, ASTM D 2464.
2. Pipe shall be supplied in pre-threaded 21-foot lengths.

2.3 SANITARY WELL CAP

A. Design: Vented, sanitary well seal, with holes for piping, electrical cables and well level measuring tube. Cap shall fit on top of casing, be constructed of steel or aluminum, and shall be lockable, vandal-resistant, removable, waterproof and vermin proof. Sized to fit casing and electrical conduit, meeting the requirements of the "Minimum Standards for Well Construction" for the state in which the well exists and meeting the requirements of Water Systems Council PAS-97. Provide electrical cable seals.

B. Model: MB-WT style with locking bolts as manufactured by Maass Midwest Manufacturing or an approved equal.

2.4 PITLESS UNIT

A. Design:

1. Material: Schedule 40 steel pipe.
2. End: Plain, prepared for welded connection to well casing.
3. Bury Depth: **6** feet.
4. Height Above Finished Grade: 1 foot (12 inches)
5. Well Casing Size (Nominal): 8 inches.
6. Drop Pipe Size (Nominal): **2** inches.
7. Lateral Discharge: 2 -inch NPT
8. Drop Pipe Connector: Suitable for connection to PVC drop pipe, Model #11P PVC coupling or approved equal.

9. Must meet applicable requirements of the state of Colorado.

B. Model: MBNL50 Merril Manufacturing or an approved equal.

2.5 DISINFECTION CHEMICALS

A. All chemicals used to disinfect the well or equipment shall meet ANSI/NSF 60.

2.6 OPERATION AND MAINTENANCE MANUAL

A. The Contractor shall furnish three sets of instructions for operating and maintaining all mechanical and electrical equipment for the pump installation. The instructions shall include a complete diagram of the pump and plumbing details, an electrical wiring diagram with color coding indicated, parts lists, and all other drawings and instructions that are required to successfully operate the pump.

2.7 ELECTRICAL SUPPLY AND CONTROLS

A. The power cable and all fittings shall be watertight at the pressure encountered in use. The cable shall be one continuous length and shall not contain any splices. The cable's jacket material must be oil- and water-resistant synthetic rubber, plastic, or other suitable protective material. The cable shall be of the size recommended by the manufacturer of the submersible pump and shall have a sufficient conductor area to meet the minimum requirement of the Insulated Power Cable Engineer's Association (IPCEA) code for operation in air.

PART 3 - EXECUTION

3.1 DISINFECTING EQUIPMENT

A. Before installing any equipment or other components in the well, the Contractor shall disinfect the equipment by flushing with a 200 PPM chlorine solution.

3.2 SUBMERSIBLE PUMP INSTALLATION

A. Install well pump at the depth indicated on the Drawings, according to HI 2.1-2.5. Provide access for periodic maintenance.

1. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.
2. Before lowering permanent pump into well, start pump to verify correct rotation.
3. Securely tighten discharge piping joints.
4. Support pump from pitless unit.

3.3 PITLESS UNIT

A. Excavation and Backfill: According to Section 312000 “Earthwork.”

B. Welded Connection: Weld pitless unit to steel casing in accordance with AWWA C206, penetrate full thickness of pipe.

3.4 MECHANICAL AND ELECTRICAL TESTING

A. Testing and operation of all mechanical and electrical equipment shall be done by the Contractor, in the presence of the Contracting Officer, to assure satisfactory operation of all components. The pump shall be operated for at least 1 hour to demonstrate that all equipment is functioning as specified.

3.5 DISINFECTING WELLS

A. After the well is cleaned it shall be disinfected with a chlorine solution of such volume and strength so that a concentration of at least 100 ppm of chlorine, after mixing with the water in the well, shall be circulated to all parts of the well. The water in the well must be agitated to mix the solution thoroughly. In addition, surfaces of all components above the water level must be flushed or washed down with the sterilizing solution. The chlorine solution shall remain undisturbed in the well for a period of a least 12 hours, but not more than 24 hours.

B. Introduction of Chlorine Solution to the Well: The method of introducing the chlorine into the well shall be one of the following as recommended by the ANSI/AWWA C654 and approved by the Contracting Officer:

1. Calcium Hypochlorite - Dribble tablets of approximately 5-gram size down the casing vent and wait at least 30 minutes for the tablets to fall through the water and dissolve.
2. Sodium Hypochlorite - Suspend a tube through the well casing vent so that it reaches the bottom of the well. Withdraw the tube as the sodium hypochlorite solution is pumped through the tube.

C. Removing Disinfection Solution from the Well - After disinfection, the well shall be pumped for a minimum of 15 minutes beyond the time that a zero chlorine residual is first detected by the Contractor.

3.6 PUMP, WELL AND ELECTRICAL DATA SHEETS

A. Print and laminate the 11”x17” As-Built Drawing sheets (typically 2 sheets total) that contain the following information:

1. Pump: Pump model, design flow and head. Pump curve if available.
2. Pump Electrical System: Electrical Schematic including float controls meeting requirements of NEC 409.110(6). This may be met by a similar requirement in the electrical specs or drawings, if existing.

B. If a new well was drilled as part of the contract, provide the following information on a separate 8-1/2” x 11” sheet, laminated.

1. Well: Total depth, static water level. Well log and pump test information if available.

C. Permanently attach the laminated sheets to the wall of the pumphouse adjacent to the pump control box (or affix per applicable codes). Sheets must be easily readable at eye-level.

END OF SECTION 221120

SECTION 260100
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. SCOPE OF WORK

1. This project requires the installation of electrical systems in accordance with these Specifications for the Bessey Irrigation Improvements.
   a. Distribution
      1) Connect to the existing service panel at the storage building.
      2) Remove existing well pump circuit and install new 40 amp breaker and circuit to the Variable Frequency Motor Controller (VFC) with a disconnect as recommended by the Manufacturer. (See manufacturer installation guides)
      3) Install new 15 amp breaker and circuit for a single duplex receptacle in the storage building near the irrigation controller.
      4) Size all conductors, grounds and control/sensing wires per the NEC and manufacturer recommendations.
   b. Equipment
      1) Install and provide final electrical connection to all mechanical, architectural, or Owner-furnished equipment specified herein or provided on the job by others. Include disconnects, overcurrent protection, flexible connections, access and guards as required by the equipment, these Specifications and pertinent codes.

B. This Section includes electrical requirements and materials for a complete electrical system including the following:

1. Raceways.
2. Building wire and connectors.
3. Circuit breakers.
4. Enclosed switches.
5. Receptacles.
6. Outlet, pull, and junction boxes.
7. Underground splice boxes.
8. Device plates and covers.
9. Electrical Identification.

1.2 WORK INCLUDED

A. As specified and as shown, furnish, install, test, and place in satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete and operable electrical system. The work also includes the

completion of those details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to Division 26 Sections.

1.4 QUALITY ASSURANCE

A. Worker's Qualifications: All electrical work shall be performed by Colorado State licensed electricians or under the direct supervision of a Colorado State licensed electrician.

B. Codes and Regulations:

1. All work shall meet requirements of governing codes and regulations, NFPA 70-2020 (NEC), and NESC.
2. Advise the Contracting Officer of conflicting codes or conflicts between codes and drawings and specifications.
3. When the requirements of specifications or drawings are more stringent than the codes, regulations, or standards, the specifications or drawings shall prevail.
4. The electrical installation shall meet the requirements of NECA Standard of Installation, except where otherwise specified.

C. UL Listing:

1. All electrical materials and equipment shall meet requirements of the applicable standards of UL if UL standards exist for such materials and equipment.
2. The UL authorized listing mark is acceptable as evidence that the materials meet this requirement.
3. In lieu of UL authorized listing mark, the Contractor may submit independent proof satisfactory to the Contracting Officer that the materials meet the standards.
4. Materials and equipment shall be installed only for their intended operational purpose.

D. Standard Products: Provide only new electrical equipment of current standard design.

1.5 PERMITS AND INSPECTIONS

A. State electrical inspection is required for this project. Obtain an electrical permit if the State requires a permit to do the inspection.

1.6 INTENT OF CONSTRUCTION DRAWINGS

A. Electrical drawings do not attempt to show complete details of construction that affect installation. Diagrams are schematic only and do not necessarily show physical arrangement of equipment. Refer to drawings of other trades for additional details that affect work.

B. Conduit, conductor, and ground connections are shown diagrammatically only. Layout does not necessarily show total number of conduits or conductors for circuits required and should not be used for obtaining quantities for linear runs of conduits or wires. Locations of indicated runs are not intended to show actual routing of conduits. Provide additional conduits and wire wherever needed to complete installation of specific equipment furnished.

C. Locations of outlets, switches, and junction boxes on drawings are approximate and may be distorted for clarity in representation.

D. Install electrical outlets and other equipment clear of and in proper relation to radiators, ducts, grilles, pipes, and other equipment, and items such as cabinets and counters.

E. Changes such as offsetting conduit runs, moving outlets, or other minor changes necessary to facilitate installation shall be made at no additional expense to the Government.

1.7 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.

B. Coordinate electrical work with the work of the various trades on the project.

1.8 SUBMITTALS

A. As specified in "Submittal Procedures" Section:
   1. Product Data: Submit manufacturer's product literature for the following items:
      a. Conduit, raceways, and fittings.
      b. Wire and cable.
      c. Receptacles.
      d. Circuit breakers.
      e. Outlet, pull, and junction boxes.
      f. Electrical Identification.

