Twain Harte
Community Services District

TECHNICAL SPECIFICATIONS

TWAIN HARTE COMMUNITY SERVICES DISTRICT

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TWAIN HARTE
COMMUNITY SERVICES DISTRICT

TECHNICAL SPECIFICATIONS
DIVISIONS AND SECTIONS

SECTION 01 10 00
SUMMARY

PART 1 – GENERAL

1.01 SPECIFICATION FORMAT

A. The following specifications are organized into Divisions and Sections using the 48-division format and the Construction Specification Institute's (CSI's) "MasterFormat 2018" numbering system.

1.02 SECTION INCLUDES

A. Project Description.

B. Definition of Parties.

C. Site Conditions.

D. General Construction Responsibilities and Procedures.

E. Other Requirements.

F. Final site cleanup.

1.03 PROJECT DESCRIPTION

A. The work described in the following specifications is part of the improvements to the Twain Harte Community Services District. The purpose of the Twain Harte Community Services District project is to mitigate hazards and provide multiple benefits to the watershed and surrounding region (increased treatment of stormwater runoff, increased water supply reliability, improvement and protection of environmental habitat and improvement of stormwater system capacity).

B. The biddable Work for the Twain Harte Community Service District project includes the following general components:

1. General site work (e.g., tree protection, temporary fencing if deemed necessary for security, cleanup, and storm drain protection).

2. Demolition, removal, and legal disposal of asphalt, abandoned pipes, and other unusable debris located on site.

3. Earthwork, including grading and excavation for Tank-1 and removal of all rocks greater than six inches in size from backfill. Grading of bioswales and raingarden.

4. Boulder, cobble, and rock mulch placement as field directed by Owner's Representative.

5. Permeable pathway, including pedestrian (DG) decomposed granite walkway.

6. Permeable parking lot.

7. Curb and ramp installation (ADA).

8. Electrical work.

9. Underground utilities (cold water to tank, irrigation, rainwater conveyance, culverts and storm drains).

10. Gravel pad and setting of Tank-1.
11. Installation aboveground plumbing, valves and accessories for Tank-1
12. Rainwater pump Installation
13. Irrigation System layout and installation.
14. Landscaping, planting and mulching

1.04 DEFINITION OF PARTIES

A. OWNER'S REPRESENTATIVE: The Twain Harte Community Services District (CSD) or officials acting on behalf of the Twain Harte Community Service (CSD).

B. WATERSHED PROGRESSIVE: Individual, firm, or corporation to provide engineering and design services during the design and construction phase of the project.

C. BIDDER: Any individual, firm, or corporation submitting a proposal for the work contemplated.

D. CONTRACTOR: Individual, firm, or corporation who has entered into contract with the OWNER to complete the Work in accordance with the drawings and specifications.

E. SUBCONTRACTOR: Individual, firm, or corporation to supply work or material at the project site pursuant to a separate agreement with the Contractor.

F. SPECIFICATIONS: The directions, provisions, and requirements described herein, together with all written or printed agreements and instructions made, or to be made, pertaining to the method and manner of performing the Work.

1.05 SITE CONDITIONS

A. CONTRACTOR's Staging Area:

1. Any staging for personnel, equipment, and materials by the Contractor must be performed within the construction limits, in an area indicated on the Drawings, or in an area designated by the Owner.

2. The Contractor may request to use other areas for staging not indicated on the drawings. All such areas are subject to approval by the Owner's Representative.

B. Disposal of Waste Material:

1. Materials identified as waste by the Contractor shall be removed immediately from the project site and disposed of in accordance with applicable requirements and regulations.

2. Remove all excess or damaged construction materials from the project site.

3. Remove all unsuitable material from the project site, including vegetative debris.

4. Burning is not permitted on site.

C. Site Investigation and Representation

1. Information about existing conditions is shown on the construction drawings. It is the Bidder and Contractor's responsibility to verify the accuracy of the construction drawings.

2. The Contractor shall carefully review, inspect, and compare the contract documents with the field conditions (including subsurface conditions, underground facilities, and existing structures).

D. Information of Site Conditions:

1. The Contractor shall promptly report any conflict, error, or discrepancy that the Contract may discover at any time to the Owner's Representative.

E. Fire Prevention and Protection:

1. The Contractor shall perform all work in a fire-safe manner and comply with applicable fire prevention regulations.

1.06 GENERAL CONSTRUCTION RESPONSIBILITIES AND PROCEDURES

A. The Contractor shall not operate outside the designated limits of disturbance without prior approval from the Owner.

B. All work areas, unless otherwise noted on the construction drawings, shall be restored to pre-construction conditions.

1.07 OTHER REQUIREMENTS

A. Dimensions and Measurements:

1. The Contractor is responsible for construction staking, which is to be approved by the Owner's Representative.

2. The Contractor shall verify dimensions shown on the construction drawings and notify the Owner's Representative of discrepancies prior to proceeding with the Work.

B. Whenever a piece of equipment, an article, or a device is referred to in a singular number, such references apply to as many such items as are shown on the construction drawings or required to complete the Work.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION (Not used)

SECTION 01 20 50

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

This Section describes the methods of measurement and payment for the specific bid items associated with the Work on the proposed Twain Harte Community Services District Office. All other provisions of the Contract documents which relate to measurement and payment are applicable, except that where conflicts occur between this section and other provisions of the technical specifications or reference specifications, this measurement and payment section shall prevail.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01. METHOD OF PAYMENT

A. Payment will be made on the basis of the unit prices or lump sum bids for the various items as called for on the Bid Sheet(s) and included in the Contract as awarded. The quantities given in the Bid and contract forms are approximate only and are given as a basis for comparison of bids, and the Owner does not expressly or by implication agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of or any class or portion of the Work or to omit portions of the Work as may deemed necessary or advisable by the Engineer or Owner's Representative.

3.02. MEASUREMENT OF QUANTITIES

A. Full compensation for all expenses involved in conforming to the above requirements for weighing materials shall be included in the prices for the materials being weighed, and therefore, no additional allowance will be made.

B. The quantity of materials paid for by the lineal foot, square foot or square yard shall be determined by horizontal measurement.

C. The Contract shall submit a schedule of values of all lump sum items described below.

3.03. SCOPE OF PAYMENT

A. The Contractor shall accept the compensation as herein provided as full payment for furnishing all materials, labor, tools, and equipment necessary to complete the Work, and for performing all work contemplated and embraced under the Contract; also, for loss or damage arising from the nature of the Work, or from the action of the elements, except as heretofore provided, or from any unforeseen difficulties which may be encountered during the prosecution of the Work, until the final acceptance by the District, and for all risks of every description connected with the prosecution of the Work; also, for all expenses incurred in consequence of the suspension or discontinuance of the Work as herein specified; and for completing the Work according to the Plans and Specifications. Neither the payment of any estimate nor any retained percentage shall relieve the Contractor of any obligation to make good any defective work of materials.

3.04. BID ITEMS

Bid Item #1 – Mobilization, Demobilization, and Construction Coordination

1. Description

   This work includes the furnishing of all tools, equipment, labor, and materials required to accomplish all the following Work within the limits of disturbance designated on the plans or as directed by the Owner's Representative in accordance with the plans and specifications for Twain Harte Meadows. The Work includes but is not limited to the following:

   a) The Contractor shall develop a construction plan for the Work with means and methods that will allow completion of the work pursuant to these specifications using the space within the proposed Twain Harte Community Services District Office area or shall, independently from the District, acquire any temporary easements from landowners that are necessary to stockpile materials or facilitate completion of the Work.

   b) **Mobilization** – The Contractor shall move in and set up all equipment, provision for power, materials, etc. as necessary to complete all aspects of this project. This item also includes the cost of all bonds, insurance, and permits for the project.

   c) **Easements** – The Contractor may determine the location, type, extent, and value to the Contractor of any temporary easement(s), which may facilitate completion of the Work, which is beyond the District's access easement and fenced tank site shown on the Plans and Specifications.

   d) **Construction Schedule** – The Contractor is responsible for preparing, amending, implementing, and complying with construction schedule for all Work on this project. The initial schedule shall be submitted to the Owner's Representative at the time of the award of the contract. The schedule shall be amended and submitted to the Owner's Representative, as necessary if progress varies significantly from the schedule and at a minimum, every month.

   e) **Construction Water** – The District will provide access to construction water.

   f) **Submittals** – The Contractor shall provide the submittals and associated planning and engineering including, field verification, structural calculations, shop drawings, materials data sheets, Material Safety Data Sheets (MSDS), certificates of compliance, and other submittals required by the plans and specifications.

   g) **Utility Coordination** – The Contractor is responsible for all coordination efforts with regards to utilities on the project site including temporary service disruptions, tie-ins, and scheduling inspections for all Contractor Work. The Contractor shall be responsible for any financial claims associated with missed inspections, repeat inspections, or any costs associated with re-working portions of the project due to failed inspections or lack of inspections based on the Contractor's failure to schedule and follow through the same.

   h) **General Site Work** - The work involved as part of the General Site Work bid item includes but is not limited to tree protection, storm drain protection and site cleanup, fencing for security, safety, stormwater pollution prevention, potholing for exact location of existing utilities if necessary, and all other general site work required to complete the Work as specified in the Contract and set forth in the Drawings.

i) **Demobilization** – The Contractor shall remove all equipment and leftover materials.

2. Measurement

   Measurement of Work associated with mobilization, demobilization, and construction coordination will be based upon completion of such work as a lump sum.

3. Payment

   Payment for this bid item will be made at the lump sum, and a schedule of values for "Mobilization, Demobilization, and Construction Coordination" will be required. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

Bid Item #2 – Clearing and Grubbing (Demolition)

1. Description

   This work includes clearing and grubbing, saw cutting of existing pavement, removal and disposal of all existing asphalt concrete/pavement, trees, and other materials from the Twain Harte Community Services District Office project site as shown on the demolition plan. This work includes saw cutting and removing pavement from the existing parking area in accordance with the plans, specifications, and the direction of the Owner's Representative. This bid item includes other demolition work that is shown on the plans, described in the specifications, or may be required as well as the legal disposal of all spoils associated with the demolition work.

2. Measurement

   Measurement of Work associated with demolition will be based upon completion of such work as a lump sum.

3. Payment

   Payment for this bid item will be made at the lump sum, and a schedule of values for demolition work will be required. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item.

Bid Item #3 – Earthwork

1. Description

   This work includes excavation, grading of rain gardens and bioswales within the tolerances specified, removal of unsuitable materials including rocks greater than 6 inches in size, and legal disposal of all spoils associated with earthwork. This bid item also includes grading for parking lot, the rainwater tank pad, and any other excavation/grading work shown on the plans or described in the specifications. In addition, excavation and rough grading work includes any necessary dewatering as well as construction staking. Finally, earthwork and rough grading work includes off-haul of excavation materials.

2. Measurement
   Measurement of Work associated with earthwork and rough grading will be based upon completion of such work as a lump sum.

3. Payment

   Payment for this bid item will be made at the lump sum, and a schedule of values for earthwork and rough grading work will be required. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item.

Bid Item #4 – Bioswales and Rain Garden

1. Description

   This bid item includes the procurement, trucking, and placement of the cobble and rock mulch/gravel mix (pea gravel, river rock, and cobbles up to 10" in size) for the bioswales and rain gardens as shown on the drawings, described in the plans, and as directed by the Owner's Representative. The rock mulch and cobble will be approved by Owner's Representative, and placement will be field directed by Owner's Representative.

2. Measurement

   Measurement of Work associated with the volume of cobble and gravel much placed (CY).

3. Payment

   Quantities for cobble and gravel mulch will be paid for at the contract unit price per cubic yard. This price will include the materials, labor, and equipment required to place cobble and gravel mulch in accordance with the plans and specifications and as directed by the Owner's Representative. A schedule of values is required.

Bid Item #5 – Check Dams (1' to 3')

1. Description

   This bid item includes procurement, trucking, and placement of 1' to 3' check dam boulders as shown on the drawings and as directed by the Owner's Representative. Check dam boulder selection will also be directed by the Owner's Representative.

2. Measurement

   Measurement of Work associated with the number of check dam boulders placed based as lump sum.

3. Payment

   Quantities of check dam boulders will be paid for at the contract price as lump sum. Such price will include the materials, labor, and equipment required to place check dam boulders in accordance with the plans and as directed by the Owner's Representative. A schedule of values is required.

Bid Item #6 – Concrete Work

1. Description

   This bid item involves installation of the concrete pathway, concrete ADA parking stall, restore curb at existing ADA ramp and concrete parking lot bench curbs in accordance with the plans, specifications, and ADA requirements. The work involved in this bid item includes construction staking, subgrade preparation, base coarse placement in addition to any materials, labor, equipment, and any other work required to install the concrete pathway. The Contractor is responsible for sourcing all materials required to complete the Work and installing the concrete

pathway and concrete ADA parking stall, complete in place as shown on the plans and described in the specifications.

2. Measurement

   Measurement of the work associated with this bid item is by the lump sum.

3. Payment

   Payment for concrete pathway, concrete ADA parking stall, restoration of curb at existing ADA ramp and concrete parking lot bench curbs shall be made at the lump sum. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

Bid Item #7 – Pathways

1. Description

   This bid item involves the installation of a pedestrian decomposed granite (DG) pathway with edging and Culvert shown along the pedestrian walkway in accordance with the plans, specifications, and ADA requirements. The work involved in this bid item includes all the materials, labor, and equipment required to install the pedestrian DG pathway complete in place as shown on the plans and described in the specifications.

2. Measurement

   Measurement of the work associated with this bid item will be based upon completion of such work as lump sum.

3. Payment

   Payment for this bid item to be made at the lump sum. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

Bid Item #8 – True-Grid (Permeable Paving) Parking Lot

1. Description

   The Permeable Parking Lot bid item includes subgrade preparation, placing rock subbase, installing the TrueGrid (or accepted equivalent), delineating parking spots with striping or parking markers (for standard and handicap designated spaces), placing parking blocks, and any other work required to place the permeable parking lot in accordance with the plans, specifications, and manufacturer's recommendations. This includes all the materials, labor, tools, and equipment necessary to complete in place as shown on the plans and described in the specifications.

2. Measurement

   Measurement of the work associated with this bid item is the square footage of permeable parking lot installed.

3. Payment

Payment for the permeable parking lot shall be made at the contract unit price per square foot. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

Bid Item #9 – Rainwater System

1. Description

   This bid item includes the procurement and installation of the poly rain tank (tank-1), electrical for the rainwater pump and peripherals, underground utilities (rainwater conveyance, makeup water lines) as shown on the plans and described in the specifications. This work also includes installing the gravel pad, excavation, compaction, setting the tank, stubbing up the rainwater conveyance piping and final pipe connection to the irrigation system and tank. The rainwater system's electrical and underground utilities includes but is not limited to obtaining permits, testing, installing the underground electrical conduit and service to all 120V points of connections, panel construction, breaker installation, connecting the pumps for the rainwater harvesting system to electrical, and coordination with existing trades and utilities, trench excavation, pipe bedding, pipe laying and coordination with existing for irrigation point of connection, underground rainwater conveyance piping. In addition, the Contractor is responsible for furnishing and installing all pertinent materials, fittings, conduits, and appurtenances associated with the rainwater system.
2. Measurement

   Measurement of the work associated with this work will be based upon completion of such work as a lump sum.

3. Payment

   Payment for this bid item will be made at the lump sum. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

Bid Item #10 – Irrigation System

1. Description
   This bid item includes the installation of the irrigation system (irrigation valves, underground and above ground irrigation pipes, emitters, valve boxes, backflow devices, controller, sleeves etc.) as

   shown on the plans. This work will involve trench excavation, pipe bedding, pipe laying, irrigation valves and components layout and installation and coordination with existing points of connection for irrigation. In addition, the Contractor is responsible for furnishing and installing all pertinent materials, fittings, and appurtenances associated with the irrigation system, underground conveyance, PVC and Poly piping.
2. Measurement

   Measurement of the work associated with installing the utilities associated with this bid item will be based upon completion of such work as a lump sum.