B. Closeout Submittals: As specified in "Closeout Procedures" Section:

   1. Field quality test reports.

PART 2 – PRODUCTS

2.1 RACEWAYS

A. Non-Metallic Conduit:
   1. RNC: Rigid nonmetallic conduit; NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

B. Metal Conduit:
   1. RMC: UL 6 rigid metal conduit; hot dipped galvanized rigid steel; ANSI C80.1 with threaded fittings.
   2. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

C. EMT: UL 797 electrical metallic tubing; ANSI C80.3, zinc-coated steel.
   1. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression or set screw type.

D. Bushings: Insulated type bushings designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system comprised of rigid steel conduit. Provide locking type grounding bushings with a feed-through compression lug.

E. Expansion Fittings: Rigid hot-dipped galvanized steel or malleable iron with factory-installed packing and grounding ring.
   1. Rigid non-metallic conduit expansion fittings: Provide short type for runs 25 feet or less and long type in runs 26 to 80 feet.
      a. Short Type: On-piece coupling with O ring providing 2 inches of total movement range in 1/2-inch to 2-inch conduit sizes.
      b. Long Type: Two-piece barrel and piston joint providing 6 inches of total movement range in 1/2-inch to 6-inch conduit sizes.

F. Sealing Fittings: Threaded, zinc or cadmium coated, cast or malleable iron type for steel conduits. Provide continuous drain type when fittings are used to prevent passage of water vapor.

2.2 WIRE AND CABLE

A. Copper, stranded conductor, 600-volt insulation, Type THW, THHN/THWN depending on application, in raceway.

2.3 CIRCUIT BREAKERS

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents. Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Heavy-duty, bolt-on or snap-in, quick make, quick break type. Minimum interrupting rating of 10,000 amperes symmetrical at 240 volts, unless otherwise noted on drawings.
   1. Multiple Pole Circuit Breakers: Thermal-magnetic type with common type handle. Minimum 100-ampere frame and through 100-ampere trip sizes shall take up same pole spacing.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.3 ENCLOSED SWITCHES

A. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type GD, with clips to accommodate specified fuses, and lockable handle, interlocked with cover.

2.4 ENCLOSURES

A. Listed for environmental conditions of installed locations, including:
   1. Outdoor Locations: NEMA 250, Type 3R.

2.5 RECEPTACLES

A. Weatherproof Receptacle Cover: NEMA 3R rated, UL listed for wet locations and designed to meet requirements of NEC Article 406.9(B). UV stabilized high impact polycarbonate cover. Single gang, weatherproof cover/base assembly, gasket, inserts, and mounting hardware.

2.6 OUTLET, PULL, AND JUNCTION BOXES

A. General: Provide one for each outlet, switch, receptacle, or combination, at each junction point.

   1. Metal Raceway Systems in Interior Dry Locations: Plastic or galvanized sheet metal.
   2. Outdoor and Wet Locations: Weatherproof, cast metal, threaded hub.
   3. Buried or Subject to Constant Moisture: Watertight.

2.7 UNDERGROUND SPLICE BOXES

A. General: install in exterior underground locations as shown on the drawings.

B. Characteristics:
   1. UV stabilized polypropylene
   2. Black base color, green lid color.
   3. Lid with word “ELECTRICAL” imprinted on it.
   4. Meeting ASTM C857, pedestrian, light duty non-vehicular traffic.
   5. Basis of Design: JD-1730 by Utility Plastics

2.8 DEVICE PLATES AND COVERS

A. Single and combination types to match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished and Unfinished Spaces: Ivory, smooth, high impact thermoplastic.
3. Material for Wet Locations: Listed and labeled for use in "wet locations," gasketed and weatherproof, with spring loaded neoprene gasketed doors for receptacles, lever operators for switches and cast aluminum cover plates for junction boxes.

2.9 GROUNDING

A. Grounding Electrode Conductors: Stranded copper cable, without splice throughout its length; bare or green insulated wire is acceptable. Size shall be based upon the size of the largest existing ungrounded service entrance conductor and the NEC.

B. Equipment Grounding Conductors: Copper wire insulated with green-colored insulation. Use same type as other wires in the circuit.

C. Ground and Supplemental Ground Rods: One piece, copper or copper-clad steel rod, 3/4 inches diameter by 120 inches.

D. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

E. Bonding Jumpers: Bare copper tape or tinned-copper tape, braided copper conductors, terminated with copper ferrules.

2.10 ELECTRICAL IDENTIFICATION

A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background. Minimum text height of 1/4-inch.

1. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws, or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

F. Engraved-Plastic Label, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate, punched or drilled for mechanical fasteners. Engraved legend in black letters on white background.

G. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and washers.

H. Circuit Directories
   1. Update circuit directories to reflect any circuity changes made during this project. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

PART 3 – EXECUTION

3.1 ELECTRICAL REMOVAL AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Disconnect, demolish, and remove electrical systems, equipment, and components indicated to be removed.

   1. Circuits to Be Removed: Remove portion of circuits, including conductors and conduit, indicated to be removed to source of supply. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
   2. Equipment to Be Removed: Disconnect equipment. Remove circuit to source of supply where circuit is indicated to be removed. Temporarily terminate conductors in a safe manner where circuit will be reattached to new equipment or devices. Remove equipment.
   3. Equipment to Be Removed and Reinstalled: Disconnect and remove circuit to source of supply. Remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   4. Equipment to Be Removed and Salvaged: Disconnect and remove circuit to source of supply. Remove equipment and deliver to Government.

B. Verify that abandoned wiring and equipment serve only abandoned facilities. Maintain electrical continuity to remaining wiring and equipment.

C. If during construction electrical conductors, conduits, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Disconnect electrical systems in ceilings scheduled for removal.

E. Existing Electrical Service: Maintain existing systems in service until new systems are accepted. Disable systems only to make switchovers and connections. Notify the

Contracting Officer in writing at least 5 business days before partially or completely disabling system. Power may be disabled no more than 48 hours. Make temporary connections to maintain service in areas adjacent to work area.

F. Where the reuse of existing conduits, outlets, junction boxes, etc. is permissible, make certain that the wiring for them is continuous from outlet to outlet.

G. Provide temporary wiring and connections to maintain existing systems in service during construction.

H. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

I. Repair adjacent construction and finishes damaged during demolition and extension work. Provide modifications to assure that circuits or systems wiring shall not pass through outlet or junction boxes that may be rendered inaccessible by changes made to the building.

J. Connect new work to existing work in a manner that will assure proper raceway grounding throughout in conformance with the National Electrical Code.

K. Removed conduits, wire, devices, fixtures, etc. is the property of the Contractor unless otherwise noted.

L. Panelboards: Replace circuit breakers damaged during construction and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.2 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

3.3 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange, and install components and equipment to provide maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.4 RACEWAY APPLICATION

A. Outdoor locations, underground: RNC.

B. Above ground, Wet and Damp Locations: RMC.

C. Connection to Vibrating Equipment: LFMC.

3.5 RACEWAY INSTALLATION

A. Install raceways in accordance with NECA "Standard of Installation" and manufacturer's recommendations.

B. Route exposed raceways parallel and perpendicular to walls.

C. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Run raceway plumb, level, and in a direct line, with long sweeping bends and offsets. Make changes in direction of raceway with symmetrical bends or metal fittings.

E. Keep legs of raceway bends in the same plane and keep straight legs of offsets parallel.

F. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104^0F.

G. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes and cast boxes in damp and wet locations.

H. Install no more than equivalent of four 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction.

I. Seal wall and roof penetrations weathertight.

J. Grout around conduit tie-ins entering building walls. Where conduit enters buildings, seal openings with duct seal to prevent circulation of air or moisture.

3.6 WIRE AND CABLE METHODS

A. Conductor Size:

1. Meet requirements of NFPA 70 or the sizes shown on the drawings if larger. Use no wire smaller than No. 12 AWG for power and lighting circuits, and no smaller than No. 14 AWG for control wiring.
2. Use No. 10 AWG conductor for 20 amperes, 120-volt branch circuit home runs longer than 75 feet.
3. Use 18-gauge wiring for irrigation line wiring.

B. Wire and Cable Application: Use wiring and cabling methods specified below to the extent permitted by applicable codes.
1. All locations: wire in raceways.

3.7 WIRE AND CABLE INSTALLATION

A. Taps and Splices:

1. Permitted only in junction or outlet boxes.
2. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

B. Place an equal number of conductors for each phase of a circuit in same raceway or cable. Pull all conductors into a raceway at the same time.

3.8 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Nameplates: Identify panels, motor starters, control points, and disconnect switches.

1. Remotely Mounted Controls: Identify the equipment controlled.
2. Panels: Identify panel number, feeder number, and voltage of panel bus.
3. Safety Switches, Relays, and Motor Starters: Identify equipment controlled and circuits from which they are fed.

E. Wire Markers: Install at each end of each wire interconnecting between such items as control panels, sensors, and control devices. Wire markers shall correspond to control wire numbers on schematic diagrams.

F. Tag and label circuits designated to be extended in the future.

G. Install warning labels on panels, disconnects, and other devices as required by NFPA 70.

3.9 ADJUST AND CLEAN

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.10 FIELD QUALITY CONTROL

A. Notify Contracting Officer at least 48 hours before inspection or testing. Perform tests in the presence of the Contracting Officer.

B. Testing: After installing disconnect switches and after electrical circuits have been energized, demonstrate product capability and compliance with requirements.

C. Inspections and Tests for Switches: Make internal and external inspections and perform tests, including the following:

1. Inspect for freedom from physical damage, proper unit rating, mechanical condition, enclosure integrity, cover operation, unit anchorage, clearances, and tightness of electrical connections. If a loose electrical connection is observed on any unit, check each electrical connection for each switch and circuit breaker with a torque wrench for compliance with manufacturer's torquing instructions.
2. Test cover and other interlocks and interlock release devices for proper operation.
3. Inspect switches for proper rating and fuse provisions. Check integrity of phase barriers.

D. Correct defective and malfunctioning units on-site, where possible, and re-inspect and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.'

3.11 INSPECTION

A. Demonstrate that electrical work operates satisfactorily and in accordance with the requirements of the drawings and specifications. Verify that all equipment works as specified in the contract.

END OF SECTION 260100

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with **ASTM B8** or stranded conductors.

D. LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES 260519

E. Conductor Insulation:

1. Type NM. Comply with UL 83 and UL 719.
2. **Type RHH and Type RHW-2**. Comply with UL 44.
3. **Type USE-2 and Type SE**. Comply with UL 854.
4. **Type THHN and Type THWN-2**. Comply with UL 83.
5. **Type THW and Type THW-2**. Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
6. Type XHHW-2. Comply with UL 44.

2.2 FIRE-ALARM WIRE AND CABLE

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper:

a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.3 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material **and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors**].

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inch (150 mm)** of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260533.13

CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

C. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).

1.2 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-A AND TYPE EMT-SS DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Aluminum Electrical Metal Tubing (EMT-A) and Elbows:
1. Material: Aluminum.

D. UL FJMX - Stainless Steel Electrical Metal Tubing (EMT-SS) and Elbows:
1. Material: Stainless steel.

2.2 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
1. Material: Steel.

2.3 TYPE ENT DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN FKHU; including UL 1653.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FKHU - Electrical Nonmetallic Tubing (ENT) and Fittings:
1. Options:
a. Fittings:

1) Mechanically Attached Fittings: UL 1653.
2) Solvent-Attached Fittings: UL 651.

2.4 TYPE HDPE AND TYPE EPEC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN EAZX; including UL 651A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.5 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DZYR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
1. Dimensional Specifications: Schedule 40.
2. Options:

a. Minimum Trade Size: [**Metric designator 16 (trade size 1/2)**] [**Metric designator 21 (trade size 3/4)**].
b. Markings: [**For use with maximum 90 deg C wire**] [**For directional boring applications**].

2.6 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL EBMB - Duct Fittings for Hazardous (Classified) Locations:
1. Listing Criteria: UL CCN EBMB; including UL 1203.

D. UL DWTT - Fittings for Type ERMC, Type IMC, Type PVC, Type HDPE, Type EPEC, and Type RTRC Duct Raceways:
1. Listing Criteria: UL CCN DWTT; including UL 514B.
2. Options:

a. Material: **Steel**.
b. Coupling Method: **Compression coupling**.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

E. UL FKAV - Fittings for Type EMT Duct Raceways:
1. Listing Criteria: UL CCN FKAV; including UL 514B.
2. Options:

a. Material: **Steel**.
b. Coupling Method: **Compression coupling**.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

2.7 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN DWTT; including UL 514B.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

B. Special Instructions Regarding HDPE Conduits: Although Article 353 of NFPA 70 permits use of HDPE conduits where encased in concrete aboveground, UL CCN EAZX listing requirements state that HDPE underground conduits are intended only for use where direct buried with or without being encased in concrete. Specified Type HDPE underground conduits are not permitted to be used aboveground on Project.

C. Outdoors:

1. Exposed and Subject to Severe Physical Damage **ERMC**.
2. Exposed and Subject to Physical Damage: **ERMC.**

   a. Locations less than 2.5 m (8 ft) above finished floor.

3. Exposed and Not Subject to Physical Damage **ERMC**.
4. Concealed Aboveground: **ERMC**.
5. Direct Buried: **PVC-80.**

D. Indoors:

1. Hazardous Classified Locations **ERMC.**
2. Exposed and Subject to Severe Physical Damage: **ERMC**.

E. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Type EMT-A: Article 358 of NFPA 70 and NECA NEIS 102.
2. Type EMT-SS: Article 358 of NFPA 70 and NECA NEIS 101.
3. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
4. Type ENT: Article 362 of NFPA 70 and NECA NEIS 102.
5. Type HDPE and Type EPEC: Article 353 of NFPA 70 and NECA NEIS 111.
6. Type ERMC-A: Article 344 of NFPA 70 and NECA NEIS 102.
7. Type ERMC-SS: Article 344 of NFPA 70 and NECA NEIS 101.
8. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
9. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
10. Type FMC-A: Article 348 of NFPA 70 and NECA NEIS 102.
11. Type FMT: Article 360 of NFPA 70 and NECA NEIS 101.
12. Type IMC: Article 342 of NFPA 70 and NECA NEIS 101.
13. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
14. Type LFNC: Article 342 of NFPA 70 and NECA NEIS 111.
15. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
16. Type RTRC: Article 355 of NFPA 70 and NECA NEIS 111.
17. Expansion Fittings: NEMA FB 2.40.
18. Consult Architect for resolution of conflicting requirements.

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533.13

SECTION 262923
VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes solid-state, pulse-width modulated (PWM), variable frequency controllers (VFCs) for speed control of three-phase, squirrel-cage induction motors.

B. Operational requirements:
   1. Controller shall be set to maintain a constant pressure of 50 psi as measured by a manufacturer provided pressure transducer.
   2. A safety pressure switch shall be set to 70 psi and deactivate pump operation above that setting.
   3. Interconnect Run/Stop input of VFC with pump output of irrigation controller to ensure that submersible pump will only energize when called by the irrigation controller and a pressure at the transducer below 50 psi.
   4. Ensure the pressure tank pre-charge conforms with manufacturer's requirement and adjust as needed.

1.2 SUBMITTALS

A. Product Data: For each VFC.

B. Shop Drawings: For each VFC.

   1. Include wiring diagrams.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Load-current and list of settings of adjustable overload relays.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

B. Comply with NFPA 70.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, minimum clearances between VFCs, and adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions, unless otherwise indicated:

1. Ambient Temperature: 0 to 40 deg C.
2. Humidity: Less than 90 percent (noncondensing).
3. Altitude: Not exceeding 5000 feet.

1.5 COORDINATION

A. Coordinate features of VFCs, installed units, and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each VFC and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 – PRODUCTS

2.1 VARIABLE FREQUENCY CONTROLLERS

A. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.

1. Provide unit suitable for operation of standard efficiency motor as defined by NEMA MG 1.

B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

D. Unit Operating Requirements:

1. Input ac voltage tolerance of 230 V, plus or minus 5 percent.
2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
3. Minimum Efficiency: 96 percent at 60 Hz, full load.
4. Minimum Displacement Primary-Side Power Factor: 96 percent.
5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
6. Starting Torque: 100 percent of rated torque or as indicated.

7. Speed Regulation: Plus or minus 1 percent.

E. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors.
2. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
3. Motor Overload Relay: Adjustable and capable of NEMA ICS 2, Class 10 performance.
4. Instantaneous line-to-line and line-to-ground overcurrent trips.
5. Loss-of-phase protection.
6. Reverse-phase protection.
7. Short-circuit protection.

F. Automatic Reset/Restart: None: only manual reset or fault correction.

G. Status Lights: Door-mounted LED indicators shall indicate the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

H. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.

I. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (VDC).
9. Set-point frequency (Hz).
10. Motor output voltage (V).

J. Control Signal Interface:
1. Pneumatic Input Signal Interface: 20 to 85 psig.

K. Model: **Aquavar Solo 2** as manufactured by **Goulds Water Technology**, or an approved equal.

2.2 ENCLOSURES

A. NEMA 3R Enclosure

2.3 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Standard Displays:

1. Output frequency (Hz).
2. Set-point frequency (Hz).
3. Motor current (amperes).
4. DC-link voltage (VDC).
5. Motor torque (percent).
6. Motor speed (rpm).
7. Motor output voltage (V).

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to VFCs before shipping.

PART 3 – EXECUTION

3.1 APPLICATIONS

A. Select features of each VFC to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; and duty cycle of motor, controller, and load.

B. Select horsepower rating of controllers to suit motor controlled.

3.2 INSTALLATION

A. Comply with mounting and anchoring requirements of the NEC.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.
3. Perform operational test of system to ensure pump on below 50 psi and automatic pump speed adjustment to maintain 50 psi at flows from 20 to 60 gpm.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

END OF SECTION 262923

SECTION 311100
CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. This work consists of clearing, grubbing, trimming, removing, and disposing of, or treatment of, live and dead timber, roots, construction slash, and debris within the areas shown on the drawings or designated on the ground. Areas may include but are not limited to roads, trails, parking areas, and other areas. This work shall include the removal and disposal of designated vegetation outside the clearing limits. Also included is the protection from injury or defacement of vegetation and other objects designated to remain and treatment or removal of damaged trees.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 CLEARING

A. Clearing Limits:

1. Irrigated Turfgrass Areas: AS SHOWN ON DRAWINGS.

B. Remove all underbrush, rubbish, and other objectionable materials within the clearing limits.

C. All trees within the clearing limits, shall be left standing and uninjured, unless otherwise noted.

D. Protect existing trees and associated root zones and other vegetation indicated to remain in place, against unnecessary cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.