3. Payment

Payment for work associated with underground utility installation be made at the lump sum. This includes full compensation for furnishing all labor, material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

Bid Item #11 – Planting

1. Description
   This bid item includes the installation of plants (trees, shrubs, groundcover, mulch etc.) as shown on the plans. This work will involve fine grading, planting layout, planting trees, shrubs and groundcover, applying soil amendments (compost), applying mulch. In addition, the Contractor is responsible for furnishing and installing all pertinent materials, plants, amendments associated with the planting plan.
2. Measurement

   Measurement of the work associated with planting plants associated with this bid item will be based upon completion of such work as a lump sum.

3. Payment
   Payment for work associated with planting plants be made at the lump sum. This includes full compensation for furnishing all labor, plant material, tools, and equipment required to complete the work associated with this bid item. A schedule of values is required.

SECTION 01 52 00
CONSTRUCTION FACILITIES

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. Temporary sanitary facilities, parking areas, temporary fencing, and security.

1.02 RELATED SECTIONS

A. SECTION 01 52 05, CONSTRUCTION STAGING AREAS

B. SECTION 01 74 14, CLEANING

1.03 TEMPORARY SANITARY FACILITIES

A. The Contractor may use the public restrooms located in the adjacent park on Meadows Drive.

B. If the Contractor deems it necessary to provide temporary sanitary facilities for this project, the Contractor shall locate the sanitary facilities in an area approved by the authorities having jurisdiction and maintain these facilities in a clean and sanitary condition during the work. Ensure the sanitary facilities are supplied with toilet paper, hand drying towels, and other related supplies.

C. Upon completion of the work, any temporary sanitary facilities shall be disinfected and removed from the site.

1.04 PARKING AREAS

A. Parking is indicated on the construction drawings. Off-site parking shall not interfere with existing community parking or traffic conditions.

1.05 TEMPORARY FENCING

A. The Contractor shall furnish, construct, maintain, and later remove temporary fencing around the jobs site as needed to provide site security (e.g., security of equipment, materials, and improvements) and to protect and keep safe the public from construction and unfinished improvements.

B. Any temporary fencing that is damaged from any cause during the progress of the Work shall be repaired or replaced by the Contractor at no additional cost to the Twain Harte Community Services District (CSD).

C. When no longer required for the work, temporary fencing shall be removed from the site. Removed fencing shall become the property of the Contractor.

D. Holes caused by the removal of temporary fences shall be properly filled to match adjacent surfaces.

1.06 SECURITY

A. Damaged, lost, or stolen materials or equipment shall be replaced by the Contractor at no additional cost to the CSD.

B. The Twain Harte CSD assumes no responsibility for loss of materials and equipment during the Work.

C. The Contractor shall repair any improvements damaged during the course of the work due to failure to appropriately secure the site.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 DEMOLITION

A. Remove base, asphalt, and concrete within the project site to the subgrade. Note that some of the concrete on site is partially buried.

B. When removing concrete associated with the abandoned inground swimming pool, remove concrete to a depth of at least 1 foot below finished grade. Concrete removal includes the removal of any steel reinforcement embedded within the concrete. Legally dispose of removed concrete offsite. All area depressions resulting from the removal of the concrete swimming pool shall be backfilled with native material and compacted to a relative density of not less than 90 percent.

C. Remove and dispose of abandoned drainage corrugated plastic piping (CPP) and corrugated metal pipe (CMP).

D. When applicable, backfill and compact depressions caused by excavations, demolition, and removal in accordance with the requirements outlined in SECTION 31 00 00, EARTHWORK.

3.02 SALVAGE

A. The existing boulder pile is to remain on site. Other items or materials to be salvaged shall be identified on the construction drawings and maybe used subject to Owner's Representative approval.

B. Repair or replace with new material, salvaged material damaged or destroyed due to Contractor's negligence, as determined by the CSD.

3.03 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by the Twain Harte CSD.

B. Burying trash and debris on site will not be permitted. Similarly, burning of trash and debris at the site will not be permitted.

C. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the site and be disposed of in a legal manner. Location of the disposal site and length of haul shall be the Contractor's responsibility.

SECTION 01 52 05
CONSTRUCTION STAGING AREAS

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. Contractor staging area requirements.

1.02 RELATED SECTIONS

A. SECTION 01 52 00, CONSTRUCTION FACILITIES

B. SECTION 01 74 14, CLEANING

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 CONTRACTOR STAGING AREAS

A. The Contractor shall only use site areas designated specifically on the construction drawings or by the Twain Harte Community Services District (CSD) for the Work.

B. The Contractor shall not block access to/from the adjacent park facilities, golf course, fire station or any emergency vehicle access lane unless specifically granted by the Twain Harte Community Services District (CSD).

D. The Contractor shall keep the staging area clear of trash and debris and in neat order.

SECTION 01 66 13

HAZARDOUS MATERIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: procedures required when encountering hazardous materials at the Work site.

1.02 REFERENCES

A. American Conference of Government Industrial Hygienists (ACGHI).

B. American National Standards Institute (ANSI).

C. California Health and Safety Code, Section 25117.

D. State of California Code of Regulations (CCR):
   1. Title 8. Industrial Relations.
   2. Title 22. Social Security.

E. National Institute for Occupational Safety and Health (NIOSH).

F. Occupational Safety and Health Administration (OSHA).

G. Society for Protective Coatings (SPCC):
   1. Guide 6 – Guide for Containing Debris Generated During Paint Removal Operations.
   2. Guide 7 – Guide for Disposal of Lead-Contamination Surface Preparation Debris. PA
   3. Guide 3 – A Guide to Safety in Paint Application.

H. United States Environmental Protection Agency (EPA).

I. United States Code of Federal Regulation (CFR):
   1. Title 29 – Labor.
   2. Title 40 – Protection of Environment.

1.03 SUBMITTALS

A. Submit laboratory reports, hazardous material removal plans, and certifications.

1.04 OPERATING DIGESTERS

A. Observe safety precautions in vicinity of operating digesters which contain digester gases, including methane, hydrogen sulfide, and carbon dioxide.

1.05 HAZARDOUS MATERIALS PROCEDURES

A. Hazardous materials are those defined by California Health and Safety Code, Section 25117.

B. When hazardous materials have been found:
   1. Prepare and initiate implementation of plan of action.
   2. Notify immediately OWNER, ENGINEER, and other affected persons.
   3. Notify such agencies as are required to be notified by Laws and Regulations with the times stipulated by such Laws and Regulations.
   4. Designate a Certified Industrial Hygienist to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
   5. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with, laws and regulations.

C. When hazardous materials have been found that were identified by the OWNER:
   1. Prepare and initiate implementation of plan of action.
   2. Notify such agencies as are required to be notified by Laws and Regulations with the times stipulated by such Laws and Regulations.
   3. Designate a Certified Industrial Hygienist to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
   4. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with, laws and regulations.

D. Forward to ENGINEER, copies of reports, permits, receipts, and other documentation related to remedial work.

E. Assume responsibility for worker health and safety, including health and safety of subcontractors and their workers.
   1. Instruct workers on recognition and reporting of materials that may be hazardous.

F. File requests for adjustments to Contract Times and Contract Price due to the finding of Hazardous Materials in the Work site in accordance with Contract Documents.
   1. Minimize delays by continuing performance of the Work in areas not affected by hazardous materials operations.

1.06 LEAD PAINT REMOVAL AND DISPOSAL

A. Existing paint on the interior and exterior surfaces that may contain lead in concentrations, which will require implementation of hazardous material compliance procedures as legislated by the following:
   1. United States Code of Federal Regulations, Title 29 and Title 40.
   2. State of California Code of Regulations, Title 8 and Title 22.

B. Submit a plan for the removal, containment, and disposal of lead-based paint and associated debris.
   1. Submit ten (10) copies of plan.

C. Prior to beginning work associated with the removal, containment, and disposal of lead-based paints, prepare and submit to the ENGINEER for review six (6) copies of the following:
   1. Listing of lead paint removal equipment to be used.
   2. Outline of procedures to be used to remove lead paint.
   3. Data and specifications describing chemical stripping materials to be used.
   4. Data and specifications describing abrasive blast materials and grit size to be used.
   5. Plan describing lead paint removal, hazardous waste debris containment, and hazardous waste disposal methods.
   6. Safety plan, consisting of a written plan of action covering operational requirements for safe removal of lead paint, safe handling and containment of waste and debris generated by the operation, and safe disposal of hazardous waste and non-hazardous waste materials, complying with the most stringent requirements of the following:
      a. Equipment and material manufacturer's safety sheets.
      b. SSPC-PA Guide 3.
      c. CFR 1910.

D. Carry out lead paint removal, containment, and disposal work in accordance with the following SSPC guidelines:
   1. SSPC-Guide 6.
   2. SSPC-Guide 7.

E. Lead paint removal methods acceptable for use as described in SSPC-Guide include:
   1. Open Abrasive Blast Cleaning with Expendable Abrasive.
   2. Open Abrasive Blast Cleaning with Recyclable Abrasive.
   3. Closed Abrasive Blast Cleaning with Recyclable Abrasive.
   4. Chemical Stripping.

F. Assume responsibility for the proper utilization of the paint removal method selected. When abrasive blast cleaning is selected to remove lead-based paint, comply with all applicable federal, state, and local air quality, pollution, and environmental control regulations for blast cleaning. When chemical stripping is selected to remove the lead based paint, adhere to the chemical manufacturer's recommendations for the application of the product, the removal of the paint, and the containment of the debris.

G. Lead paint removal work shall be performed by a CONTRACTOR having prior experience in the removal method selected and shall provide at least five (5) references of similar projects completed, three (3) of which must have been completed within the past twelve (12) months, documenting their experience.

H. Utilize a Class 3 containment and ventilation system as described in SSPC-Guide 6 during lead paint removal and containment procedures. Comply with the following requirements as described in SSPC-Guide 6:
   1. Containment materials: Type A1 – Rigid or Type A2 – Flexible.
   2. Permeability of containment materials: Type B1 – Air Impermeable.
   3. Support structure: Type C1 – Rigid or Type C2 – Flexible Support Structure.
   4. Joints: Type D1 – Fully Sealed Joints.
   5. Entryways: Type E2 – Overlapping Door Tarps.
   6. Air makeup system: Type F1 – Controlled Air Makeup.
   7. Input air flow system: Type G1 – Forced Input Air Flow.
   8. Air flow air pressure: Type H2 – Visual Verification.
   9. Air movement: In accordance with Type I1 – Minimum Air Movement Specified.
   10. Exhaust dust filtration system: Type J1 – Air Filtration System.
   11. Method for assessing quantity of emissions from site: Method A: Visible emissions with a Level O emissions requirement. Perform abrasive blasting inside containment structures.

I. Do not leave spent abrasive blast material, chemical stripping material, or lead paint debris uncontained on the project site overnight.

J. Test each container of paint debris, spent blast cleaning abrasive, chemical stripping debris, and other waste material generated by the operation to determine the waste material hazardous waste classification.

K. Assume responsibility for the disposal of lead paint waste and associated waste generated by the removal of the lead paint and the preparation of the surfaces for recoating. Dispose in accordance with applicable federal, state, and local requirements and regulations.

L. Accurately complete the Uniform Hazardous Waste Manifest included at the end of SSPC-Guide 7. Indicate on the Manifest that the OWNER is the hazardous waste generator, and obtain the OWNER'S Environmental Protection Agency identification number for use in completing the Manifest.

1.07 ASBESTOS MATERIALS

A. It is the specific intent of these Contract Documents to exclude from the Work any and all products or materials containing asbestos. No products containing asbestos shall be incorporated in the Work.

B. Removal of existing ACM shall be performed by a firm that is registered by Cal-OSHA and certified by the State Contractors Licensing Board and shall be a California Licensed Abatement Contractor.

C. Submit ten (10) copies of plan for the removal, containment, and disposal of ACM.

D. Submit six (6) copies of abatement license of ACM removal contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 74 14
CLEANING

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. Cleaning and cleanup during construction.

B. Debris disposal.

C. Final site cleanup.

1.02 RELATED SECTIONS

A. SECTION 01 52 00, CONSTRUCTION FACILITIES

B. SECTION 01 52 05, CONSTRUCTION STAGING AREA

C. SECTION 02 41 00, DEMOLITION

1.03 CODES AND STANDARDS

A. Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Article 2, Regulation for Reducing VOC Emissions from Consumer Products.

1.04 CLEANING AND CLEANUP DURING CONSTRUCTION

A. The project site, including the Contractor's work and storage areas, shall be kept in a neat, clean, and orderly condition during the course of the Work. The Contractor shall conduct generally daily clean-up and disposal tasks. Such tasks include the removal of waste, trash, rubbish, and debris away from the site.

1.05 DISPOSAL OF DEBRIS

A. The Contractor shall dispose of all waste, trash, rubbish, and debris in accordance with applicable laws and ordinances and as prescribed by the Twain Harte CSD. The Contractor shall bury no waste material or debris on the project site or burn any trash or waste on the site.

B. The Contractor is responsible for identifying an acceptable disposal site for waste, trash, rubbish, and debris.

1.06 FINAL SITE CLEANUP

A. Upon completion of the Work, ensure the site is in a clean, neat, and acceptable condition. Remove all construction waste, unused materials, loose rock and stones, excess soil, and debris.

B. Ensure all existing and new drainage systems are free of debris and damage.

C. Clean and protect all conduit openings.

D. Upon completion of the Work, the Contractor shall remove all markings made during the course of the Work from streets, sidewalks, walls, or any other infrastructure owned by the Twain Harte CSD.

1.07 DISPOSAL OF MATERIALS

A. The Contractor shall dispose of materials unsuitable for reuse in the Work offsite. Suitable materials may be reused in the Work for embankment, fill, or backfill subject to Owner's Representative approval.

PART 2 – PRODUCTS

2.01. CLEANING PRODUCTS

A. Use cleaning products that meet the requirements of the Green Seal GS-37 standard or comply with the requirements and maximum volatile organic compounds (VOC) limits of Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 8.5, Article 2, Regulation for Reducing VOC Emissions from Consumer Products.

PART 3 – EXECUTION

3.01 GENERAL

A. **Prevention:** The Contractor shall prevent the pollution of storm drain systems and the creek near the construction Project site resulting from the construction. The Contractor shall keep pollutants out of storm drains by reducing the possibility of accidental discharge of materials and wastes, by reducing erosion and sedimentation, and by any action as required. The Contractor shall ensure that all employees and subcontractors are aware of the consequences as described in paragraph 3.01C. below. The Contractor shall include appropriate subcontract provisions to ensure that these requirements are met by all subcontractors.

B. Notification: If the Contractor causes or permits the spillage or overflow of any oil, or petroleum product, hazardous substance, contaminant, waste or wastewater, including overflows or releases of untreated or treated (partially or fully) wastewater, and backups into buildings and on private property, the Contractor shall notify the Twain Harte CSD as soon as possible to the extent notification can be provided without substantially impeding cleanup or other emergency measures. In no event shall such notification be later than one (1) hour after knowledge of the occurrence.

C. **Cleanup:** Immediately upon gaining knowledge of such spillage, overflow, or discharge, the Contractor shall eliminate the cause of the spillage, overflow, or discharge and take action to minimize any damages. The Contractor shall also immediately implement a cleanup program. The cleanup, including sampling and testing required by regulatory agencies to determine the nature and level of contamination, shall be performed and completed to the satisfaction of the various regulatory agencies involved and the Twain Harte CSD, at the expense of the Contractor. If the Contractor's response is not satisfactory to the District, the District may, at its own discretion, mobilize to eliminate the cause of the overflow and implement a cleanup program, including any necessary sampling and testing. District costs of cleanup efforts shall be at the Contractor's expense and collected at the discretion of the Twain Harte CSD. Any fines, penalties, and/or subsequent actions imposed upon the Twain Harte CSD and/or the Contractor by regulatory agencies related to the spillage, overflow, or discharge and any subsequent monitoring, testing, and reporting, as required by regulatory agencies, shall also be at the expense of the Contractor. The Contractor shall keep a stockpile of spill cleanup materials, such as rags or absorbents, readily accessible on site. The quantity of cleanup materials shall be appropriate in consideration of the risk of an occurrence of a spill, overflow, or discharge.

3.02 MANAGEMENT OF NONHAZARDOUS MATERIAL AND/OR WASTE

A. **Designated Area**: The Contractor shall propose designated areas of the Project site, for approval by the Twain Harte CSD, suitable for material delivery, storage, and waste collection that to the maximum extent practicable are near construction entrances and away from catch basins, gutters, drainage courses, and creeks.

B. **Backfill or Excavated Material:** The Contractor shall not allow backfill or excavated material to enter the storm drains or creeks. When rain is forecast within 24 hours or during wet weather, the Contractor may be required to cover such material with a tarpaulin and to surround the material with sandbags.

C. **Disposal:** At the end of each working day, the Contractor shall collect all scrap, debris, and waste material, and dispose of such materials properly. The materials may be stored in the Contractor's yard in stockpiles or placed in dumpsters. The Contractor shall inspect dumpsters for leaks and replace or repair dumpsters that leak. The Contractor shall not discharge water from cleaning dumpsters on site. The Contractor shall arrange for regular waste collection before dumpsters overflow.

3.03 MANAGEMENT OF HAZARDOUS MATERIAL AND/OR WASTE

A. **Storage:** The Contractor shall label and store all hazardous materials, such as pesticides, paints, thinners, solvents, and fuels, and all hazardous wastes, such as waste oil and antifreeze, in accordance with all applicable state and federal regulations. The Contractor shall store all hazardous materials and all hazardous wastes in accordance with secondary containment regulations. All such materials and wastes shall be covered, as needed, to avoid rainwater becoming polluted with hazardous constituents, which could result in potential management of collected rainwater as hazardous waste. The Contractor shall keep an accurate, up-to-date inventory, including Material Safety Data Sheets (MSDS), of hazardous materials and hazardous wastes stored on site.

B. **Usage:** When rain is forecast within 24 hours or during wet weather, the Contractor shall refrain from applying chemicals in outside areas. The Contractor shall follow the material manufacturer's instruction regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals. The Contractor shall post warning signs in areas treated with chemicals.

C. **Disposal:** The Contractor shall arrange for regular hazardous waste collection to comply with time limits on storage of hazardous wastes. The Contractor shall dispose of hazardous waste in accordance with Part V, General Conditions, Section GC-25, Contaminated Soil/Materials. The Contractor shall not wash any spilled material into streets, gutters, storm drains, or creeks and shall not bury spilled hazardous materials. The Contractor shall report any hazardous material spills to the Twain Harte CSD in accordance with paragraph 3.01B above.

3.04 VEHICLE/EQUIPMENT CLEANING, MAINTENANCE, AND FUELING

A. **General**: The Contractor shall inspect vehicles and equipment arriving on site for leaking fluids and shall promptly repair leaking vehicles and equipment. Drip pans shall be used to catch leaks until repairs are made.

B. Cleaning: The Contractor shall perform vehicle or equipment cleaning with water only in a designated, bermed area that will not allow rinse water to run off site into streets, gutters, storm drains, or creeks. Soaps, solvents, degreasers, steam-cleaning equipment, or equivalent methods shall not be allowed.

C. **Maintenance and Fueling**: The Contractor shall perform maintenance and fueling of vehicles or equipment in areas that will not allow run-on of storm water or runoff of spills to storm drains and that provide for confined cleanup. Examples are working in bermed areas or utilizing drip pans. The Contractor shall not contaminate the soil or groundwater with such maintenance and fueling activities.

The Contractor shall use secondary containment, such as a drip pan, to catch leaks or spills any time that vehicle or equipment fluids are dispensed, changed, or poured, and shall clean up leaks and spills of vehicle or equipment fluids immediately and dispose of the waste and cleanup materials as hazardous waste, as described in paragraph 3.03C above.

3.05 CONCRETE, GROUT, AND MORTAR WASTE MANAGEMENT

A. **Concrete Truck/Equipment Washout**: The Contractor shall not wash out concrete trucks or equipment into streets, gutters, storm drains, or creeks. The Contractor shall perform washout of concrete trucks or equipment off site or in a designated area on site where the water will flow onto dirt or into a temporary pit in a dirt area. The Contractor shall let the water percolate into the soil and dispose of the hardened concrete in a trash container. If a suitable dirt area is not available, the Contractor shall collect the wash water and remove it off site.

B. **Exposed Aggregate Concrete Wash Water**: The Contractor shall avoid creating runoff by draining water from washing of exposed aggregate concrete to a dirt area. If a suitable dirt area is not available, the Contractor shall filter the wash water through straw bales or equivalent material before discharging to a storm drain. The Contractor shall collect sweepings from exposed aggregate concrete for disposal.

SECTION 01 89 13

SITE PREPARATION

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section specifies site preparation which consists of clearing, grubbing and demolition.

1.02 JOB CONDITIONS

A. Existing Conditions
   1. The CONTRACTOR shall determine the actual condition of the Site as it affects this portion of Work.

B. Protection
   1. Site preparation shall not damage structures, landscaping, or vegetation adjacent to the Site. The CONTRACTOR shall repair, or replace any damaged property.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall notify the ENGINEER when site preparation is complete.

3.02 PERFORMANCE

A. Clearing and Grubbing
   1. Unless otherwise specified, the CONTRACTOR shall remove obstructions such as brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones larger that 6-inches in any dimension, broken or old concrete and pavement, debris, and structures where the completion of the Work require their removal.
   2. Material that is removed and is not to be incorporated in the Work shall be disposed of off the Site.

B. Demolition and Removal
   1. Structures
      a. Demolition and removal of structures consist of removal of abandoned superstructures, foundation walls, footings, slabs and any other structures. Excavations caused by existing foundations shall be cleared of waste, debris and loose soil, and refilled as specified.
   2. Pavement

a. When portions of asphalt pavements and concrete pads are to be removed and later construction is to be connected, edges shall be saw cut, on a neat line at right angles to the curb face.

3. Salvage
   a. The OWNER has the right to salvage any items scheduled for removal. The CONTRACTOR shall notify the ENGINEER five (5) days prior to any salvage or demolition work to determine the disposition of items to be removed. The ENGINEER will mark items to be salvaged. Such items shall be properly disconnected, removed from their foundations, cleaned, and stored at a location on the plant site as specified.

C. Utility Interference
   1. The OWNER has endeavored to determine the existence of utilities at the site of the Work from the records of the owners of known utilities in the vicinity of the Work. The positions of these utilities as derived from such records are shown on the Drawings. No excavations were made to verify the locations shown for underground utilities. The service connections to these utilities are not shown on the Drawings. It shall be the responsibility of the CONTRACTOR to determine the exact location of utilities and service connections thereto. The CONTRACTOR shall make his own investigations, including exploratory excavations, to determine the locations and type of existing utilities, including service connections, prior to commencing work which could result in damage to such utilities. The CONTRACTOR shall immediately notify the ENGINEER as to any utility discovered by him in a different position than shown on the Drawings or which is not shown on the Drawings.
   2. In case it should be necessary to remove, relocate, or temporarily maintain a utility because of interference with the Work, the work on the utility shall be performed and paid for as follows:
      a. When it is necessary to remove, relocate, or temporarily maintain a service connection, the cost of which is not required to be borne by the OWNER thereof, the CONTRACTOR shall bear the expenses incidental to the work on the service connection. The work on the service connection shall be done in a manner satisfactory to the OWNER thereof; it being understood that the OWNER of the service connection has the option of doing such work with his own forces, or permitting the work to be done by the CONTRACTOR.
      b. When it is necessary to remove, relocate, or temporarily maintain a utility which is in the position shown on the Drawings, the cost of which is not required to be borne by the OWNER thereof, the CONTRACTOR shall bear the expenses incidental to the work on the utility. The work on the utility shall be done in a manner satisfactory to the OWNER thereof; it being understood that the OWNER of the utility has the option of doing such work with his own forces, or permitting the work to be done by the CONTRACTOR.
      c. When it is necessary to remove, relocate, or temporarily maintain a utility which is not shown on the Drawings or is in a position different from that shown on the Drawings and were it in the position shown on the Drawings would not need to be removed, relocated, or temporarily maintained, the cost of which is not required to be borne by the OWNER thereof, the ENGINEER will make arrangements with the OWNER of the utility for such work to be done at no cost to the CONTRACTOR, or will require the CONTRACTOR to do such work

in accordance with the article on changes in the work or will make changes in the alignment and grade of the work to obviate the necessity to remove, relocate, or temporarily maintain the utility.

3. No representations are made that the obligations to move or temporarily maintain the utility and to pay the cost thereof is or is not required to be borne by the OWNER of such utility, and it shall be the responsibility of the CONTRACTOR to investigate to find out whether or not said cost is required to be borne by the OWNER of the utility.
4. The right is reserved to governmental agencies and to owners of utilities to enter upon streets, alleys, rights of way, or easements for the purpose of making changes in their property made necessary by the Work and for the purpose of maintaining and making repairs to their property.

D. Cleanup
   1. Remove and transport debris, rubbish, and excess material from the Site in a manner that will prevent spillage on streets or adjacent areas. Cleanup spillage from streets and adjacent areas. Comply with Federal, State, and local hauling disposal regulations. Cleanup shall be an ongoing activity throughout the Contract period.

E. Disposal of Materials
   1. All materials removed shall become the property of the CONTRACTOR unless designated by the ENGINEER and shall be removed from the Project Site. CONTRACTOR shall make his own arrangements for disposing of materials outside the Project Site and shall pay all costs involved. Arrangements shall include, but not be limited to, entering into agreements with property owners and obtaining necessary permits, licenses, and environmental clearances.

END OF SECTION

SECTION 03 05 00

CONCRETE WORK

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Concrete formwork, concrete accessories, concrete reinforcement, cast-in-place concrete mixing, placement and curing.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the CONTRACTOR'S responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR'S Work.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. 305 - Hot Weather Concreting.
   3. 306 - Standard Specification for Cold Weather Concreting.
   4. 315 - Details and Detailing of Concrete Reinforcement.
   5. 318 - Building Code Requirements for Structural Concrete.

B. ASTM International (ASTM)
   1. A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   2. A 615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. C 29 - Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate.
   4. C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   5. C 33 - Standard Specification for Concrete Aggregates.
   6. C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
   7. C 88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
   8. C 94 - Standard Specification for Ready-Mixed Concrete.
   9. C 114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement.
   10. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

11. C 143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
12. C 150 - Standard Specification for Portland Cement.
13. C 156 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
14. C 171 - Standard Specification for Sheet Materials for Curing Concrete.
15. C 172 - Standard Practice for Sampling Freshly Mixed Concrete.
16. C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
17. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
18. C 289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
19. C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
20. C 311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
21. C 494 - Standard Specification for Chemical Admixtures for Concrete.
22. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
23. C 1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
24. D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
25. D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
26. D 2103 - Standard Specification for Polyethylene Film and Sheeting.

C. Concrete Reinforcing Steel Institute (CRSI).

1.03 DEFINITIONS

A. “Neat Cement Grout”: Grout made from a mixture of portland cement and water.

1.04 SUBMITTALS

A. General:
   1. Submittal in accordance with Section 01 33 00 Submittal Procedures unless modified in this Section.

B. Product data:
   1. Formwork:
      a. Formwork facing materials. Data on facing materials for concrete exposed to view in the finished work, if different from that specified in this Section.
      b. Form release agent. Manufacturer’s name and catalog data, including materials safety data sheet and documentation of suitability for use in contact with potable water.
      c. Concrete bar supports:

d. Precast concrete bar supports ("dobies"): manufacturer's product data indicating compression strength of concrete supports and material used for tie wires.
e. Wire chairs and slab bolsters: manufacturer's product data.

2. Joint materials:
   a. Preformed expansion joint material: manufacturer's name and catalog data with documentation of conformance to materials standards specified for each type and thickness of material.
   b. Injected tube waterstops: manufacturer's name and catalog data for waterstop system including tubes and injection grout.
3. Reinforcement:
   a. Mill certificates for each heat of steel provided.
4. Concrete materials:
   a. Cement Mill Tests: Mill certificate in accordance with ASTM C 150 and including "Type" and results of testing for alkali content.
   b. Concrete aggregates:
      1) Type, pit or quarry location, and producer's name.
      2) Commercial laboratory test reports, conducted within 90 days of the date of award of this Work, for samples of each aggregate proposed for use.
         a) Fine aggregate: Gradation analysis, specific gravity, and reports of deleterious materials to document in accordance with ASTM C 33.
         b) Coarse aggregate: Gradation analysis, specific gravity, and reports of deleterious materials to document in accordance with ASTM C 33 for each size used.
   c. Admixtures: manufacturer's catalog cuts and product data indicating compliance with the standards specified.
5. Concrete mixes: Submit full details, including:
   a. Mix proportions and concrete properties for each class of concrete proposed for use.
      1) Information on correction of batching for varying moisture contents of fine aggregate.
   b. Data to establish the average compressive strength:
      1) If established by field test records, submit:
         a) Product and test data for the materials actually used in the mix.
         b) Actual mix proportions.
         c) Field test data for slump, air content, and 28-day compressive strength.
            1. Include not less than 15 tests in accordance with ACI 318 Chapter 5.
      2) If established by testing of trial batches, submit:
         a) Confirmation that the materials and proportions used in the trial batches are those that will be provided for the mix.
         b) Mix test data for slump, air content, and 28-day compressive strength.
      3) For either method, include calculations for:
         a) Standard deviation calculated in accordance with ACI 318 Chapter 5 requirements.

b) Calculation of required average compression strength (f'cr) using the calculated standard deviation.
c) Statement demonstrating that the average compression strength resulting from field-testing or trial batch testing for each mix (f'cavg) exceeds the minimum required average compressive strength (f'cr) for that mix.

c. Submit source quality test reports with mix design submittal.
1) Include calculations for required average compression strength of concrete (f'cr) based on source quality test records.

6. Concrete finishing and curing materials:
a. Manufacturer's name and product data sheets.

C. Shop Drawings:
1. Reinforcement:
a. Submit drawings showing bending and placement of reinforcement.
1) Drawings shall be in accordance with ACI 315.
2) Clearly show placement, shapes, and dimensions of each bar listed in the bill of materials, including additional reinforcement at corners and openings required by details in the Contract Documents.
3) Show splice locations and bar lengths reflecting CONTRACTOR'S intended placement sequence.
b. Drawings that, in the ENGINEER'S opinion, are not sufficiently clear or complete will be rejected and a re-submittal will be required.
1) Such determination will be solely at the discretion of the ENGINEER, and rejection may occur with or without review comments.

D. Samples:
1. Form ties: If requested by the ENGINEER.
2. Concrete bar supports: If requested by the ENGINEER:
a. Precast reinforcement supports.
b. Wire reinforcement supports.

E. Project record documents:
1. Concrete delivery tickets: Submit copies of concrete delivery tickets when requested by the ENGINEER.
2. Field test reports:
a. Reports of field-testing for slump, temperature, unit weight, and air entrainment.
1) Note location of the concrete in the structure, and include tag numbers of associated cylinders for compression strength tests with report.
b. Testing laboratory reports of compression strength.

F. Notifications:
1. Modifications to concrete mixes:
a. Submit notification of any adjustments to mixture proportions and any changes in materials made during the course of the Work for ENGINEER'S review.
b. Include details of the changes and supporting documentation.
2. Joint locations:

a. Where joint locations other than those indicated on the Drawings are requested, submit proposed locations for ENGINEER'S review.
b. Provide drawings showing proposed joint locations with joint types labeled and joint details referenced when requested by the ENGINEER.