E. Provide temporary guards to protect trees and vegetation to be left standing.

F. Where any trees are damaged, or where limbs are required to be trimmed or removed because of operations under this contract, or because of interference with new construction, any cutting or removal of limbs or branches shall be done only with prior approval of Contracting Officer.

G. Solvents, oils, and other material which may be harmful to plant life shall be disposed of in containers and removed from the site. At the completion of the work, any contaminated soil shall be removed and replaced with approved soil.

H. Materials shall be treated as slash and disposed of according to 3.4.

3.2 STRIPPING

A. Complete clearing and grubbing as applicable.

B. Strip topsoil to up to 4-inch max. depth in a manner to prevent intermingling with underlying subsoil or other objectionable material.

C. Remove large roots, stones (over 4" in diameter) and other debris.

3.3 TOPSOIL STOCKPILING

A. The Contractor may stockpile provided the location and method of stockpiling are as approved by the Contracting Officer. Stockpiling shall employ such protective measures as the Contracting Officer deems feasible to hold segregation, intermixing and waste to a practical minimum. Stockpiles shall be constructed to freely drain surface water. Upon completion of topsoil placement, the stockpile area shall be cleaned and restored to original condition. Excess topsoil shall be wasted upon site in locations approved by the Contracting Officer.

3.2 GRUBBING

A. All debris, stumps, roots, and other protruding vegetative material within the clearing limits, not designated to remain, shall be grubbed, removed, and disposed of, except the following:
   1. Trails: On all trails, stumps within the trailbed shall be removed. Stumps located between the edge of the trailbed and the edge of the trailway that cannot be cut flush with the finished slope, or are not tightly rooted, shall be removed.
   2. Branches on remaining trees or shrubs shall be trimmed to give a clear height of 14 feet above the roadbed unless otherwise shown on the drawings. Tree limbs shall be trimmed as near flush with the trunk as practicable.
   3. When grubbing for structures, buildings, and areas to be landscape graded; grub and remove all stumps inside the clearing limits, Grub and remove all roots to a depth of at least 6 inches below the natural ground when fill is required for site grading. When excavation is required for site grading, grub and remove all roots to a depth of at least 6 inches below finished grade.
   4. Stumps, roots, and material developed in grubbing operations shall be removed off National Forest lands.

3.3 SLASH TREATMENT

A. Treatment of construction slash shall be accomplished by one or more of the following methods:

1. Removal

B. All Methods. No construction slash shall be deposited in lakes, meadows, streams, or streambeds. Construction slash that interferes with drainage structures shall be removed immediately.

C. Specific Methods
   1. Removal. Construction slash shall be hauled to locations designated on the ground or removed from National Forest Lands at an approved landfill.

END OF SECTION 311100

SECTION 312317
TRENCHING, BEDDING AND BACKFILL FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. The work in this Section includes excavation, dewatering, preparation of the trench bottom, supply and installation of bedding and backfill materials, and disposal of waste material for the installation of utilities and related appurtenances.

1.2 QUALITY ASSURANCE

A. Conduct compaction tests as necessary to monitor the installation procedure and assure the quality of the work.

B. Perform all trench excavation in accordance with minimum requirements of OSHA Regulations. Provide shoring, bracing and tight sheeting to prevent caving and to protect workers in accordance with OSHA requirements and to protect adjacent property and structures.

C. Direct dewatering operations to natural drainages or storm sewers as appropriate. Perform discharge from dewatering operations in accordance with rules and regulations established by the Nebraska Department of Environmental Quality or equivalent.

1.3 SUBMITTALS

A. As specified in Division 1 Section, "Submittal Procedures."

1. Submit the source of bedding and backfill materials and certified sieve analysis.
2. Product Data: Provide manufacturer's literature for the following:

a. Warning tape.
b. Tracer wire system.

1.4 PROJECT CONDITIONS

A. The type, size, and location of known underground utilities have been shown on the drawings; however, no guarantee is made as to the true location of such utilities.

B. Verify the existence and location of all underground utilities at the project site. Notify Nebraska 811 at least three business days prior to any excavation work so local utility companies can locate their lines.

1.5 DEFINITIONS

A. Bedding: Layer placed over the excavated subgrade in a trench before laying pipe.

B. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Subsequent Backfill: Backfill placed over initial backfill to fill a trench.

C. Borrow: Satisfactory soil imported off-site for fill or backfill.

D. Unclassified excavation: Excavation and disposal of all material encountered in the work, including excavation obtained from borrow source.

E. Rock excavation: Removal and disposal of igneous, metamorphic, and sedimentary rock which cannot be excavated without blasting or using rippers, and all boulders or other detached stones each having a volume of one-half cubic yard or more.

F. Muck excavation: Removal and disposal of saturated organic mixtures of soils or organic matter which requires additional work or equipment which would not normally be required for unclassified excavation.

PART 2 - PRODUCTS

2.1 BEDDING

A. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940, except with 100 percent passing a ½- inch sieve and not more than 8 percent passing a No. 200 sieve. On site materials may be used.

2.2 BACKFILL AND FILL

A. Excavated material may be processed and used as backfill if compliance with the material specified herein can be documented. Provide documentation to the Contracting Officer for review. Import material if excavated material is not sufficient to meet requirements.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols, free of rock or gravel larger than 3 inches in any dimension, debris, waste frozen materials, vegetation, and other deleterious matter.

C. Initial Backfill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940, except with 100 percent passing a ½- inch sieve and not more than 8 percent passing a No. 200 sieve. On site materials may be used.

D. Subsequent Backfill: Excavated material or borrow material, free from rock larger than 6 inches in the greatest dimension, frozen material, clods, debris, or organic material.

Borrow material used as subsequent backfill shall have a gradation and character suitable to achieve the compaction specified in this Section.

2.3 WARNING TAPE

A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 3 inches wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep, colored as follows:

1. Red: Electric.
2. Blue: Water systems.
3. Green: Wastewater systems.

2.4 TRACER WIRE SYSTEM

A. Tracer Wire: #12 AWG copper clad steel with minimum 450 lb. break load, 30 ml HDPE insulation intended for direct bury. Color coat insulation per APWA standard for the specific utility being marked.

B. Connectors: Direct bury, dielectric silicon filled or split bolt, lock type wire connectors manufactured for use in underground tracer wire installation.

C. Terminations and Test Stations: Grade level, in ground, access box with lockable, cast iron or encapsulated magnet type, anti-corrosion lid. Provide light duty, adjustable type boxes for non-roadway applications and roadway boxes for boxes in roads and shoulders.

D. Ground Rod: Magnesium anode, drive-in type, 1.0 lb. minimum, rod with factory installed insulated, copper clad steel tracer wire and connector.

PART 3 - EXECUTION

3.1 ALIGNMENT AND GRADE

A. Stake out and establish grades for the location of pipelines and utility structures. Obtain Contracting Officer approval before starting excavation.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 SHEETING AND SHORING

A. Provide adequate shoring and bracing as required by OSHA and other local governing regulations.

B. Support excavations and sides of trenches with adequate materials as necessary for the safety of personnel and protection of the utility before backfilling.

C. Install and remove all sheeting, shoring, piling, and bracing to maintain the required trench or excavated section, and to maintain the undisturbed state of the soils at and below the bottom of the excavation.

D. Withdraw sheet piling and timbers in trench excavations in such a manner as to prevent subsequent settlement of the pipe or additional backfill loadings which might overload the pipe.

E. Remove all sheeting and shoring when safe to do so.

3.4 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.5 EXPLOSIVES

A. Do not use explosives.

3.6 PAVEMENT CROSSING

A. Wherever proposed utility trenches cross a proposed paved surface, contractor shall install appropriate PVC or conduit sleeves prior to paving or concrete placement operations. Size and material type shall be determined and submitted to CO for approval.

B. Wherever new utility trenches cross a paved surface, saw cut the surface prior to removal. Once the surface has been removed and the area has been excavated, place all utilities that lie directly under asphalt in schedule 80 PVC sleeves, backfill and compact and replace with new asphalt.

3.7 EXCAVATION, GENERAL

A. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Remove topsoil from the area to be excavated and from the area where excavated material will be piled prior to excavation. Store topsoil as specified below.

C. Maintain the excavations to guard against and prevent injury to employees and the public. Provide adequate shoring and bracing as required by OSHA and other local governing regulations.

D. Fence excavations left open at the end of the working day to protect the public.

E. Notify the Contracting Officer when excavation is completed. Do not place pipe, bedding or backfill until the excavation is approved by the Contracting Officer. Do not cover pipe until placement has been approved by the CO.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Neatly saw cut pavement to the limits indicated where trenches are cut across existing pavement.

C. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance (General): 6 inches on each side of pipe or conduit.
2. Clearance from other utilities: 12 inches on each side of pipe or conduit.

D. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Pipes and conduit less than 6 inches in nominal diameter: Hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. Pipes and conduit 6 inches or larger in nominal diameter: Shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped initial bedding course.