3. Reinforcement placement: Where necessary to move reinforcement beyond the specified placing tolerances to avoid interference, submit the proposed arrangement for ENGINEER'S review.
4. Concrete placements: Submit notification of readiness for each concrete placement at least 24 hours in advance.
5. Concrete repairs:
   a. Where concrete surfaces or sections exhibit defects after removal of forms, submit description of existing conditions and of proposed repair procedures and materials.
   b. Include photos of existing conditions.

1.05 QUALITY ASSURANCE

A. Tolerances on concrete construction: In accordance with ACI 117, unless more stringent requirements are specified in the Contract Documents.

B. Concrete mixtures:
   1. Ensure that concrete produced has the specified characteristics in the freshly mixed state, and that those are maintained to during transport and delivery and to the point of final placement.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle concrete materials in manner as to prevent damage and inclusion of foreign substances.

B. Deliver reinforcing steel bundled and tagged with identifying tags marked in a legible manner with waterproof markings showing the same designations as indicated on the submitted shop drawings.
   1. Store off the ground and protect from moisture, dirt, oil, and other injurious contaminants.

C. Protect concrete accessories for weather and direct exposure to sunlight before installation.

1.07 PROJECT CONDITIONS

A. Environmental requirements:
   1. Hot weather concreting: Construct in accordance with ACI 305 during conditions when the ambient air temperature is above 90 degrees Fahrenheit.
   2. Cold weather concreting: Construct in accordance with ACI 306 when ambient air temperature is below 40 degrees Fahrenheit, or is 45 degrees Fahrenheit and falling.

3. Conditions that promote rapid drying of freshly placed concrete, such as low humidity, high temperature, and wind: Take corrective action to minimize loss of water from the concrete.

1.08 SEQUENCING

A. Schedule placing of concrete in such a manner as to complete any single placing operation to a construction, or expansion joint.

PART 2 PRODUCTS

2.01 FORMS

A. Forms:
   1. Design and performance requirements:
      a. Design and performance of formwork shall be the responsibility of the CONTRACTOR, subject to the requirements of the Contract Documents.
      b. Design, construct, and brace formwork to:
         1) Carry all loads applied or transmitted, including the pressure resulting from placement and vibration of plastic concrete.
         2) Remain tight to prevent loss of mortar.
         3) Maintain specified tolerances and provide finished surfaces as specified in this Section.
      c. Maximum deflection of facing materials and supporting members on surfaces exposed to view in the finished work: 0.0042 times the clear span (1/240).
      d. Maximum deviation from alignment (horizontal or vertical): In accordance with ACI 117.
   2. Form facing materials:
      a. Surfaces exposed to view in the finished work:
         1) Facing materials shall produce a smooth, uniform texture on the concrete.
            a) Do not use materials with raised grain, tears, worn edges, patches, dents, or other similar defects.
         2) Acceptable materials: Plywood with “C” or better face; plastic-faced plywood; tempered concrete form grade hardboard; or steel.
      b. Surfaces not exposed to view in the finished work: No form facing material is specified.
   3. Forms for chamfers and keyways:
      a. Uniform steel, plastic, or lumber section of dimensions shown or specified.
      b. Provide adequate stiffness and support to maintain a true line at the concrete surface.
      c. Treated if required to eliminate bond with the concrete.

B. Form ties:
   1. General:
      a. Provide form ties fabricated by recognized manufacturer of concrete forming equipment and suitable for use with the forming system selected.
      b. Provide ties that accurately tie, lock, and spread forms.
         1) Do not use wire ties or wood spreaders.

c. Provide form ties of such design that, when forms are removed, the tie leaves no metal or other material within 1-1/2 inches of the surface of the concrete.
d. Do not allow tie holes through forms for ties to leak during concrete placement.

2. Cone snap ties: Tie with removable plastic cone leaving a tapered depression having a minimum diameter of 1 inch at the surface of the concrete and a depth of 1-1/2 inches below the surface.
3. Dry-pack mortar for filling cone snap tie holes: Proportioned mix of 1 part of portland cement to 1 part plaster sand with potable water added to provide a stiff consistency that can be driven into holes and properly compacted.
4. Admixtures or additives are not permitted.

C. Form release agent: Commercially manufactured, non-staining formwork release agent that will prevent absorption of water by the formwork and will prevent bond between the formwork and the concrete.
1. Form release agent to comply with all local air quality management regulations.

2.02 JOINT MATERIALS

A. Preformed synthetic sponge rubber expansion joint material:
1. Elastic sponge rubber compound in accordance with ASTM D 1752, Type I.
2. Concrete-gray color unless otherwise noted.
3. Thickness: As indicated on the Drawings.
4. Manufacturers: The following or equal:
a. Right Pointe: Sponge Rubber Expansion Joint.

B. Preformed bituminous fiber expansion joint material:
1. Asphalt-impregnated fiberboard in accordance with ASTM D 1751.

C. Sealants and caulking: As specified in Section 07 92 00 Joint Sealants.

D. Injected tube waterstops:
1. System composed of permeable injection tubes consisting of a reinforcing spiral covered with inner and outer protective membranes, injected polyurethane grout, and accessories required for installation.
a. Grout shall cure to a flexible, closed-cell, polyurethane foam resistant to degradation under cycles of wetting and drying, and to chemicals found in concrete water treatment structures.
b. System and grout shall be certified in accordance with NSF 61 for use in contact with potable water.
2. Manufacturers: The following, or equal:
a. DeNeef Construction Chemicals, Inc. Injecto Tube with Hydro Active Flex LV polyurethane grout.

2.03 REINFORCEMENT

A. Materials:
1. Deformed bars: In accordance with ASTM A 615 Grade 60.
2. Welded wire fabric: Sheets of plain wire in accordance with ASTM A 185.
3. Bar supports:

a. Over ground or “mud mat”:
    1) Precast concrete blocks with cast-in annealed steel tie wires, 16 gauge or heavier.
        a) Compressive strength of blocks equal to or exceeding the compressive strength of the surrounding concrete.
    2) Height as required for minimum 3 inches of clear concrete cover below reinforcement.
    3) Minimum block “footprint” of 4 square inches, or as required to supporting load from reinforcement while maintaining the required concrete cover.
b. Wire supports: Stainless steel in accordance with CRSI Class 2, Type B.

4. Tie wire: Annealed steel.

B. Fabrication:
1. Cut and cold-bend bars in accordance with provisions of ACI 315 and ACI 318.
2. Fabricate reinforcement to the tolerances in accordance with ACI 117.
3. Provide bars free from defects and kinks and from bends not indicated on the Drawings.

2.04 CONCRETE MIXES

A. General:
1. Pre-construction testing of materials and mixes to demonstrate that they comply with the requirements of this Section shall be at the CONTRACTOR’S expense.
2. Mixes shall be ready-mix or transit-mixed concrete in accordance with ASTM C 94.
    a. Hand-mixed batches shall not be used.
3. Submit documentation that the proposed concrete mixes will conform to the requirements of this Section and will produce concrete having the required proportions and properties specified in this Section.
4. Proportion mixes to conform to requirements for workability and durability specified in this Section.
    a. Provide concrete with workability and consistency that can be readily worked into corners and angles of forms and around reinforcement without excessive vibration and without permitting materials to segregate or free water to collect on the surface.
    b. Control and adjust batch weights to secure maximum yield.
        1) At all times, maintain proportions of concrete mix within specified limits.
5. Cement content:
    a. Use only 1 brand of portland cement for all exposed concrete surfaces in any single structure.
    b. Minimum cementitious materials content: Conform to values specified in Table A.
    c. Ratio of water to cementitious materials: Conform to values specified in Table A.

TABLE A CONCRETE REQUIREMENTS BY CLASS				
Class	**Specified Compressive Strength f'c at 28 Days (Pounds per Square Inch)**	**Maximum Water-to-Cementitious Materials Ratio**	**Minimum Cementitious Materials per Cubic Yard of Concrete by Weight (Pounds)**	**Slump Range (Inches)**
A	4,000	0.45	564	2 to 4
B (Type III cement)	4,000	0.45	564	2 to 4
C	2,500	0.62	423	3 to 6
CE	2,500	0.62	564	3 to 6

6. Ratio of coarse aggregate to fine aggregate: Not less than 1.0 or more than 2.0 for all concrete classes, with exception of Class CE.
7. Admixtures: Use in accordance with manufacturer's instructions.
   a. Air entraining admixture: Provide all concrete with entrained air content of 6 percent within 1 percent consisting of evenly dispersed air bubbles.
   b. Water reducing admixture:
      1) Required in all concrete mixes.
      2) No decrease in cementitious materials content is permitted as a result of use of water reducing admixture.
   c. High range water reducing admixtures/plasticizing admixtures:
      1) Proportion concrete for a slump of 2 to 4 inches before the admixture is added, and a maximum slump of 8 inches after the admixture is added.
8. Pozzolans:
   a. Fly ash: Maximum of 15 percent by weight of total weight of cementitious materials (cement plus fly ash).
   b. Other pozzolans shall not be used without prior acceptance by the ENGINEER.
9. Average compression strength (f'c):
   a. Proportion each concrete mix to provide the required average compressive strength (f'cr) determined in accordance with the provisions of ACI 318 Chapter 5.
   b. Determine required average compressive strength (f'cr) for each class of concrete using the specified compressive strength of the mix, f'c, and the standard deviation in accordance with ACI 318.
      1) Establish the standard deviation in accordance with ACI 318.
      2) Documentation of standard deviation based on field test records.
         a) Calculate standard deviation in accordance with ACI 318 procedures using test records that:
            1. Represent materials, quality control procedures, and conditions similar to materials, quality control procedures, and conditions expected for this Work.

2. Do not include provisions on materials that are more restrictive than the materials proposed for use.
3. Represent a mix design proportioned to provide a specified compressive strength (f'c) within 1,000 pounds per square inch of that specified in this Section.

3) Documentation of standard deviation based on trial batches plus empirical code requirements:
   a) When records of at least 15 consecutive tests spanning a period of not less than 45 calendar days are unavailable, determine required average compressive strength (f'cr) from Table B:

TABLE B	
Specified Compressive Strength f'c (pounds per square inch)	**Required Average Compressive Strength f'cr (pounds per square inch)**
Less than 3,000	f'c + 1,000
3,000 to 5,000	f'c + 1,200

B. Constituent materials:
   1. Portland cement: Conform to specifications and tests in accordance with ASTM C 150, Type II or Type I/II, Low Alkali; or ASTM C 150, Type III, Low Alkali.
      a. Low Alkali materials shall be those having total alkali content of not more than 0.60 percent when determined by method in accordance with ASTM C 114.
      b. Cement for finishes: Provide cement from same source and of same type as concrete to be finished.
   2. Aggregates:
      a. General:
         1) Provide concrete aggregates that are sound, uniformly graded, and free of deleterious material in excess of the amounts specified.
         2) Do not use aggregate made from recycled materials such as crushed and screened hydraulic-cement concrete, brick, or other construction waste.
         3) Obtain aggregate from source that is capable of providing uniform quality, moisture content, and grading during any single day's operation.
      b. Fine aggregate:
         1) Provide fine aggregate consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel and in accordance with ASTM C 33 and the following:
            a) Alkali and organics: Not containing strong alkali nor organic matter yielding a color darker than “standard color” when tested in accordance with ASTM C 40.
            b) Reactivity: Complying with reactivity requirements in accordance with ASTM C 33 when tested in accordance with ASTM C 289.
      c. Coarse aggregate:
         1) Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings,

organic matter, or other foreign substances and in accordance with ASTM C 33, Class 4S and the following:

a) Soundness when tested in accordance with ASTM C 88:
   1. Have loss not greater than 10 percent when tested with sodium sulfate.
b) Abrasion loss: Not exceed 45 percent after 500 revolutions when tested in accordance with ASTM C 131.
c) Reactivity: Not exceeding limits specified in Appendix of ASTM C 33 when tested in accordance with ASTM C 289.

2) Grading:
   a) Aggregate for Class A, B, C, and D Concrete: In accordance with ASTM C 33 Size Number 57.
   b) Aggregate for Class CE Concrete: In accordance with ASTM C 33 for Size Number 8.
   c) Where a combination of 2 or more sizes of coarse aggregate are used, the gradation of the blend shall conform to the grading requirements in accordance with ASTM C 33 for the size number specified.

3. Water:
   a. Water for concrete mixes, for washing aggregate, and for curing concrete: Potable water, clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances.
4. Admixtures:
   a. General:
      1) Do not use admixtures, except those specified, unless written authorization has been obtained from the ENGINEER.
      2) Admixtures shall be compatible with concrete constituents and shall be from the same manufacturer to provide compatibility with other admixtures.
      3) Do not use admixtures containing chlorides in excess of 0.5 percent by weight when calculated as chloride ion.
   b. Air entraining admixture: In accordance with ASTM C 260.
   c. Fly ash: In accordance with ASTM C 618, Class C.
      1) Sampling and testing: In accordance with ASTM C 311.
      2) Loss on ignition: Not to exceed 4 percent.
   d. Water reducing admixture: In accordance with ASTM C 494, Type A or Type D, not containing air-entraining agents.
   e. High range water reducing admixtures/plasticizing admixtures: Use shall produce non-segregating concrete mixture with little bleeding that remains in a plastic state for not less than 2 hours.
      1) High range water reducing admixtures: In accordance with ASTM C 494, Type F.
      2) Plasticizing admixtures: In accordance with ASTM C 1017, Type I.
   f. Electrical conduit encasement coloring admixture: To produce red-colored concrete used for encasement of electrical ducts, conduits, and similar items.
      1) Conduit encasement concrete: Mix into each cubic yard of concrete 10 pounds of coloring agent.
      2) Manufacturers: One of the following or equal:
         a) Davis Colors, #100 Utility Red.

b) I. Reiss Company, Inc., equivalent product.

C. Concrete mix design requirements by class:
   1. Provide concrete mixes by classes as specified in this Section.
   2. Use each class at the locations specified or indicated on the Drawings.
      a. Class A Concrete: General use. Use at all locations unless otherwise indicated on the Drawings or listed in the following paragraphs.
      b. Class B Concrete:
         1) May be substituted for Class A concrete for elements where high-early strength concrete is needed and that do not require sulfate resistant concrete.
         2) Use only after prior acceptance by the ENGINEER.
      c. Class C Concrete: May be used as fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and elsewhere as indicated on the Drawings.
      d. Class CE Concrete: Use for electrical conduit encasements.

D. Concrete mixes: Source quality control:
   1. Mix submittal and acceptance:
      a. Do not place concrete until the concrete mix design and the results of any trial batch testing have been accepted by the ENGINEER.
      b. If the ENGINEER requires changes to the mix design, modify mixes within limits set forth in this Section and submit new mix design for ENGINEER'S review.
      c. After acceptance, do not change mixes or mix proportions without prior acceptance by the ENGINEER.
         1) Exception:
            a) At all times, adjust batching of water to compensate for free moisture content of aggregates.
            b) Total water content in the mix shall not exceed that specified.
      d. If there is change in source of cement or aggregate, or if there is a significant change in the characteristics or quality of any constituent material received a source already approved to supply materials, submit new design mixes for each class of concrete affected.

2.05 CONCRETE FINISHING AND CURING MATERIALS

A. Evaporation retardant:
   1. Manufacturers: One of the following or equal:
      a. Master Builders Technologies, Cleveland, Ohio, Confilm.
      b. Euclid Chemical Company, Cleveland, Ohio, Eucobar.

B. Plastic membrane:
   1. White polyethylene film in accordance with ASTM C 171:
      a. Nominal thickness not less than 0.0040 inches when measured in accordance with ASTM D 2103.
         1) Thickness at any point not less than 0.0030 inches.
      b. Loss of moisture: Not to exceed 0.055 grams per square centimeter of surface when tested in accordance with ASTM C 156.