3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for initial bedding course.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent geotechnical engineering testing agency to perform field quality control testing including inspection and testing subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work complies with requirements.

B. Test compaction of soils in place according to ASTM D 2922. Perform tests at the following locations and frequencies:

1. Trench Backfill: At each compacted layer (bedding and backfill), at least one test for every 75 feet or less of trench length, but in no case fewer than two tests.

C. When testing agency reports that fills or backfills have not achieved degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

D. Correct excessive settlement or other evidence of improper backfill by reopening the trench or excavation to the depth required for proper compaction. Refill, compact, and retest.

E. Pay for the correction and retesting of unacceptable work at no expense to the Government.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

B. Keep topsoil separate from trench-excavated material by stockpiling. Reuse topsoil after backfilling.

3.11 UTILITY TRENCH BACKFILL

A. Place bedding material on trench bottoms by hand and tamp to the density specified. Install bedding to the full width of the trench bottom to a minimum depth of 6 inches. Shape initial bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Carefully compact bedding under pipe haunches

B. After individual pipe is jointed, place initial backfill material by hand along each side of the pipe to offset conditions that might tend to move the pipe offline and grade. Place backfill to prevent pipe movement under pressure tests. Tamp backfill to the density specified. Compact evenly up on both sides and along the full length of utility piping or

conduit to avoid damage or displacement of piping or conduit. Keep all joints, valves, etc., uncovered for inspection purposes during testing.

C. Do not complete backfill until pressure and leakage tests have been performed and the pipeline installation is approved by the Contracting Officer. Place and compact initial backfill to a height of 12 inches over the utility pipe or conduit. Place initial backfill and bedding in layers not to exceed 4 inches in loose depth.

D. Place and compact subsequent backfill to final subgrade in layers not to exceed twelve inches in loose depth. Compact each layer as specified in this section. Do not place large rock remaining in the backfill material and approved by the Contracting Officer within three feet of the pipe.

E. Fill voids with backfill materials while shoring and bracing, and as sheeting is removed.

F. Install warning tape directly above utilities, between 4 and 8 inches below finished grade.

G. Place 6 inches of topsoil as final backfill in trench areas where this material had been previously stripped and stockpiled. Compact topsoil layer to remain in place but remain loose enough to allow plant growth.

3.12 TRACER WIRE INSTALLATION

A. Install tracer wire system in trenches where water lines are the only utility located in the trench.

B. Install tracer wire no further than 6 inches from the pipe and where possible directly above the pipe.

C. Install tracer wire system as a continuous wire with no looping or coiling. Use manufacturer recommended connectors where connections are required. Interconnect tracer wire at tees and crosses using 3-way or 4-way connectors. Wrap connectors and exposed wire with electrical tape.

D. Provide access boxes on service laterals and stubs and at 500-foot intervals on lines without service laterals or stubs.

1. Locate access box directly above the utility.
2. Terminate tracer wire in box and provide a minimum of 2 feet of excess wire after setting access box at final grade.

E. Grounding: Ground tracer wire at dead ends, stubs, valves, or curb stops. Trim wire to appropriate length before connecting wire. Connect ground rod to the tracer wire using manufacturer recommended connectors. Where anode wire is connected to tracer wire access box, provide a minimum of 2 feet of slack after meeting final elevation.

F. Install warning tape 12-inches above the pipe.

G. Testing: Notify Contracting Officer at least 48 hours before testing. Perform tests in the presence of the Contracting Officer. Prepare report for each test, signed by Installer, General Contractor, and Contracting Officer.

1. Perform testing upon completion of rough grading and again prior to acceptance.
2. Locate tracer wire installation using low frequency, 512 Hz, line testing equipment.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. The minimum degree of compaction required shall be a percent of the maximum laboratory density obtained by the standard proctor test AASHTO T-99 or ASTM D698. The in-place field density shall be determined by AASHTTO T238 or ASTM D2922.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off National Forest Service property.

END OF SECTION 312317

SECTION 312500
TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included. Furnish, install, maintain, and remove temporary erosion and sedimentation controls specified herein, or as required to complete the work.

B. Related Sections include the following:
   1. Division 31 Section "Earthwork" for soil materials, site excavating, filling, and grading.

B. Permits and Fees: Obtain and pay for all permits and fees required for the work of this section, including erosion and sediment control and water quality permits required by the authority having jurisdiction and the local Department of Public Health and Environment, Water Quality Control Division.

C. Erosion Control: Provide erosion control on all exposed surfaces created by construction activities.

1.2 SUBMITTALS

A. Storm Water Management Plan:

   1. The Contractor is to provide a Storm Water Management Plan (SWMP) and report addressing erosion and sediment control measures for all sites with over one acre of disturbed ground. The Contractor is responsible for the preparation of the General Permit application.
   2. The Contractor is responsible for obtaining all required permits including a General Permit application for Storm Water Discharges associated with construction activities at least ten (10) days prior to start of construction. Permits are to be filed with the local Department of Public Health and Environment, Water Quality Control Division.
   3. Contractor shall have the Storm Water Management Plan (SWMP) and report available on-site at all times.

1.3 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with applicable local, State and Federal ordinances, rules and regulations concerning sedimentation control and storm water runoff.

B. In case of conflict between the above codes, regulations, references and standards and these specifications, the more stringent requirements shall govern.

C. Preconstruction Conference: Conduct conference at Project site as directed by Contracting Officer prior to start of construction.

1.4 PROJECT/SITE CONDITIONS

A. Existing Conditions: Verify all existing conditions affecting the work of this section prior to submitting bids or proposals. Additional compensation will not be allowed for revisions or modification of work resulting from failure to verify existing conditions.

1.5 WARRANTY

A. Temporary Erosion and Sediment Control measures shall be maintained until permanent measures are in place. All damaged, disturbed or devices filled with sediment, which may occur within the specified project warranty period, shall be corrected at no cost to the Government. Any devices damaged by erosion or sediment shall be restored to their original condition by the Contractor, at no cost to the Government.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Erosion and Sedimentation Control Materials: Provide one or more of the following materials, as shown on the drawings or as applicable for site conditions:

1. Sandbags.
2. Clean, seed-free, certified, cereal hay or grain straw bales.
3. Silt fences.
4. Rock riprap.
5. Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh.
6. Biodegradable twisted jute or spun-coir mesh, 0.92 lb/sy minimum, with 50 to 65 percent open area.
7. Drainage geotextile.
8. Impervious fill.
9. Other materials proposed for use on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:

1. Determine the existing ground elevations, drainage patterns, and changes to such patterns during excavation in order to satisfactorily plan and provide materials for adequate erosion and sediment control devices.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and rights-of-way according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Secure grading permit from agency have jurisdiction prior to commencing grading operations.

3.3 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work of this section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

3.4 INSTALLATION

A. Erosion and Sedimentation Control Devices. Erosion and sedimentation control measures to be taken during construction include, but are not necessarily limited to the following:

1. Apply soil stabilization within 14 days to all disturbed areas that are to be dormant for a period longer than 30 calendar days after reaching grade. Stabilize soil with mulch anchored per criteria of authorities having jurisdiction. Temporarily revegetate areas that will remain in an interim condition for more than three months.
2. Roads and parking areas indicated to be paved may be covered with an appropriate aggregate base course in lieu of mulch. Temporary mulching or aggregate base course is not required if final pavement construction will take place within 30 days after grading to final contours.
3. Soils that will be stockpiled for more than 30 days must be mulched and seeded within 14 days after stockpile construction.

4. Prevent sediment from leaving the project site by installing a silt fence or other BMPs as indicated on the plans. Protect existing storm inlets adjacent to the site by an approved gravel filter.
5. Straw waddles may be used at specific locations to provide temporary filtration of sediment from runoff.
6. Provide temporary erosion controls consisting of berms at the top of slopes and interceptor ditches at ends of berms and at those locations which will eliminate or minimize erosion during construction, along with temporary seeding, temporary diversion, chutes, and down pipes and lining of water courses.
7. Temporary sedimentation controls shall consist of silt dams, traps, silt fence, barriers, and appurtenances at the top of spoil and borrow area slopes and where runoff water exits the site.
8. Maintain the available silt holding capacity of silt dams, fence traps and barriers until no longer needed. The sediment capacity of sediment retainage areas shall be at a minimum, the capacity shown on the plans in conformance with Urban Drainage Criteria Manual, Volume 3. Prior to removal, obtain concurrence of the Contracting Officer and Engineer.
9. Remove accumulated sediment and debris from a BMP when the sediment level reaches one-half the height of the BMP, or at any time the sediment or debris adversely impacts the functioning of the BMP.
10. Remove straw waddles which have deteriorated and filter stone or cloth which has become dislodged. Place new straw waddles and new filter and fence.
11. The erosion/sediment control plan shows the minimum required for the project. If it becomes apparent that additional controls are necessary, the Contractor shall install additional controls.

B. Chemicals and Pollutants:

1. Store construction materials and chemicals that could contribute pollutants to the runoff within an enclosure, container, or dike located around the perimeter of the storage area, to prevent discharge of these materials into runoff from the construction site.
2. Locate areas used for collection and temporary storage of solid and liquid waste away from the storm drainage system. Provide covering or fencing as required to prevent windblown materials; construct perimeter dike to contain liquid runoff. These measures may not be necessary if materials are immediately placed in covered waste containers.
3. Perform equipment maintenance in designated areas using measures such as drip pans to control petroleum products spillage.
4. Immediately clean up and properly dispose of spills of construction related materials such as paints, solvents, or other chemicals.