C. Sprayed-on membrane curing compound:
   1. In accordance with ASTM C 309, Type 1D.
   2. Clear with fugitive dye.

PART 3 EXECUTION

3.01 GENERAL

A. Preparation:
   1. Use construction methods and sequences that allow time for concrete to reach adequate strength to prevent damage to or overstress of the concrete structure or its elements during construction.
   2. Schedule placing of concrete in such a manner as to complete any single placing operation between designated construction, contraction, or expansion joints.
      a. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as the concrete for the adjacent slabs.

B. Verification of conditions:
   1. Do not place concrete until:
      a. Forms have been cleaned and oiled as specified.
      b. All forms have been thoroughly checked for alignment, level, strength, and accurate location of reinforcement, joint accessories, and all mechanical and electrical inserts or other embedded items.
      c. Reinforcement is secure and properly fastened in its correct position.
      d. Dowels, bucks, sleeves, hangers, pipes, conduits, anchor bolts, and any other fixtures required to be embedded in concrete have been placed and adequately anchored.
      e. Forms are aligned and secured, and loose form ties at construction joints have been retightened.
   2. Notify the ENGINEER in writing of readiness, not just intention, to place concrete in any portion of the work:
      a. Provide this notification in such time in advance of operations, as the ENGINEER deems necessary to make final observation of preparations at location of the concrete placement.
      b. Have forms, reinforcement, screeds, anchors, ties, embeds, and inserts in place before notifying ENGINEER of readiness for final observations.
   3. Do not place concrete until ENGINEER has completed final observations of conditions at the placement and has given acceptance to proceed.

3.02 FORMING

A. General
   1. Do not use earth cuts as forms for vertical or sloped surfaces unless specifically required by the Contract Documents.
   2. Joints: Locate construction and expansion joints as indicated on the Drawings.
      a. Submit joint locations other than or differing from those indicated on the Drawings for ENGINEER'S review before construction.
   3. Chamfers:
      a. Permanently exposed outside corners: Provide 3/4-inch chamfer.

b. Re-entrant corners:
    1) Chamfer not required.
    2) Corner may be left square.
c. Edges of formed joints: Chamfer not required unless indicated on the Drawings.

4. Level strips: Install level strips at top of wall concrete placements to maintain true line at horizontal construction joints.

B. Constructing and erecting formwork:
1. Brace and anchor formwork to ensure vertical and lateral stability and to maintain finish tolerances when subjected to uplift pressures and lateral pressures from plastic concrete.
    a. Ensure that formwork is positioned, braced, and firmly held against previously placed concrete to maintain true surfaces and to prevent loss or leaking of mortar at construction joints.
        1) At joints with flush surfaces exposed to view, lap contact surface of form a maximum of 1 inch over the previously placed concrete.
    b. Design and construct forms with sufficient strength and stiffness that deflections resulting from loading by plastic concrete will not exceed the surface tolerance limits specified.
    c. Set facing materials in an orderly and symmetrical arrangement, keeping the number of seams to a practical minimum.
    d. Form ties: Tie forms together using cone snap ties placed at not more than 2-foot centers vertically and horizontally.
    e. Construct formwork to permit easy removal without damage to formed surfaces.
    f. Provide temporary openings at the base of column and wall formwork to allow cleaning and inspection immediately before concrete placement.
    g. Cracks, openings, or offsets at joints in formwork: Close those that are 1/16 inch or larger by tightening forms or by filling with acceptable crack filler.
2. Where forms are re-used, clean surfaces of mortar, grout, and foreign materials before coating with form release agent and setting.
3. Cover formwork surfaces with form release agent to prevent bond with the concrete.
    a. Do not allow form release agent to puddle in the forms.
    b. Do not allow form release agent to contact reinforcement, embeds, or previously placed concrete.
4. Provide runways supported directly on the formwork for moving equipment and supplies during preparations for concreting.
    a. Do not rest such runways on reinforcement.

C. Embeds, joints, and accessories:
1. Position pipes, sleeves, conduits, inserts, anchors, castings, and other embedded items in the forms, and anchor to formwork to prevent displacement.
2. Fill voids in sleeves, pipes, inserts and anchor slots with readily removable material, and seal if required to prevent entry of mortar.
3. For pipe or conduit runs, position embeds to allow at least 3 inches of clear concrete separation between parallel runs of pipes, conduits, or any combination of these items with each other or with reinforcement.

D. Removing formwork:
   1. Remove forms after the specified time for curing and protection has been provided and when operations will not damage concrete.
   2. Immediately after forms are removed, carefully examine concrete surfaces.
      a. Report any irregularities in surfaces and finishes to the ENGINEER.
      b. Where surface repairs are needed, contact ENGINEER with description of conditions and description of repair procedures before proceeding with work.
   3. Immediately follow form removal with installation of specified curing materials and procedures.
   4. After forms are removed from wall and curing is complete, fill tie holes as follows:
      a. Remove form ties and cones from surfaces.
      b. Roughen cone-shaped tie holes by heavy sandblasting before repair.
      c. Clean and dampen tie holes, maintaining a saturated surface for at least 2 hours before applying dry-pack mortar.
      d. Dry pack cone-shaped tie holes with dry-pack mortar as specified in this Section.

3.03 PLACING CONCRETE REINFORCEMENT, EMBEDS, AND ACCESSORIES

A. Preparation:
   1. Cut and bend deformed steel reinforcement in the shop and deliver completed bars to the site for installation.
      a. Do not field-bend deformed reinforcement.
   2. Surface preparation:
      a. Thoroughly clean reinforcing bars from rust scale, loose mill scale, rust coat, dirt, oil, and other coatings that adversely affect bonding capacity when placed in the work.
         1) Thin coating of red rust resulting from short exposures will not be considered objectionable.
      b. Remove concrete or other deleterious coatings from dowels and other reinforcement projecting from previous placements by wire brushing or sandblasting before the reinforcement is embedded in the subsequent placement.

B. Support of reinforcement and accessories:
   1. Provide supports for deformed bars and wire fabric to maintain reinforcement position indicated on the Drawings and to provide specified minimum clear concrete cover around the reinforcement.
      a. Support wire fabric from reinforcing supports.
         1) Do not place fabric on grade or forms and lift into subsequently placed concrete.
         2) Take care to maintain specified position of wire fabric in the concrete section and to prevent bending, draping, or kinking of the wires.
   2. Use number of supports required to prevent reinforcement form sagging and to support loads during construction, but in no fewer quantities and locations than required in accordance with ACI 315.
   3. Do not:
      a. Use brick, broken concrete masonry units, concrete spalls, rocks, or other such material for supporting reinforcement.

b. Support reinforcement on additional reinforcing bars installed with less cover than that required by the Contract Documents (“give away bars”).
c. Adjust location of reinforcement indicated on the Drawings to increase cover over support bars.

4. Furnish and use templates for placing column dowels.

C. Placing reinforcement:
1. Locate reinforcement to provide minimum clear concrete cover specified.
a. Where cover is not specified, in accordance with ACI 318.
2. Accurately place reinforcement in accordance with the tolerances of ACI 117.
a. Where reinforcement must be moved beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embeds, submit the proposed arrangement for ENGINEER’S review.
3. Fasten reinforcement securely in place with wire ties.
a. After tying, bend ends of wire ties inward towards the center of the concrete to match clear concrete cover provided for reinforcement.
4. Do not weld reinforcing bars or wires.
5. Deformed reinforcing bars:
a. Tie slab bars at every intersection around the perimeter of slabs.
b. Tie wall bar and slab bar intersections, other than those around the perimeter, at every fourth intersection, but not more than 48 inches on center each way.
c. Lap splices:
1) Lap reinforcement at splices as indicated on the Drawings or specified.
2) Unless indicated on the Drawings, install lap splices with bars in contact and fastened together with tie wire.
3) If lap splice length is not indicated on the Drawings, install in accordance with ACI 318.
6. Welded wire fabric reinforcement:
a. Bend fabric as indicated on the Drawings or required to fit work.
b. Unroll or otherwise straighten fabric to make perfectly flat sheet before placing in the Work.
c. Extend welded wire fabric across concrete section to provide fabric to within 2 inches of vertical concrete edges.
d. Lap splice welded wire fabric as indicated on the Drawings.
1) If no splice details are indicated, lap fabric at least 12 inches, fasten with wire ties spaced not more than 24 inches on center, and lace lap with wire of the same diameter of the fabric.

3.04 BATCHING, MIXING, TRANSPORTING AND DELIVERING CONCRETE

A. General:
1. Measure, batch, mix, transport, and deliver concrete in accordance with ASTM C 94.

B. Measuring and batching:
1. Measure materials by weighing, except as otherwise specified or where other methods are specifically authorized in writing by the ENGINEER.
2. On-site volumetric batching using pre-packaged dry materials is not permitted.
3. Measuring or weighing devices:

a. Furnish apparatus for weighing aggregates and cementitious materials that is suitably designed and constructed for this purpose.
b. Furnish devices that have capability of providing successive quantities of individual material that can be measured to within 1 percent of desired amount of that material.
c. Shall bear valid seal of the verification by the authority having jurisdiction.
d. Subject to review by the ENGINEER.

4. Weighing cementitious materials: Weigh cementitious materials separately.
5. Furnish satisfactory means for checking moisture content of aggregates before batching.
   a. Adjust mix water to compensate for free moisture content of aggregate.
6. Mixing water:
   a. Measure by volume or by weight.
   b. Maximum water-to-cementitious materials ratio for each concrete class shall not exceed that specified in Table A of this Specification.
7. Admixtures:
   a. Provide admixtures as specified.
   b. Batch solutions by means of mechanical batcher capable of accurate measurement.

C. Mixing and transporting:
   1. Mixing:
      a. Equip each truck mixer with device capable of counting number of drum revolutions and interlocked to prevent discharge of concrete from drum before required number of turns is complete.
      b. Once drum revolutions commence, continuously revolve drum until it has completely discharged its batch.
      c. Do not add water until drum commences revolutions.
      d. The ENGINEER may require an increase required minimum number of revolutions or a decrease in the designated maximum number of revolutions if necessary to obtain satisfactory mixing.
         1) Incorporate such changes without additional costs to the OWNER.
   2. Do not exceed the following time period for mixing and delivery:
      a. Total elapsed time from addition of water at batch plant through discharging of completed mix: Not to exceed 90 minutes, nor 300 revolutions of the mixer drum.
      b. Total elapsed time at project site: Not to exceed 30 minutes.
      c. Under conditions contributing to quick setting, the ENGINEER may reduce total elapsed time permitted.

D. On-site acceptance of concrete mixes:
   1. Concrete shall possess the properties specified in this Section at the point of placement.
   2. Do not place concrete:
      a. Having slump outside the limits indicated in Table A.
      b. That does not conform to specifications for entrained air content.
      c. For which the total elapsed time of mixing or elapsed time at the site exceeds the specified maximums.

3.05 CONVEYING, DEPOSITING, CONSOLIDATING AND FINISHING CONCRETE

A. Preparation:
   1. General:
      a. Clean construction joints and formed surfaces of dirt, sawdust, chips, and other debris after forms are built and immediately before concrete or grout placement.
         1) Use vacuum cleaner if required to provide clean surfaces.
      b. Remove snow, ice, frost, and standing water from surfaces of formwork, reinforcement, and embeds in contact with concrete.
      c. Secure reinforcement, joint materials, anchors, embeds and other items in place.
      d. Obtain ENGINEER'S observation and acceptance of preparations.
      e. During conveying, placement, consolidation, and finishing of concrete, protect surrounding construction, including concrete walls and slab surfaces, from concrete splatter.
         1) Thoroughly clean surrounding construction at the completion of each placement.
   2. Slabs or concrete construction on grade:
      a. Provide subgrade preparation, base materials, and compaction as required by the Contract Documents.
      b. Remove loose soils, debris, standing water, snow, or ice from subgrade.
      c. Provide moist subgrade with no standing or free water and no muddy or soft spots.
         1) When subgrade is not moist, sprinkle with water not less than 2 nor more than 6 hours in advance of placing concrete.
         2) If subgrade becomes dry prior to actual placing of concrete, sprinkle again, without forming pools of water.
   3. Weather conditions:
      a. Hot weather: In hot weather conditions, make provisions in advance of placement for windbreaks, shading, fogging, sprinkling, ponding, or wet covering.
      b. Cold weather: In cold weather conditions, make provisions to maintain the required concrete temperatures without overheating or drying, and without exposing concrete to carbon dioxide from heater exhaust.
      c. Precipitation:
         1) Do not begin placements while rain, sleet, or snow is falling or anticipated, or unless adequate protection is provided.
         2) Do not allow precipitation to increase concrete water content or to damage the surface of the concrete.
      d. Wind:
         1) Do not begin placements during wind events that will blow dust or debris into the plastic concrete.
         2) Do not allow wind-blown debris to become embedded in or to damage the surface of the concrete.
         3) At all times, have sufficient coverings on hand to protect new concrete from excessive drying or blowing debris.

B. Conveying concrete:

1. Convey concrete from mixer to place of final deposit by methods that prevent segregation or loss of materials.
2. Use chutes, pumps, and conveyors of size and design that will ensure continuous flow of concrete at delivery end to prevent the formation of cold joints.
3. Design and use chutes and devices for conveying and depositing concrete that direct concrete vertically downward when discharged from the chute or conveying device.
4. Keep conveying equipment clean by thoroughly washing and scraping upon completion of any placement.

C. Depositing concrete:
   1. Do not place concrete under the following conditions:
      a. After initial set has occurred.
      b. When re-tempering has occurred.
   2. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing.
      a. Do not use vibrators to move concrete from its point of deposit.
      b. Use tremies for placing concrete where drop is over 5 feet.
   3. Place concrete continuously in approximately horizontal layers not exceeding 24 inches in depth. Bring level up evenly in all parts of forms.
      a. After placement begins, continue without significant interruption and as a continuous operation until the end of that placement is reached.
      b. Do not allow “cold joints” to form between adjacent layers or areas of the placement, or initial set to form on “wet edge” of placements.
      c. Take precautions to prevent delays between placement of adjacent layers or areas from exceeding 20 minutes.
         1) If more than 20 minutes have elapsed since the initial surface was placed, spread a layer of neat cement grout, not less than 1/2 inch in thickness nor more than 1 inch in thickness, over the previously placed surface before depositing additional concrete.
   4. Placing concrete on slopes:
      a. Commence placement at bottom of slope and work upward.
   5. Placing horizontal concrete monolithically with structures below:
      a. If concrete for slabs, beams, or walkways is to be cast monolithically with walls or columns below, do not place the horizontal concrete elements until the concrete in walls or columns below has been placed, consolidated, and allowed to achieve initial set.
         1) Allow set time of not less than 1 hour.
         2) Maintain a moist surface at the top of the walls or columns during the setting period.
   6. Placing a second concrete lift over hardened concrete below:
      a. Take special precautions in form work at top of old lift and bottom of new lift to prevent:
         1) Spreading and vertical or horizontal displacement of forms.
         2) Grout "bleeding" onto finished concrete surfaces.

D. Consolidating concrete:
   1. Thoroughly consolidate concrete into forms and around reinforcement, pipes, and other embeds using mechanical vibrators.

a. Take special care to place concrete solidly against forms, leaving no voids.
b. Make concrete solid, dense, compact, and smooth.

2. Provide vibration energy sufficient to cause concrete to flow and readily settle into place leaving no voids.
   a. Vibration should visibly affect concrete over a radius of at least 18 inches without segregation.
3. Vibrators:
   a. At all times, have sufficient vibrators on hand to consolidate concrete as it is placed.
   b. In addition to vibrators in use while concrete is being placed, have on hand at least 1 spare vibrator in serviceable condition.
   c. Place no concrete until it has been ascertained that all vibrating equipment, including spares, are in serviceable condition.