C. Final Stabilization and Long-Term Management:

1. Final stabilization shall be achieved through permanent vegetation and landscaping after construction of all buildings and paved surfaces.

2. With approval of Contracting Officer temporary erosion and sediment control measures may be removed within 30 days after final site stabilization is achieved or after temporary measures are no longer needed.

A. Inspection and Maintenance: Inspect erosion and sediment control measures weekly during construction. In addition, inspect all facilities immediately after any significant runoff or snowmelt which results in runoff. Repair or otherwise mitigate any damage to the erosion and sediment control facilities at no additional cost to the Government.

3.5 CLEANING

A. Removal of Controls: Remove controls upon completion of that portion of the work for which controls were furnished. Leave the site and work area in a clean condition.

END OF SECTION

SECTION 328400

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Sleeves.
3. Manual valves.
4. Automatic control valves.
5. Sprinklers.
6. Quick couplers.
7. Controllers.
8. Boxes for automatic control valves.

1.2 ACTION SUBMITTALS

A. Water Flow & Pressure Testing: Contractor shall test water flow (GPM) and water pressure (PSI) after the installation of the new well pump and pressure tank. Contractor shall make necessary adjustments to the irrigation design based on flow and pressure testing results, with approval from the contracting officer.
   1. Testing results shall be indicated on AS-BUILT DRAWINGS and submittal reports.

B. Product Data:

1. Pipes, tubes, and fittings.
2. Manual valves.
3. Automatic control valves.
4. Sprinklers.
5. Quick couplers.
6. Controllers.
7. Boxes for automatic control valves.
8. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Wiring Diagrams: For power, signal, and control wiring.

D. Delegated Design Submittal: For irrigation systems analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are indicated and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions, such as signs and light standards.

B. Zoning Chart: Indicate each irrigation zone and its control valve.

C. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs a Certified Irrigation Designer - Landscape qualified by the Irrigation Association or equivalent.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Irrigation Zone Control: Automatic operation with controller and automatic control valves with battery back-up.
1. Controller system shall include sensors to monitor wind, rain, and freeze conditions.

B. Location of Sprinklers and Specialties: Design location is approximate, as shown on the drawings. Make minor adjustments necessary to avoid trees, root zones, and obstructions, such as signs, sidewalks, vegetation, and facilities. Maintain 100 percent irrigation coverage of turfgrass areas indicated with no more than 30% overlapping spray patterns. Design irrigation system with respect to the project's soil type.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Line Piping (Sch. 40): 200 psig (1380 kPa)
2. Circuit or Lateral Piping: 100 psig min.
3. Drip Piping: Use manufacturer's recommendations

2.2 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.

C. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper or equivalent to local plumbing regulations.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.

D. PE Pipe with Controlled ID: ASTM D2239, PE 3408 compound; SIDR 11.5 and SIDR 15.

1. Insert Fittings for PE Pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include stainless steel "crimp-style" clamps, bands, or other fasteners.

E. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedules 40.

1. PVC Socket Fittings: ASTM D2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D2464, Schedule 80.
3. PVC Socket Unions: Construction similar to that of MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

F. PVC Pipe, Pressure Rated: ASTM D2241, PVC 1120 compound, SDR 21.

1. PVC Socket Fittings: ASTM D2467, Schedule 80.
2. PVC Socket Unions: Construction similar to that of MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.3 PIPING SLEEVES

A. Sleeves for irrigation piping and wiring shall be 3" diameter minimum PVC to be set under all existing or planned hardscape surfacing or compacted aggregate surfacing, AS SHOWN ON DRAWINGS.
1. Actual sleeve locations shall be clearly marked on AS-BUILT DRAWINGS.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3 mm) thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.

E. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.

F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

G. Brass Ball Valves:
   1. Description:

      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Forged brass.
      f. Ends: Threaded or solder joint if indicated.
      g. Seats: PTFE or TFE.
      h. Stem: Brass.
      i. Ball: Chrome-plated brass.
      j. Port: Full or regular, but not reduced.

H. Plastic Ball Valves:
   1. Description:

      a. Standard: MSS SP-122.
      b. Pressure Rating: 150 psig (1035 kPa)
      c. Body Material: PVC.
      d. Type: Union.
      e. End Connections: Socket or threaded.
      f. Port: Full.

2.5 AUTOMATIC CONTROL VALVES

A. Plastic, Automatic Control Valves:

1. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24 V ac solenoid.
2. Control valve shall be “Hunter 2” PGV valve” or approved equal.

B. Plastic, Automatic Control Valves for Drip Irrigation:
1. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24 V ac solenoid.
2. Drip Control valve shall be “Rainbird’s 1” wide flow control zone kit w/ IVM” or approved equal.

2.6 AUTOMATIC DRAIN VALVES

A. General Requirements: Designed to drain water from irrigation piping when the pressure falls below 5 to 10 psi.
1. Auto Drain Valves shall be ¾” MPT “King Drain” or approved equal.

B. Installation Requirements
1. Auto Drain Valves shall be installed per the manufacturer's recommendations.
2. Shall be installed at all low points along the lateral irrigation line AND/OR every 100 feet intervals.
3. Install a 12” diameter by 4” depth ¾” washed aggregate sump under each Auto Drain Valve unless otherwise directed.
4. Install each drain valve at a 45 degree angle from straight down, as shown on the drawings.

2.7 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up Overhead Spray Sprinklers:
1. Hunter Industries’ “PROS-06” Spray Body or approved equal.
2. Description:

   a. Body Material: ABS.
   b. Pop-up Height: 6 inches aboveground to nozzle.
   c. Nozzle: ABS
   d. Retraction Spring: Stainless steel.
   e. Internal Parts: Corrosion resistant.
   f. Pattern: Adjustable, with flow adjustment.

3. Capacities and Characteristics:

   a. Nozzle: Hunter Industries’ “MP Rotator” or approved equal, as shown on Nozzle schedule.

b. Flow: Adjustable GPM (L/s)
c. Arc: Adjustable.
d. Radius: Adjustable.
e. Inlet: NPS 1/2 or NPS 3/4 (DN 15 or DN 20)

2.8 DRIP EMITTERS

A. General Requirements: Designed for uniform water delivery to plants at available water pressure.

B. Plastic, Drip Irrigation Spot Watering Dripper/Emitter:
1. Rainbird SW10 – 1.0 GPH or approved equal
2. Pressure compensating
3. Self-piercing barbed design

2.9 CONTROLLERS

A. Description:

1. CONTROLLER
   a. Controller shall be a "Hunter PRO-C Controller" or approved equal.

2. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.

3. Interior Control Enclosures: NEMA 250, Type 12, drip proof, with cover.

   a. Body Material: Molded plastic
   b. Mounting: Surface type for wall

4. Control Transformer: 24 V secondary, with primary fuse.

5. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

   a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
   b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
   c. Surge Protection: Metal-oxide-varistor type on each station and primary power.

6. Weather Sensor: shall be “Hunter’s Mini-Weather Station MWS-FR” or approved equal. Adjustable to shut off water flow during windy, rainy, or freezing conditions.

7. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.

    a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
    b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
    c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector, or crimped joint and epoxy resin moisture seal; suitable for direct burial.

2.10 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Valve Boxes:

1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

    a. Size: As required for valves and service.
    b. Shape: Round, Square, or Rectangular.
    c. Sidewall Material: PE, ABS, or FRP
    d. Cover Material: PE, ABS, or FRP

        1) Lettering: "IRRIGATION VALVE BOX”

B. Drainage Backfill: 4” depth, cleaned gravel or crushed stone, graded from 3/4-inch (19 mm) minimum to 3 inches (75 mm) maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312250 "Earthwork" and Section 312317 “Trenching Utilities.”

B. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.

C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 24 inches (600 mm) below finished grade.
2. Circuit Piping: 18 inches (450 mm) minimum.
3. Sleeves: 12 inches (300 mm) minimum.

3.2 INSTALLATION OF PVC PIPING

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping as to avoid, as much as possible, tree root zones.

C. Install piping free of sags and excessive bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 (DN 50) or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 (DN 65) or larger pipe connection.

H. Lay piping on solid subbase, uniformly sloped without humps or depressions.

I. Install PVC piping in dry weather when temperature is above 40 deg F (5 deg C). Allow joints to cure at least 1 hour at temperatures above 40 deg F (5 deg C) before testing.

3.3 INSTALLATION OF POLYETHYLENE PIPING

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping as to avoid, as much as possible, tree root zones.

C. Install piping free of sags and excessive bends.

D. Install groups of pipes in same trench and parallel to each other, spaced to permit valve servicing.

E. Lay piping on solid subbase, uniformly sloped without humps or depressions.

3.4 JOINT CONSTRUCTION

A. Copper-Tubing Brazed Joints: Construct joints in accordance with CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.

B. Copper-Tubing Soldered Joints: Apply ASTM B813 water-flushable flux to tube end unless otherwise indicated. Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.

C. PE Piping Fastener Joints: Join with insert fittings and two (2) “crimp-style” stainless steel clamps or bands on each connection and in accordance with piping manufacturer's written instructions.

D. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D1785, PVC pipe and PVC socket fittings in accordance with ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings in accordance with ASTM D2855.
3. PVC Non-pressure Piping: Join in accordance with ASTM D2855.

3.5 INSTALLATION OF VALVES

A. Throttling Valves: Install in underground piping in boxes for automatic control valves as specified by the valve manufacturer.

3.6 INSTALLATION OF SPRINKLERS

A. Install sprinklers after hydrostatic test is completed.
1. Intent is for the sprinkler system to run at 40 gpm and at 40 psi unless otherwise approved.

B. Install sprinklers at manufacturer's recommended heights.

3.7 INSTALLATION OF AUTOMATIC IRRIGATION CONTROL SYSTEM

A. Equipment Mounting, Interior: Install controllers on interior wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Install control cable, or multi-strand irrigation wire, in same trench as irrigation piping and at least 2 inches (50 mm) below piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.8 IDENTIFICATION

A. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312317 Trenching Utilities for warning tapes.

3.9 FIELD QUALITY CONTROL

A. Perform post-installation tests, inspections, and adjustments.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Irrigation system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 INITIAL CONTROLLER SET-UP

A. Contractor shall set up the irrigation controller.

B. Contractor shall set up the initial watering schedule based on watering requirements for the on-site grass type, soil type, and any known watering restrictions or requirements.
1. Watering schedule shall be printed and provided to on-site Forest Service personnel.

C. Contractor shall set up cistern filling valve or zone such that local Forest Service personnel can turn on manually using the irrigation controller. The valve controlling water flow to the cistern will NOT be included in the regular watering schedule.

3.11 ADJUSTING

A. Adjust settings of controllers and weather sensor.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.

3.12 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Underground Irrigation Main Piping:
   1. Schedule 40 or Schedule 80, PVC pipe and socket fittings, and solvent-cemented joints.
   2. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
   3. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

D. Circuit Piping:

   1. Irrigation industry standard 2” diameter Polyethylene or HDPE pipe rated for at least 100 psi with Sch. 40 male barbed insert fittings.

E. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

   1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

F. Risers to Aboveground Sprinklers and Specialties:
   1. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

3.13 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

   1. NPS 2 (DN 50) and Smaller: Curb valve, curb-valve casing, and shutoff rod.

B. Aboveground, Shutoff-Duty Valves:

   1. NPS 2 (DN 50) and Smaller:

      a. Brass or bronze ball valve.
      b. Bronze gate valve.

C. Throttling-Duty Valves:

1. NPS 2 (DN 50) and Smaller:

a. Plastic automatic control valve.
b. Plastic ball valve.

END OF SECTION 328400

SECTION 330500
COMMON WORK RESULTS FOR UTILITIES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Piping system common requirements.
3. Equipment installation common requirements.
4. Metal supports and anchorages.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 – PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

PART 3 – EXECUTION

3.1 PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Verify final equipment locations for roughing-in.

J. Refer to equipment specifications in other Sections for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.4 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

END OF SECTION 330500

SECTION 331112
WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping and appurtenances for potable-water service outside the buildings. This Section also includes flushing, testing, and disinfecting waterlines.

1.2 SUBMITTALS

A. Product Data for the following:

1. Pipe and fittings
2. Compression couplings for similar and dissimilar pipes
3. Gradation of Rip-Rap
4. Curb Stop and Box
5. Gate Valve and Box
6. Operating Tools For Curb Stop And Gate Valve

B. Operation and Maintenance Data: For the following:
1. Valves.
2. Protective enclosures.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressures: The following are minimum pressure requirements for piping and specialties, unless otherwise indicated:

1. Potable-Water Service: 160 psig.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Contracting Officer (CO) not less than two days in advance have proposed utility interruptions.
2. Do not proceed with utility interruptions without CO's written permission.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied endcaps. Maintain endcaps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Protect flanges, fittings, and specialties from moisture and dirt.

C. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate connection to water main with utility company.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building water distribution piping.

C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

A. All waterlines, pipes, and fittings shall be new and unused, of the type, pressure rating or class, and size specified and as shown on the drawings.

2.2 GALVANIZED STEEL PIPE (GSP)

A. Pipe

1. ASTM A53 for pipe 4-inch diameter and smaller. Schedule 40.
2. Plain ends for joining with standard manufactured couplings.
3. Threaded ends shall meet requirements of ASME B1.20.1.

B. Fittings

1. ASTM A53. Schedule 40.
2. For threaded ends use Teflon thread sealing tape.

2.3 PVC, SCHEDULE PIPE

A. PVC, Schedule 40 Pipe:

1. ASTM D 1785.

2. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.

2.4 COUPLINGS FOR SIMILAR OR DISSIMILAR PIPE

A. Compression type transition fittings for making connections between like and dissimilar pipe materials shall be designed to enable a variety of connections between polyethylene pipe to various pipes. Fittings shall be Cepex performance series compression fittings as manufactured by Cepex Holding, S.A. and distributed by The Lateral Connection Corp., Sparks, NV 89434 (775) 626-6777 or approved equal and supplied by Ferguson Waterworks, Denver, CO, (303) 571-4444 or approved equal.

2.5 PIPE SLEEVE

A. PVC, Schedule 80 Pipe: ASTM D 1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.

2.6 FLAT STEEL SUCTION STRAINER

A. Zinc plated, 16-gauge, cold-rolled steel strainer with threaded end to attach to GSP pipe, part SSS6, as manufactured by Campbell Manufacturing, Inc., Bechtelsville, PA, (800) 523-0224 or approved equal.

2.7 INSECT SCREEN

A. 24-mesh woven wire cloth, type 304 stainless steel standard grade, non-corrodible.

2.8 RIPRAP AT DAYLIGHT DRAIN

A. Riprap shall consist of hard, dense, durable stone, angular in shape and resistant to weathering. Rounded stone or boulders will not be accepted as riprap material. The stone shall have a specific gravity of at least 2.5. Each piece shall have its greatest dimension not greater than three times its least dimension. Riprap shall be nominal stone size 6” and shall conform to the gradation requirements of CDOT 506.02 6” riprap given in the table below.

Stone Size d50	% of Material Smaller Than Typical Stone	Typical Stone Dimensions (Inches)	Typical Stone Weight (Pounds)
6	70-100	12	85
	50-70	9	35
	35-50	6	10

	2-10	2	.4

OR

B. Riprap shall consist of hard, dense, durable stone, angular in shape and resistant to weathering. Rounded stone or boulders will not be accepted as riprap material. Individual stones shall have dimensions of 6” to 12”. Source of stone shall be from rocks uncovered on site during construction operations or from an approved off-site source.

2.9 CURB STOP

A. One-piece, closed-bottom body with tee head and plug integrally cast, o-ring sealed design, and 175 psig maximum working pressure.

B. Minneapolis pattern.

C. Female iron pipe inlet by female iron pipe outlet.

D. Hole for attaching curb box rod or handle in provided in tee head.

E. Heavy cast bronze body construction conforming to AWWA C800.

F. Curb stops shall be 200 psig Irrigation valve with auto drain, sized for pipe diameter and material, both ends female threaded with Minneapolis pattern top, model number 78-625-10, as supplied by Dean Bennet Supply, Denver, CO 80239, (800) 621-4291, or approved equal.

2.10 CURB BOX

A. Extension type curb box with arch base, cast iron base, steel pipe telescoping upper section.

B. Lids shall be two-piece, cast iron with brass pentagon plug and have lettering “WATER” permanently imprinted on them.

C. Box shall be equipped with stationary rod. The rod length shall be within 12 inches of the top of the box.

D. Curb box, complete with lid and stationary rod, shall be Arch style, series number 5602ALR for 2” valves, length as needed, as manufactured by A.Y. McDonald Mfg., P.O. Box 508, Dubuque, Iowa, (800) 292-2737, or approved equal.

E. Box length shall be adjustable between 19-22 inches.

F. Model 461-S as manufactured by Tyler Pipe, P.O. Box 2027, Tyler, TX 75710, phone: (214) 882-5511; or approved equal.

2.11 TOOLS FOR OPERATING GATE VALVES, CURB STOPS

A. Three combination keys to operate stationary rods and pentagon screw on lids shall be supplied to the CO. Keys shall be model number H-10356, 3-foot length, as manufactured by Mueller Co., Decatur, Illinois, (800) 423-1323, or approved equal.

2.12 UNDERGROUND DETECTION AND MARKING TAPE

A. Detectable Warning Tape: Acid-and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 3 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is curried up to 30 inches deep; colored as follows.

1. Red: Electric.

2. Yellow: Gas.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

2.13 PITS

A. Description: Precast, reinforced concrete pit, designed for A0-16 load designation according to ASTM C 857, and made according to ASTM C 858.

B. Ladder: ASTM A 36 (ASTM A 36M), steel or polyethylene-encased steel steps.

C. Manhole: ASTM A 48, class No. 35 (ASTM A 36M), steel or polyethylene-encased steel.

1. Weight and Dimensions: Not smaller than 24-inch (610 mm) diameter, unless otherwise indicated.

D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron, 24-inch (610 mm) diameter traffic frame and cover.