E. Finishing concrete:
1. Provide concrete finishes specified in Section 03 35 29 Tooled Concrete Finishes.
2. Liquid evaporation retardant:
   a. Where conditions will result in rapid evaporation of moisture from the surface of the fresh concrete during finishing operations, use evaporation retardant.
      1) Such conditions include low humidity, high heat, and wind occurring alone or in combination.
   b. Immediately after the concrete is screeded, coat the surface of the concrete with a liquid evaporation retardant.
      1) Apply the evaporation retardant again after each work operation as necessary to prevent drying shrinkage cracks and crazing at the surface.

3.06 CURING AND PROTECTING CONCRETE

A. Curing concrete:
1. Cure concrete by methods specified in this Section.
   a. Maintain the designated level of curing for a minimum of 7 days after placement, unless the details of a particular method specify a longer period.
      1) Make provisions to maintain moisture or curing membrane integrity at edges of slabs, tops of walls, and joint surfaces, and to prevent loss of protection.
2. Schedule of curing methods:
   a. Concrete surfaces that will receive additional materials that require bond to the initial placement (including concrete; coatings, paints, sealers; grout, and other materials):
      1) Water curing or plastic membrane curing.
   b. Formed surfaces:
      1) If non-absorbent forms are left in place for 7 days after placement: No additional requirements.
      2) For absorbent forms or when forms are removed during the 7 days following placement: Cure by water curing, plastic membrane curing, or sprayed membrane curing.
   c. Unformed concrete surfaces:
      1) Water curing, plastic membrane curing, or sprayed membrane curing.

3. Water curing:
    a. Keep surfaces of concrete constantly and visibly moist to saturated by ponding, continuous fogging, or continuous sprinkling at all times during curing period.
        1) Cover surfaces if required to maintain moist conditions.
        2) For horizontal slabs, pond the surface with at least 2 inches of water or cover with saturated mats or fabric kept continuously wet.
    b. Formed surfaces: Each day forms remain in place may be counted as 1 day of water curing.
        1) Do not loosen form ties while concrete is being cured by form left in place.
        2) No further credit for curing time will be allowed after contact between the concrete surface and the forms has been broken.
4. Plastic membrane curing:
    a. Cover concrete with plastic membrane, sealing joints and edges against displacement by wind or site operations and to prevent loss of moisture.
    b. Install plastic membrane as soon as concrete is finished and can be walked on without damage.
    c. Keep all surfaces of concrete under plastic membrane moist at all times during the curing period.
5. Sprayed membrane curing:
    a. Application of curing compound:
        1) Apply curing compound to concrete surface after repairing and patching, and within 1 hour after forms are removed.
            a) If more than 1 hour elapses after removal of forms, do not use sprayed membrane curing, but use water curing for full curing period.
        2) CONTRACTOR is cautioned that the method of applying curing compound specified in this Section may require more compound than normally suggested by manufacturer of compound, and also more than is customary in the trade.
        3) Apply curing compound by mechanical, power-operated sprayer with mechanical agitator that will uniformly mix all pigment and compound.
        4) Apply compound in at least 2 coats.
        5) Apply each coat in a direction turned 90 degrees from the preceding coat.
        6) Apply curing compound in sufficient quantity that concrete has uniform appearance and that the natural color of the concrete is effectively and completely concealed at time of spraying.
        7) Continue to coat and recoat surfaces until specified coverage is achieved and until coating film remains on concrete surfaces.
        8) Provide compound having a film thickness that can be scraped from surfaces at any and all points after drying for at least 24 hours.
        9) Take care to apply curing compound to edges of placements and in areas of construction joints.
            a) See that curing compound is placed over the full profile of construction joint surface.
    b. Removal of curing compound:
        1) Do not remove curing compound from concrete in less than 7 days.

a) During this period, the CONTRACTOR may remove curing compound only after receiving ENGINEER'S acceptance of written request to do so.
1. Include with the request the measures that will be provided to adequately cure surfaces where curing compound has been removed.

2) Before placing fresh concrete against a surface previously coated with curing compound, remove the curing compound by heavy sandblasting.

3) Prior to final acceptance of the work, remove any curing compound on surfaces exposed to view by sandblasting or other acceptable method, so that only natural color of finished concrete is visible and uniform over the entire surface.

B. Protecting concrete:
1. Immediately after placement, protect concrete from drying, hot or cold weather, and mechanical damage.
2. Temperature:
a. Cold weather: Protect concrete during the curing period so that the concrete temperature is maintained within the following requirements.
1) Sections less than 12 inches thick: Minimum 55 degrees Fahrenheit.
2) Sections 12 to 36 inches thick: Minimum 50 degrees Fahrenheit.
b. Hot weather: Protect concrete during the curing period so that the concrete temperature does not exceed 90 degrees Fahrenheit.
c. Remove protection against temperature gradually so that concrete surface temperature does not drop or rise by more than 40 degrees Fahrenheit during any 24-hour period.
3. Maintain forms, shoring, and bracing in place after concrete placement for a period after concrete placement as indicated in the following paragraphs. Forms may be removed after these periods if the concrete has developed sufficient strength and hardness to resist surface or other damage.
a. Vertical forms:
1) General: Minimum 24 hours after concrete placement.
2) Sides of footings: Minimum 24 hours after concrete placement.
3) Sides of beams, girders, and similar members: Minimum 48 hours after concrete placement.
b. Horizontal forms:
1) Slabs, beams, and girders: Until concrete reaches specified compressive strength, f'c, or until shoring is installed.
c. Shoring for slabs, beams, and girders:
1) Shore until concrete strength reaches specified compressive strength, f'c.
a) Temporary shoring may be required after the specified compressive strength is reached if construction loads will exceed the designated live load capacity of the structure.
d. Wall bracing:
1) Brace until strength of concrete beams and slabs laterally supporting the wall reaches specified compressive strength, f'c.
4. Loads against or on the concrete:

a. Loading of “green” concrete, by backfilling or by personnel or equipment placed on the surface, is not permitted.
    1) Green concrete: Defined as concrete whose current compressive strength is less than 100 percent of the specified compressive strength, f’c.
b. Backfilling: Do not place backfill against concrete walls until the wall and all elements attached to it, including connecting slabs or beams, are fully braced by the structure, and have achieved their specified compressive strength, f’c.

3.07 JOINTS AND JOINT PREPARATION

A. Joint locations and details:
1. Construct concrete work as monolith to the extent practical.
2. Construct joints as indicated on the Drawings and as specified.
3. Locations of construction, expansion, and other joints are indicated on the Drawings or specified in this Section.
    a. Do not relocate, add, or delete joints without prior approval from the ENGINEER.

B. General:
1. Keyways in joints:
    a. Provide keyways in joints where indicated on the Drawings.
    b. Treat lumber keyway material with form release coating, applied in accordance with manufacturer's instructions.

C. Construction joints:
1. Where spacing is not indicated on the Drawings, provide construction joints in slabs and walls at intervals not greater than 35 feet.
2. Construct as indicated on the Drawings.
    a. Before placing fresh concrete against the joint: Use heavy sandblast to thoroughly clean joint surfaces and reinforcement crossing the joint of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter.
    b. Just before placing concrete against the joint, wash surface with water to saturate joint surface and concrete surfaces within 12 inches of the joint.
    c. Horizontal joints:
        1) Immediately before placing concrete, thoroughly spread bed of neat cement over the joint surface.
        2) Grout thickness: Not less than 1/2 inch, nor more than 1 inch.

D. Expansion joints:
1. Where width is not indicated on the Drawings, provide 3/4-inch wide joint.
2. Construct as indicated on the Drawings.
3. Do not extend through expansion joints reinforcement, conduits, or other items unless details for such crossings are indicated on the Drawings.
4. Preformed expansion joint material:
    a. Accurately position joint filler in the joint and fasten to concrete or forms with adhesive.
    b. Tape splices in joint filler to prevent intrusion of mortar.

1) Fastening joint filler using nails, bolts, screws, or similar items is not permitted.

3.08 TOLERANCES

A. Concrete:
   1. Finished concrete: Conform to shapes, lines, grades, and dimensions indicated on the Drawings.
   2. In accordance with ACI 117, except as modified in the following paragraphs:
      a. Slabs where slope is indicated:
         1) Uniformly slope to drain.
         2) Provide slabs without depressions that puddle water.
      b. Slabs indicated to be level: Maximum deviation of 1/8 inch in 10 feet without any apparent changes in grade.

B. Embeds:
   1. General:
      a. Sleeves and inserts: Plus 1/8 inch.
      b. Projected ends of anchor bolts: From 0 to 1/4 inch.
      c. Anchor bolt position: Plus 1/16 inch.
   2. Equipment: Set inserts to tolerances required for proper installation and operation of equipment or systems to which insert pertains.

3.09 FIELD QUALITY CONTROL

A. Field testing of concrete:
   1. During progress of construction, the OWNER will perform testing to determine whether the concrete, as being produced, complies with requirements specified.
      a. Cost of this testing will be borne by the OWNER.
   2. Program for sampling and testing:
      a. Sample concrete in accordance with ASTM C 172.
      b. Slump: Test for slump in accordance with ASTM C 143.
         1) Test slump at the beginning of each placement, as often as necessary to keep slump within the specified range, and when requested to do so by the ENGINEER.
      c. Compressive strength, f'c: Make and cure test specimens in accordance with ASTM C 31: Test for compressive strength in accordance with ASTM C 29.
         1) Prepare and test not less than 3-cylinder specimens, 6-inch diameter by 12-inches long, for each test.
            a) One cylinder will be broken at 7 days and 2 cylinders will be broken at 28 days.
         2) Prepare and test cylinders according to the following schedule:
            a) Minimum of 1 set of cylinders for each150 cubic yards of each class of concrete.
            b) Minimum of 1 set of cylinders for each class of concrete for each half-day of placement.
      d. Air entrainment: Test for air entrainment in accordance with ASTM C 173.

1) Test percent of entrained air in concrete at the beginning of each placement, as often as necessary to keep entrained air within the specified range, and when requested to do so by the ENGINEER.

3. The CONTRACTOR shall:
   a. Furnish concrete for test specimens and provide manual assistance to the ENGINEER in preparing said specimens.
   b. Assume responsibility for providing care and on-site curing and protection for test specimens in accordance with ASTM C 31.

B. Enforcement of specification requirements:
   1. Do not place concrete that does not conform to the requirements of these Specifications.
      a. Remove such materials from the site.
   2. Strength requirements:
      a. Concrete is expected to reach higher compressive strength than that which is indicated in Table A as specified compressive strength f'c.
      b. Concrete strength will be considered acceptable if following conditions are satisfied:
         1) Averages of all sets of 3 consecutive strength test results are greater than or equal to specified compressive strength f'c.
         2) No individual strength test (average of 2 cylinders tested at 28 days) falls below specified compressive strength f'c by more than 500 pounds per square inch.
      c. Whenever 1 or both of the conditions stated above is not satisfied, provide additional curing or testing of the affected portion as directed by the ENGINEER.
         1) The costs of such curing or testing shall be at the CONTRACTOR'S expense.

3.10 ADJUSTING

A. Remove and replace or repair defective work as directed by the ENGINEER.
   1. Do not patch, repair, or cover defective work before observation by the ENGINEER.
   2. Make no repairs until ENGINEER has accepted proposed methods for preparation and repair.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Bar supports.
   2. Reinforcing bars.
   3. Thread bars.
   4. Tie wires.
   5. Welded wire fabric reinforcement.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. 315 - Details and Detailing of Concrete Reinforcement.
   2. 318 - Building Code Requirements for Structural Concrete and Commentary.
   3. 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.

B. American Welding Society (AWS):
   1. D1.4 - Structural Welding Code - Reinforcing Steel.

C. ASTM International (ASTM):
   1. A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   2. A 615 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   3. A 706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

1.03 DEFINITIONS

A. Give away bars: Bars that are not required by Contract Documents, but are installed by the CONTRACTOR to support the required reinforcing bars.

1.04 SYSTEM DESCRIPTION

A. The Drawings contain general notes concerning amount of reinforcement and placing, details of reinforcement at wall corners and intersections, and details of extra reinforcement around openings in concrete.

1.05 SUBMITTALS

A. Shop drawings:
   1. Changes to reinforcing steel Contract Drawing requirements:
      a. Indicate in separate letter submitted with shop drawings any changes of requirements indicated on the Drawings for reinforcing steel.
      b. Such changes will not be acceptable unless the ENGINEER has accepted such changes in writing.

B. Reinforcement shop drawings:
   1. Review of reinforcement shop drawings by the ENGINEER will be limited to general compliance with the Contract Documents.
   2. Submit reinforcement shop drawings in a complete package for each specific structure. Partial submittals will be rejected.

C. Samples:
   1. Bar support chairs: Submit samples of chairs proposed for use along with letter stating where each type of chair will be used.

D. Procedures:
   1. Welding procedures conforming to AWS D1.4 for reinforcement designated to be field welded.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:
   1. Deliver bars bundled and tagged with identifying tags.

B. Acceptance at site:
   1. Reinforcing bars: Deliver reinforcing bars lacking grade identification marks accompanied by manufacturer's guarantee of grade.

1.07 SEQUENCING AND SCHEDULING

A. Bar supports: Do not place concrete until samples and product data for bar supports have been accepted by the ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bar supports:
   1. Wire bar supports located between reinforcing bars and face of concrete:
      a. Stainless steel. Type 304 stainless steel bar supports.
      b. Support reinforcing for concrete placed on ground using bar support chairs with Type 304 stainless steel plates for resting on ground welded to the chairs.
   2. Wire bar supports located between mats of reinforcing bar:
      a. Steel bar supports.

B. Reinforcing bars:
   1. Reinforcing bars to be embedded in concrete:
      a. ASTM A 615 Grade 60 deformed bars, except as follows.
   2. Reinforcing bars that are required to be welded:
      a. Low alloy ASTM A 706 Grade 60 deformed bars.
      b. ASTM A 615 Grade 60 reinforcement may be used in lieu of ASTM A 706 Grade 60 if the following requirements are satisfied.
         1) Welding procedures conforming to AWS D1.4 are submitted to the ENGINEER.
         2) The specific location for the proposed substitution is acceptable to the ENGINEER.

C. Tie wires: Annealed steel.

D. Welded wire fabric reinforcement:
   1. In accordance with ASTM A 185.
   2. Fabric may be used in place of reinforcing bars if accepted by the ENGINEER.
   3. Provide welded wire fabric in flat sheet form.
   4. Provide welded wire fabric having cross-sectional area per linear foot of not less than cross-sectional area per linear foot of reinforcing bars indicated on the Drawings.

2.02 FABRICATION

A. Shop assembly:
   1. Cut and bend bars in accordance with provisions of ACI 315, ACI 318, and ACI 350.
   2. Bend bars cold.
   3. Provide bars free from defects and kinks and from bends not indicated on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions:
   1. Reinforcing bars and welded wire fabric reinforcement: Verify that reinforcement is new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work.

3.02 PREPARATION

A. Surface preparation:
   1. Reinforcing bars: Thin coating of red rust resulting from short exposure will not be considered objectionable. Thoroughly clean any bars having rust scale, loose mill scale, or thick rust coat.
   2. Cleaning of reinforcement materials: Remove concrete or other deleterious coatings from dowels and other projecting bars by wire brushing or sandblasting before bars are embedded in subsequent concrete placement.

3.03 INSTALLATION

A. Reinforcing bars:
   1. No field bending of bars will be allowed.
   2. Welding:
      a. Weld reinforcing bars where indicated on the Drawings or acceptable to the ENGINEER.
      b. Perform welding in accordance with AWS D1.4 and welding procedures accepted by the ENGINEER.
         1) Conform to requirements for minimum preheat and interpass temperatures.
      c. Do not tack weld reinforcing bars.

B. Placing reinforcing bars:
   1. Accurately place bars to meet tolerances of ACI 318 and adequately secure them in position.
   2. Lap bars at splices as indicated on the Drawings or specified.
      a. Unless specifically otherwise indicated on the Drawings, install bars at lap splices in contact with each other and fasten together with tie wire.
      b. Where reinforcing bars are to be lap spliced at concrete joints, ensure that bars project from first concrete placement a length equal to or greater than the minimum lap splice length indicated on the Drawings.
      c. Where lap splice lengths are not indicated on the Drawings, provide lap splice lengths in accordance with ACI 318 and ACI 350.
   3. Bar supports:
      a. Provide a sufficient number to prevent sagging, to prevent shirting, and to support loads during construction; but in no case less than quantities and at locations as indicated in ACI 315.
      b. Do not use brick, broken concrete masonry units, spalls, rocks, wood or similar materials for supporting reinforcing steel.
      c. Do not use give away bars that have less cover than required by the Contract Documents. Do not adjust location of reinforcement required by the Contract Documents to provide cover to the giveaway bars.
   4. If not indicated on the Drawings, provide protective concrete cover in accordance with ACI 318 and ACI 350.

C. Tying of bar reinforcement:
   1. Fasten bars securely in place with wire ties.
   2. Tie bars sufficiently often to prevent shifting.
   3. Provide at least three (3) ties in each bar length.
      a. Do not apply to dowel lap splices or to bars shorter than 4-feet, unless necessary for rigidity.
   4. Tie slab bars at every intersection around periphery of slab.
   5. Tie wall bars and slab bar intersections other than around periphery at not less than every fourth intersection, but at not greater than following maximum spacings:

Bar Size	Slab Bar Spacing Inches	Wall Bar Spacing Inches
Bars Number 5 and Smaller	60	48
Bars Number 6 through Number 9	96	60
Bars Number 10 and Number 11	120	96

6. After tying wire ties, bend ends of wire ties in towards the center of the concrete section.
   a. The cover for wire ties shall be the same as the cover requirements for reinforcing bars.

D. Welded wire fabric reinforcement:
   1. Install necessary wiring, spacing chairs, or supports to keep welded wire fabric in place while concrete is being placed.
   2. Bend fabric as indicated on the Drawings or required to fit work.
   3. Unroll or otherwise straighten fabric to make flat sheet before placing in the Work.
   4. Lap splice welded wire fabric as indicated on the Drawings.
   5. If lap splice length is not indicated on the Drawings, splice fabric in accordance with ACI 318 and ACI 350.

END OF SECTION

SECTION 22 14 53
RAINWATER HARVESTING SYSTEM

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. The work described in this specification is intended for the constructability and installation of a rainwater harvesting system per applicable codes and standards. This section includes specifications for the rainwater harvesting system and its components, quality assurance and inspection.

B. Rainwater Harvesting System:

a. Rainwater Pre-Filter(s)

b. Storage Tanks

c. Distribution Pump(s)

d. Controls

1.02 RELATED SECTIONS

A. SECTION 01 52 00, CONSTRUCTION FACILITIES

B. SECTION 01 74 14, CLEANING

1.03 APPLICABLE CODES AND STANDARDS

A. International Organization for Standardization (ISO):

a. ISO 9001 – Quality management systems requirements.

B. California Plumbing Code (CPC-2022)

a. Chapter 15: Alternate Water Sources for Non-Potable Applications

b. Chapter 16: Non-Potable Rainwater Catchment Systems

1.04 SITE CONDITIONS

A. Verify site conditions where the rainwater harvesting system is to be installed and ensure constructability and installation access is free and clear of obstructions.

B. Notify Owner's representative if any open depressions and excavations made as part of the demolition/grading work for system installation and post warning signs if applicable.

C. Protect active sewer, water, gas, electric, drainage, and irrigation indicated or, when not indicated, found, or otherwise made known to the CONTRACTOR before or during installation work. If a utility is damaged, immediately notify the Owner's Representative for corrective action.

1.05 QUALITY ASSURANCE

A. Product and Equipment Manufacturer Qualifications:

a. Minimum of 10-years of experience of this Section.

b. Successful completion of previous projects of similar scope and complexity.
c. Maintain ISO-9001 production facilities including quality management protocols for production.

B. Installer Qualifications:
a. Successful completion of (3) previous projects of similar scope of complexity.
b. Maintain trained technicians on staff providing field service and warranty related work.
c. Minimum of (3) years of experience in work in this Section.
d. This does not apply to the contractor who is installing underground piping, tank pads and setting tanks.

C. Installation and Excavation Safety: In accordance with OSHA requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver (unless otherwise specified) system components until time needed for installation and after proper protection can be provided for materials.
B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
C. Protect from damage due to weather, excessive temperature, and construction operations.
D. Leave protective coverings in place until just prior to installation.
E. Store water storage components with forklifts (or approved equivalent) and manufacturers recommended equipment during transportation and site construction. System components shall be protected from damage during delivery.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within manufacturers limits for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.

PART 2 – PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

A. The CONTRACTOR shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required to perform the installation of the rainwater harvesting system as shown in the construction drawings and described in the specifications.

2.02 MANUFACTURERS

A. Acceptable Manufacturer(s) for Storage Tanks:

a. RainHarvest Systems LLC.

b. Bushman USA

c. Aquascape

c. American Tank Depot

d. Norwesco

B. Acceptable Manufacturer(s) for Pumps and Pump Skids:

a. RainHarvest Systems

b. Grundfos

c. Aquascape

d. Oase

e. RainFlo

C. Acceptable Manufacturer(s) for Controls and Float Switches:

a. RainHarvest Systems

b. RainFlo

c. Aquascape/Hudson

D. Acceptable Manufacturer(s) for Rainwater Filters, Storage Tank Accessories:

a. RainHarvest Systems

b. RainAid

c. RainFlo

d. GRAF

E. Substitutions: Must be equal to specified equipment as determined by Owner's Representative or Designer.

2.03 RAINWATER HARVESTING SYSTEMS

A. Rainwater Harvesting Systems:

a. The system shall collect rainwater from the roof and convey rainwater through roof drains, downspouts and conveyance piping, gravity fed pre-filters. Filtered rainwater will travel through the pre-filter and into a rainwater storage tank. Water will be drawn out of the storage tank and pumped through a submersible pumping system to provide water at the desired design point of connection on an on-demand basis.

B. Design Requirements: Filter, store, treat and distribute harvested rainwater as specified on plans.

C. Water Filtration Method: Include sediment and UV filtration.

D. Hydrostatically test pump to manufacturer's requirements prior to final installation.

E. Components:

a. Rainwater Pre-Filter: Model: RainHarvest Leaf Eater Advanced Downspout Filter

b. Rainwater Storage Tanks:

- Bushman Poly 5050 – Capacity: 5,000-Gallons

- Rainwater Inlet: 4-inches

- Rainwater Overflow: 4-Inches

- Rainwater Outlet (pumped): 1-Inches

c. Downspouts:

- Model: Commerical Zincalume Steel Rainharvest 4" Leaf Eater Advanced downspout filter.

d. Pump Systems:

- Model: Rain Brothers Traditional Springer Series Cistern Pump with Floating Intake Valve.

- Plumbed to allow for removal without entering tank.

- Connected to power supply by power cable and waterproof connections.

e. Rainwater System Control:

- Water level measurement with automatic switchover to municipal backup water supply. Controller to activate valve based on programmed water level in the rainwater system controller.

f. Non-Potable Water Signage:

- All rainwater harvesting equipment and conveyance pipes shall denote "Non-Potable Water – Do Not Drink".

g. Storage Tank Accessories:

- Floating Filter and Hose (reference: Rain Brothers Springer Series Pump)

h. Make Up Water Valve:

- MV-1: ¾" Rain Aid or approved equal

i. Accessories:

- Bulkhead Fitting: Sized to match system inlet, outlet, pump flow rate, vents and other penetrations.

- Vent Assembly: PVC rodent-proof screen/cap for tank air and vacuum relief; Extent from top of tank to above grade.

- Waterproof Electrical Connection Box: Field installed and inspected.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrates under given project conditions.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Owner's Representative in writing of deviations from manufacturer's recommended installation tolerances and conditions.

D. When applicable, backfill and compact depressions caused by excavations, demolition, and removal in accordance with the requirements outlined in SECTION 31 00 00, EARTHWORK.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, per plan and in proper relationship with adjacent construction.

B. Arrange equipment so that components requiring removal or maintenance are readily available accessible without disturbing other components. Arrange for clear passage between components.

D. Do not bury components deeper than manufacturer's recommended depth or in a manner that would exceed engineering loads.

E. Ground components in accordance with component manufacturer's instructions.

F. Install pre-filters at the time storage tanks are installed.

3.03 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection with Owner's Representative within one (1) year of construction.

B. System Testing shall be provided by contractor:

a. Installation oversight and technical support.

b. Terminate and test control system wiring and operation of electrical components.

c. Demonstrate proper pump and controls operation.

d. Make adjustments to meet user-defined system performance.

e. Review operation and maintenance procedures with Twain Harte CSD.

3.04 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

A. Clean and protect products in accordance with manufacturer's recommendations.

B. Touch-Up, repair or replace products before substantial completion.

C. Dispose of scrap materials, waste, trash, and debris from the installation of the rainwater harvesting system in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by the Twain Harte CSD.

D. Burying trash and debris on site will not be permitted. Similarly, burning of trash and debris at the site will not be permitted.

E. Scrap materials, trash, and debris shall become the property of the CONTRACTOR and shall be removed from the site and be disposed of in a legal manner. Location of the disposal site and length of haul shall be the CONTRACTOR's responsibility.

END OF SECTION 32 84 00

SECTION 22 14 53
RAINWATER HARVESTING SYSTEM

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. The work described in this specification is intended for the constructability and installation of a rainwater harvesting system per applicable codes and standards. This section includes specifications for the rainwater harvesting system and its components, quality assurance and inspection.

B. Rainwater Harvesting System:

a. Rainwater Pre-Filter(s)

b. Storage Tanks

c. Distribution Pump(s)

d. Controls

1.02 RELATED SECTIONS

A. SECTION 01 52 00, CONSTRUCTION FACILITIES

B. SECTION 01 74 14, CLEANING

1.03 APPLICABLE CODES AND STANDARDS

A. International Organization for Standardization (ISO):

a. ISO 9001 – Quality management systems requirements.

B. California Plumbing Code (CPC-2022)

a. Chapter 15: Alternate Water Sources for Non-Potable Applications

b. Chapter 16: Non-Potable Rainwater Catchment Systems

1.04 SITE CONDITIONS

A. Verify site conditions where the rainwater harvesting system is to be installed and ensure constructability and installation access is free and clear of obstructions.

B. Notify Owner's representative if any open depressions and excavations made as part of the demolition/grading work for system installation and post warning signs if applicable.

C. Protect active sewer, water, gas, electric, drainage, and irrigation indicated or, when not indicated, found, or otherwise made known to the CONTRACTOR before or during installation work. If a utility is damaged, immediately notify the Owner's Representative for corrective action.

1.05 QUALITY ASSURANCE

A. Product and Equipment Manufacturer Qualifications:

a. Minimum of 10-years of experience of this Section.

b. Successful completion of previous projects of similar scope and complexity.
c. Maintain ISO-9001 production facilities including quality management protocols for production.

B. Installer Qualifications:
a. Successful completion of (3) previous projects of similar scope of complexity.
b. Maintain trained technicians on staff providing field service and warranty related work.
c. Minimum of (3) years of experience in work in this Section.
d. This does not apply to the contractor who is installing underground piping, tank pads and setting tanks.

C. Installation and Excavation Safety: In accordance with OSHA requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver (unless otherwise specified) system components until time needed for installation and after proper protection can be provided for materials.
B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
C. Protect from damage due to weather, excessive temperature, and construction operations.
D. Leave protective coverings in place until just prior to installation.
E. Store water storage components with forklifts (or approved equivalent) and manufacturers recommended equipment during transportation and site construction. System components shall be protected from damage during delivery.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within manufacturers limits for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.

PART 2 – PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

A. The CONTRACTOR shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required to perform the installation of the rainwater harvesting system as shown in the construction drawings and described in the specifications.

2.02 MANUFACTURERS

A. Acceptable Manufacturer(s) for Storage Tanks:

a. RainHarvest Systems LLC.

b. Bushman USA

c. Aquascape

c. American Tank Depot

d. Norwesco

B. Acceptable Manufacturer(s) for Pumps and Pump Skids:

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C. Acceptable Manufacturer(s) for Controls and Float Switches:

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D. Acceptable Manufacturer(s) for Rainwater Filters, Storage Tank Accessories:

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E. Substitutions: Must be equal to specified equipment as determined by Owner's Representative or Designer.

2.03 RAINWATER HARVESTING SYSTEMS

A. Rainwater Harvesting Systems:

a. The system shall collect rainwater from the roof and convey rainwater through roof drains, downspouts and conveyance piping, gravity fed pre-filters. Filtered rainwater will travel through the pre-filter and into a rainwater storage tank. Water will be drawn out of the storage tank and pumped through a submersible pumping system to provide water at the desired design point of connection on an on-demand basis.

B. Design Requirements: Filter, store, treat and distribute harvested rainwater as specified on plans.

C. Water Filtration Method: Include sediment and UV filtration.

D. Hydrostatically test pump to manufacturer's requirements prior to final installation.

E. Components:

a. Rainwater Pre-Filter: Model: RainHarvest Leaf Eater Advanced Downspout Filter

b. Rainwater Storage Tanks:

- Bushman Poly 5050 – Capacity: 5,000-Gallons

- Rainwater Inlet: 4-inches

- Rainwater Overflow: 4-Inches

- Rainwater Outlet (pumped): 1-Inches

c. Downspouts:

- Model: Commerical Zincalume Steel Rainharvest 4" Leaf Eater Advanced downspout filter.

d. Pump Systems:

- Model: Rain Brothers Traditional Springer Series Cistern Pump with Floating Intake Valve.

- Plumbed to allow for removal without entering tank.

- Connected to power supply by power cable and waterproof connections.

e. Rainwater System Control:

- Water level measurement with automatic switchover to municipal backup water supply. Controller to activate valve based on programmed water level in the rainwater system controller.

f. Non-Potable Water Signage:

- All rainwater harvesting equipment and conveyance pipes shall denote "Non-Potable Water – Do Not Drink".

g. Storage Tank Accessories:

- Floating Filter and Hose (reference: Rain Brothers Springer Series Pump)

h. Make Up Water Valve:

- MV-1: ¾" Rain Aid or approved equal

i. Accessories:

- Bulkhead Fitting: Sized to match system inlet, outlet, pump flow rate, vents and other penetrations.

- Vent Assembly: PVC rodent-proof screen/cap for tank air and vacuum relief; Extent from top of tank to above grade.

- Waterproof Electrical Connection Box: Field installed and inspected.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrates under given project conditions.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Owner's Representative in writing of deviations from manufacturer's recommended installation tolerances and conditions.

D. When applicable, backfill and compact depressions caused by excavations, demolition, and removal in accordance with the requirements outlined in SECTION 31 00 00, EARTHWORK.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, per plan and in proper relationship with adjacent construction.

B. Arrange equipment so that components requiring removal or maintenance are readily available accessible without disturbing other components. Arrange for clear passage between components.

D. Do not bury components deeper than manufacturer's recommended depth or in a manner that would exceed engineering loads.

E. Ground components in accordance with component manufacturer's instructions.

F. Install pre-filters at the time storage tanks are installed.

3.03 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection with Owner's Representative within one (1) year of construction.

B. System Testing shall be provided by contractor:

a. Installation oversight and technical support.

b. Terminate and test control system wiring and operation of electrical components.

c. Demonstrate proper pump and controls operation.

d. Make adjustments to meet user-defined system performance.

e. Review operation and maintenance procedures with Twain Harte CSD.