1. Weight and Dimensions: Not smaller than 24-inch (610 mm) diameter, unless otherwise indicated.

E. Drain: ASME A112.21.1M, cast-iron area drain, of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.14 TRACER WIRE

A. UF insulated #12 copper wire.

PART 3 - EXECUTION

3.1 PIPE ALIGNMENT AND GRADE

A. Construct the water system to the lines and grades shown or established in the field.

B. Stake locations of water lines as shown on the drawings. The Contracting Officer (CO) shall approve the water line location prior to the start of excavation.

C. Sections of the water system that operate seasonally shall be constructed to drain by gravity to daylight drains for winter campground shutdown. Waterlines shall be constructed to drain at a minimum grade of 0.5% unless indicated on the drawings. Waterlines not meeting this requirement shall be removed by the Contactor and replaced at no cost to the Government.

D. Pipelines may be relocated slightly, if necessary, to avoid existing obstacles. However, seasonally operated lines shall be installed to slope towards drains as shown on the drawings.

E. Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed the manufacturer's recommended maximum joint deflection or curvature for their pipe. If the alignment requires curvature or deflections in excess of these limitations, the Contractor shall provide special bends, standard fittings, or a sufficient number of shorter lengths of pipe to provide angular deflections at the joints within the limit set forth by the manufacturer.

F. Bends resulting in tension on joints will not be allowed.

3.2 GENERAL

A. All pipe, fittings, and appurtenances shall be handled and laid in strict conformance to the manufacturer’s recommendations.

B. Drains, valves, and other regulating and controlling devices shall be installed in the line where called for on the drawings.

C. The interior of all pipe, fittings, and other accessories shall be kept as free as possible from dirt and foreign matter at all times. Each piece of line as it is laid shall be cleaned of all debris. When the pipeline has become dirty on the inside during shipment or storage, it shall be swabbed out by drawing a damp swab through the line before lying. Care shall be exercised to keep all joining surfaces clean. Any pipe with contaminated or damaged joining surfaces, which cannot be satisfactorily cleaned or repaired, shall be discarded. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or the weather is unsuitable for such work. At all times when work is not in progress, all open ends of the pipe and fittings shall be securely closed to the satisfaction of the CO so that no trench water, rodents, earth, or other substance will enter the pipe or fittings.

D. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe at the Contractor's expense.

E. When sewer and water lines cross, the water and sewer pipes shall be centered at the crossing so that the joints will be an equal distance and as far as possible from the crossing. When sewer lines are less than 10 feet horizontally from water lines or if they are less than 18 inches lower than waterlines then encase the joints of the sewer lines in concrete.

F. Where water line crosses a road culvert, adjust grade of water line to provide a minimum of 12 inches of separation between the water line and culvert, maintaining slope of water line to daylight drain.

G. A minimum of one-foot separation shall be maintained between electric and water lines in the same trench. Unless the electric conductors are in conduit the water line shall be a minimum of one foot below the electric conductors.

H. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration.

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

J. Anchor service-entry piping to building wall.

3.3 EXCAVATION, TRENCHING AND BEDDING

A. Refer to Division 2 Section "Earthwork".

3.4 CUTTING AND HANDLING OF PIPE

A. Cutting of pipe for closure pieces or for other reasons shall be done in a neat manner by methods, which will not damage the pipe. The pipe and fittings shall be handled in such a manner as to insure delivery and final placement in good, undamaged condition. Particular care shall be exercised not to injure the pipe surfaces or coatings. Damaged pipe shall not be used in the work.

3.5 LAYING PIPE

A. No pipe shall be placed in the trench until the CO has approved the trench and bedding.

B. Each section of the pipe shall rest upon the pipe bed for the full length of its barrel.

C. Backfill the pipe within 24 hours after installing the pipe in the trench, leaving the joints and one foot of pipe on each side of each joint exposed until testing is complete.

D. When work is not in progress, securely close open ends of pipe and fittings.

E. When high density polyethylene pipe is used, it shall be weaved in the trench to provide horizontal slack in the line for expansion and contraction.

F. High density polyethylene pipe shall be allowed to cool to within 20° F of the shaded trench bottom temperature before backfilling.

3.6 PVC, AWWA PIPE INSTALLATION

A. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.

3.7 JOINT CONSTRUCTION

A. Joints shall be made using jointing materials and applied with the proper accessories, in accordance with the manufacturer's instructions. The joints shall be adjusted, and the work performed in a manner so as to obtain the degree of water tightness required. If pipe and fittings are assembled with lubricant, it must be nontoxic. Where connections are made between new work and existing lines, the connections shall be made by using special fittings to suit the actual conditions.

B. Threaded Joints:

1. Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to fitting and valve ends into which pipes are being threaded.
2. Exposed threaded pipe joints on galvanized steel pipe shall be painted with mastic following the manufacturer's application procedures.
3. Field cut ends shall be squared off by grinding or filing; ends shall be reamed with all chips and flakes removed.
4. Field cut threads or machined joints shall be made with sharp tools to sharp finished ends.

C. Dissimilar Materials Piping Joints

1. Polyethylene pipe and fittings may be joined to other materials by means of couplings designed for joining polyethylene pipe to another material. Couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the coupling will cause the pipe to yield before the coupling disjoints.
2. Use adapters compatible with both piping materials, OD, and system working pressure.

3.8 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

3.9 PIPE SLEEVE INSTALLATION

A. Where waterline crosses road paving install waterline in pipe sleeve. Extend pipe sleeve a minimum of three feet beyond edge of pavement.

3.10 TRACER WIRE

A. Tape tracer wire to water line at a maximum interval of 20 feet.

B. Clamp tracer wire to outlet drains, hydrants, curb stops and air/vacuum valves with ground clamps sized for pipe at appurtenance.

3.11 BRANCH CONNECTIONS

A. Branch connections to the main shall be made with tees.

B. Horizontal tees for waterline laterals shall not be permitted. The branch side of tees shall be up when drainage is toward the tee, and down when drainage is away from the tee.

C. Waterline tees shall be the same diameter as the largest pipe connected to the tee.

3.12 VALVE INSTALLATION

A. Corporation Valves and Curb Valves

1. Install each underground curb valve with head pointed up and curb box.
2. Install concrete pad around top of box as shown on the drawings.

3.13 DAYLIGHT DRAIN

A. Transition from water system piping to galvanized steel pipe 10-feet from atmospheric outlet of daylight drain.

B. Install suction strainer and insect screens on the atmospheric outlet of daylight drains. Attach insect screens to pipe with stainless steel hose clamps.

C. Minimum grade of slope of drain shall be 1%.

D. Place riprap securely around outlet with a minimum 6” air gap.

3.14 BACKFILLING AND WATERLINE MARKING

A. As specified in Division 31 Section "Earthwork”.

3.15 FINAL PIPE CLEANING AND FLUSHING

A. Before testing, clean new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired by high pressure water jet or mechanical means.

B. If the new waterlines are extensions or modifications of an existing water system, the new system(s) and all of the existing system immediately downstream of the control valve shall be flushed to remove sediment. The control valve referred to here is the valve in the existing system that must be closed to allow construction of new facilities.

C. During the flushing operation, operate all valves, hydrants, hose bibs and other outlets.

D. Flush system with clean potable water until dirty water does not appear at points of outlet.

3.16 PRESSURE TESTING WATERLINES

A. Conduct piping tests before joints are covered and after thrust blocks, if required, have hardened sufficiently. Joints shall remain uncovered until testing is completed satisfactorily.

B. The Contractor shall furnish the pump, pipe, gauge, measuring device, connections, and all other necessary apparatus, and shall furnish the necessary personnel to conduct the tests. All equipment, gauges, and attachments shall be subject to approval by the CO.

C. The CO shall be present during the testing period.

D. Test all newly constructed portions of the water system, including water mains, service lines, fittings, valves, and hydrants. New waterlines that are extensions or modifications of an existing water system shall be tested at the test pressure specified here unless the CO specifies another pressure. Pneumatic testing will not be allowed.

E. Waterlines shall be tested in sections not to exceed 2,000 ft in length or a maximum pressure differential of 30 psi in the test section.

F. Test Procedure

1. Slowly fill each valve or plugged test section of pipe with water. The line shall be filled by means of the well pump. Operate all hydrants and taps to bleed entrapped air from the test section. Operate the pump as needed.
2. Raise the internal pressure of the system by pumping in water. Increase pressure in 50-psig increments and inspect each joint between increments. Raise internal pressure to a test pressure of 80 psi other test pressure as approved by the CO.
3. The system should be allowed to stabilize for 1 hour at the test pressure before conducting the hydrostatic test. Make up liquid may be added during this time to return to test pressure.

4. Immediately following the initial expansion phase, reduce the test pressure by 10 psi, and stop adding test liquid. If the test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is indicated.

G. Leakage shall be verified by the Contractor and the CO.

H. If there is leakage in excess of the above requirements, the Contractor shall, at his own expense, locate and replace any defective pipe, fittings, valves, joints, and hydrants as required, until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage. Flush the system and repeat the pressure test until leak is repaired.

I. No paints, asphalts, tars, enamels, or other types of pipe compounds shall be used to eliminate leaks.

J. Backfill for waterlines shall be completed after the CO approves testing.

K. The Contractor shall furnish a written report to the CO describing the results of each test. The report must identify the specific portions of the pipeline tested, the pressure, the duration of the tests, and the amount of leakage.

END OF SECTION 331112