3.04 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

A. Clean and protect products in accordance with manufacturer's recommendations.

B. Touch-Up, repair or replace products before substantial completion.

C. Dispose of scrap materials, waste, trash, and debris from the installation of the rainwater harvesting system in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by the Twain Harte CSD.

D. Burying trash and debris on site will not be permitted. Similarly, burning of trash and debris at the site will not be permitted.

E. Scrap materials, trash, and debris shall become the property of the CONTRACTOR and shall be removed from the site and be disposed of in a legal manner. Location of the disposal site and length of haul shall be the CONTRACTOR's responsibility.

END OF SECTION 32 84 00

SECTION 31 05 00

SOILS AND AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Aggregate Base Course.
2. Class 2 Permeable.
3. Drain Rock.
4. Gravel.
5. Native Material.
6. Sand.
7. Select Material.
8. Stabilization Material.

1.02 REFERENCES

A. ASTM International (ASTM):
1. C 117 - Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
2. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
4. D 422 - Standard Test Method for Particle-Size Analysis of Soils.
5. D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. D 2844 - Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
7. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
8. D 4829 - Standard Test Method for Expansion Index for Soils.
9. D 5821 - Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

B. California Department of Transportation:
1. Standard Specifications.
2. California Test 205.
3. California Test 211.
4. California Test 217.
5. California Test 229.
6. California Test 301.

1.03 SUBMITTALS

A. Product data:
   1. Material source.
   2. Gradation.
   3. Testing data.

B. Quality control for aggregate base course:
   1. Test reports: Reports for tests required by Sections of Standard Specifications.
   2. Certificates of Compliance: Certificates as required by Sections of Standard Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
   1. Provide material having maximum particle size not exceeding 4 inches and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other organic matter.
   2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

B. Aggregate Base Course:
   1. Class 2, 3/4-inch maximum aggregate size free from organic matter and other deleterious substances, and of such nature that aggregate can be compacted readily under watering and rolling to form a firm, stable base.
      a. Aggregate base course for structures:
      b. Consist of crushed or fragmented particles.
      c. Coarse aggregate material retained in Number 4 sieve shall consist of material of which at least 25 percent by weight shall be crushed particles when tested in accordance with California Test 205.
   2. Aggregate shall not be treated with lime, cement, or other chemical material.
   3. Durability index: Not less than 35 when tested in accordance with California Test 229.
   4. Aggregate grading and sand equivalent tests shall be performed to represent not more than 500 cubic yards or 1 day's production of material, whichever is smaller.
   5. Sand equivalent: Not less than 25 when tested in accordance with California Test 217.
   6. Resistance (R value): Not less than 78 when tested in accordance with California Test 301.
   7. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 117 and ASTM C 136:

Sieve Sizes (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
Number 4	35-60
Number 30	10-30
Number 200	2-9

C. Class 2 Permeable:
   1. Consist of hard, durable particles of stone or gravel, screened, or crushed to the specified size and gradation.
   2. Provide free of organic matter, lumps or balls of clay, and other deleterious matter.
   3. Sand equivalent: Not less than 75 when tested in accordance with ASTM D 2419.
   4. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 117 and C 136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
3/8 inch	40-100
Number 4	25-40
Number 8	18-33
Number 30	5-15
Number 50	0-7
Number 200	0-3

D. Drain Rock:
   1. Durability: Percentage of wear not greater than 40 percent when tested in accordance with ASTM C 131.
   2. Consist of hard, durable particles of stone or gravel, screened, or crushed to specified size and gradation.
   3. Free from organic matter, lumps or balls of clay, or other deleterious matter.
   4. Crush or waste coarse material and waste fine material as required to meet gradation requirements.
   5. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 117 and C 136:

Sieve Size (Square Openings)	Percent By Weight Passing Sieve
2 inch	100
1-1/2 inch	95-100
3/4 inch	50-100
3/8 inch	15-55
Number 200	0-2

E. Native material:
   1. Sound, earthen material passing 1-inch sieve.
   2. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM D 422.
   3. Expansion index less than 35 when tested in accordance with ASTM D 4829.

F. Sand:
   1. Clean, coarse, natural sand.
   2. Non-plastic when tested in accordance with ASTM D 4318.
   3. One hundred percent shall pass a 1/2-inch screen.
   4. No more than 20 percent shall pass a Number 200 sieve.

G. Select material:
   1. Sound earthen material for which sum of plasticity index when tested in accordance with ASTM D 4318 and the percent of material by weight passing Number 200 sieve shall not exceed 23 when tested in accordance with ASTM D 422.
   2. Organic content shall not be greater than 3 percent by volume.

H. Stabilization material:
   1. Durability percentage of wear not greater than 40 percent when tested in accordance with California Test 211.
   2. Consist of clean, hard, durable particles of crushed rock or gravel screened or crushed to the specified sizes and gradations.
   3. Shall be free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.
   4. Shall be free of slaking or decomposition under the action of alternate wetting and drying.
   5. The portion of material retained on the 3/8-inch sieve shall contain at least 50 percent of particles having three or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes the 3/8-inch sieve but is retained on the No. 4 sieve, not more than 10 percent shall be pieces that show no faces resulting from crushing.
   6. Conform to size and grade when tested in accordance with ASTM C 117 and ASTM C 136.

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
Number 4	0-10
Number 200	0-2

2.02 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 31 20 00
EARTHWORK – BIOSWALE AND RAIN GARDEN, COBBLE

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. Excavating and fill for rough grading at the site.

B. Trenching and backfilling for utilities and rainwater conveyance.

C. Stockpiling of soil for later use.

1.02 RELATED SECTIONS

A. SECTION 01 52 05, CONSTRUCTION STAGING AREAS

B. SECTION 01 74 14, CLEANING

1.03 CODES AND STANDARDS

A. State of California, Department of Transportation (CalTrans), Chapter 19, 2018

B. ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

C. Code of Federal Regulations Title 29 CFR Part 1926, Subpart P, Excavations.

D. Occupational Safety and Health Administration (OSHA) Document 2226.

E. ASTM 21556: Density and Unit Weight of Soil in Place by Sand-Cone Method.

F. ASTM D 1557: Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 lbf/ft^3)

G. ASTM D 2922: Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

H. ASTM D 2937: Density of Soil-In-Place by the Drive-Cylinder Method.

I. ASTM D 422: Standard Test Method for Particle-Size Analysis of Soils

J. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

K. Title 29 CFR Part 1926: Safety and Health Regulations for Construction.

1.04 TEST AND INSPECTIONS

A. **Fill Material**: Determine suitability of fill material not previously evaluated.

B. **Maximum Density Tests**: Determine optimum moisture content and maximum dry density of fill materials placed and compacted in accordance with ASTM D1557, Procedure A.

C. **Field Density Tests**: Determine in-place density of fill materials placed and compacted in accordance with ASTM D 1556, ASTM D 2922, or ASTM D 2937. One test should be conducted for every 10,000 square feet per lift.

1.05 DEFINITIONS

A. **Backfill** is soil material used to refill the spaces from excavation.

B. **Borrow Material** refers to material obtained from sources off the site.

C. **Dewatering** consists of discharging accumulated stormwater, groundwater, or surface water from excavations or temporary containment facilities.

D. **Embankment** is soil material being placed upon the surface of existing ground where the resulting construction will be higher than the adjacent ground surface.

E. **Excavation** is the removal of material above subgrade elevations indicated on the plans.

F. **Existing Boulders** are boulders salvaged from site areas as noted on Plans and as directed by Owner's Representative.

G. **Fill** is soil material used to raise the existing grade.

H. **Final Backfill** is the material above the select backfill zone to three (3) inches below finish grade.

I. **Initial Backfill** is material surrounding and covering pipe extending from the pipe bedding to six inches above the top of the pipe.

J. **Palliation** involves intermittently watering and sprinkling water with such frequency as will satisfactorily alleviate dust.

K. **Pipe bedding** is material placed under and around pipes to provide equal support along the length of pipe installed underground in a trench.

L. **Recycled Fill** refers to asphalt concrete paving debris from demolition work.

M. **Select Backfill** is material above the initial backfill zone and below the finish backfill zone.

N. **Site Boulders** are New, imported, boulders.

O. **Subgrade** refers to the surface of an excavation or the top surface of a fill or backfill immediately below subbase or topsoil materials.

P. **Structures** refers to retaining walls, slabs on-grade, rain tanks, curbs, electrical or mechanical appurtenances, or any other man-made stationary feature constructed above or below the ground surface.

Q. **Topsoil** is all the soil above the lower root line of fine vegetation.

1.06 EXISTING UTILITIES

A. The Contractor shall locate and mark all substructures and utilities prior to beginning excavation.

B. The Contractor shall dig test pits to confirm the location of underground facilities. These test pits shall include dewatering, backfilling, and surface restoration when necessary. If test pits are excavated in paved areas, surface restoration will consist of temporary pavement until final trenching and pavement restoration is completed.

C. When utility line excavation occurs near existing utilities, whether or not indicated on the Plans, ensure existing utility services remain fully operational. Protect and support utility lines in a manner to prevent damage. Method of protection is subject to Owner's Representative's approval.

D. Expeditiously repair damaged utilities at no cost to the Owner.

1.07 DUST CONTROL

A. Effectively dust-palliate working area, unpaved areas, and involved portions of the site throughout the entire construction period.

B. Chemical treatment of any type is not permitted. Use of reclaimed water shall conform to the requirements and guidelines of governing health authorities and be specified approved by Owner's Representative.

1.08 TRAFFIC

A. The Contractor shall minimize the amount of interference with adjacent roads, streets, walkways, and other occupied facilities during earth-moving operations.

B. The Contractor shall not block the entrance or exit of the neighboring fire station.

C. The Contractor not close or obstruct street, walkways, park, golf course or other neighboring occupied or used facilities without permission from the Twain Harte Community Services District (CSD).

1.09 DISPOSAL OF MATERIALS

A. The Contractor shall dispose of materials unsuitable for reuse in the Work offsite. Suitable materials may be reused in the Work for embankment, fill, or backfill.

B. Unless otherwise specified by Owner's Representative, material obtained from the project excavations may be presumed to be suitable for use as fill or backfill provided that all organic material, rubbish, debris, and other objectionable material is first removed.

1.10 DEWATERING

A. The Contractor shall prevent surface water and groundwater from entering excavations and from ponding on subgrades.

B. The Contractor shall reroute surface water away from excavated area and not use excavated trenches as temporary drainage ditches.

C. The Contractor shall discharge of water within the project limits. If water cannot be discharged within the project limits due to site constraints, dispose of uncontaminated water in an area approved by the Twain Harte CSD.

D. The Contractor shall ensure that any dewatering discharge does not cause erosion, scour, or sedimentary deposits that could impact natural bedding materials.

E. The Contractor shall conduct all dewatering operations in accordance with the CalTrans *Field Guide to Construction Site Dewatering.*

1.11 ALLOWABLE TOLERANCES:

A. All cut and fill shall be within a tolerance of $\pm$0.10 feet for grades indicated on the Plans.

B. All structures (including hardscape) shall be within $\pm$0.02 feet of the grades indicated on the Plans.

1.12 SUPPORTED EXCAVATION

A. The Contractor shall provide ladders, steps, ramps, or other safe means of egress for workers in trench excavations 4 feet or deeper per Occupational Safety and Health Administration (OSHA) standards.

1.13 CONTAMINATED MATERIALS

A. The Owner is not aware of any contaminated material within the project limits. If such material is encountered, the Contractor shall contact the Engineer immediately for directions.

1.14 EXPLOSIVES

A. The use of explosives is not permitted at the site.

PART 2 – PRODUCTS

2.01. BACKFILL

A. Backfill material shall be compacted to achieve a minimum relative compaction of 90%.

B. Material from excavations that is to be used for backfilling should be free of trash, debris, and stones greater than 6 inches.

C. Material excavated in excess of that required for backfilling will be disposed of away from the site, unless otherwise permitted by the Twain Harte CSD.

D. If backfill is to be placed around a structure, the material is to be spread equally around all sides.

2.02. BORROW SOIL

A. Borrow material shall be non-expansive, predominantly granular material that is free of particles less than 2 inches in any dimensions, free of organic and inorganic debris, and not more than 12 percent by weight passing the No. 200 sieve behind retaining walls and 25 percent elsewhere.

B. Borrow material must be free of man-made refuse such as concrete, asphalt concrete, residue from grinding operations, metal, rubber, debris, and rubble.

2.03. RECYCLED FILL

A. In lieu of disposal off-site, some asphalt concrete paving debris, resulting from the work of this Project only, may be crushed for limited use as recycled fill. Imported asphalt concrete debris may not be broken, crushed, or otherwise processed on-site.

B. Recycled fill shall conform to SSPWC Section 200-2.4 unless otherwise indicated by the Owner's Representative.

C. Recycled fill shall comprise no more than 10 percent (by volume, compacted) of the total fill.

D. Recycled fill is limited to not less than two feet below the bottom of concrete pads and foundations. Recycled fill is not to be used in the top one foot of landscaped areas.

E. Imported recycled fill is not acceptable.

2.04. RAIN GARDEN / BIO-SWALE SOIL MIX

A. Rain garden / bio-swale soil mix material must be suitable for the purpose intended and be free of unsuitable material and contaminants.

B. Soil Mix shall, at a minimum, be composed of 50%-60% Sand, 20%-30% of Top Soil and 20%-30% Compost.

C. Soil Mix material must be free of trash, site debris and other materials not meeting the composition mix above.

2.05. SITE BOULDERS AND COBBLES

A. Existing Site Boulders – N/A.

B. The Contractor is responsible for sourcing the gravel/cobble mix (rock mulch) for the bioswales and rain gardens. Gravel and cobble placement will be field directed by the Owner's Representative. The gravel and cobble mix for rain gardens and bioswales shall be as follows:

- 2 parts ¾" to 1" wash gravel,
- 6 parts 1" to 3" wash gravel,
- 2 parts 4" to 6" wash gravel,
- 1 part 6" to 10" cobble, and
- 1 part pea gravel.

C. The Contractor is responsible for procuring and transporting all stone to the site and completing the work as specified. Contractor will have an excavator with a thumb attachment to minimize damage to boulder material and grading of park stormwater basin.

2.06. PIPE BEDDING

A. Unless otherwise indicated on the Plans, pipe bedding shall be comprised of clean sand and native free-draining granular materials, free from all vegetation and debris.

B. Bedding shall meet gradation requirements when tested in accordance with ASTM D 422 and have a minimum sand equivalent of 30 as determined by ASTM D 2419.

Sieve Size	% Passing Sieve by Weight
½ inch	100
No. 4	70 - 100
No. 16	50 - 90
No. 50	10 - 50
No. 200	0 - 10

PART 3 – EXECUTION

3.01. PROTECTION

A. The Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other potential hazards created by earth-moving operations.

B. Do not allow earth-moving equipment within the branch spread perimeter (drip line) of existing trees that are to remain.

C. When excavation adjacent to existing trees to remain is necessary, exercise all possible care to avoid injury to trees and tree roots. Excavate by hand all areas where there are roots two inches or larger. Tunnel under and heavily wrap with burlap roots two inches or larger in

diameter, except when directly in the path of the pipe or conduit, to prevent scarring and excessive drying. When a trenching machine runs close to trees that have roots smaller than two inches in diameter, hand trim the wall of the trench adjacent to the tree, making clean cuts through the roots. Paint roots one inch and larger in diameter with two coats of Tree Seal or approved equal. Close trenches adjacent to trees within 24 hours. When this is not possible, shade the side of the tree adjacent to the tree with burlap or canvas.

D. Barricade all open trenches during work hours and cover at the close of each day's work.

E. Provide adequate barriers marked with white flags, throughout the duration of the installation to project site improvements, existing features, and stockpiles of materials.

F. Sequence, schedule, coordinate, and perform the Work to maintain safe, unobstructed passage as required for emergency egress and general site access. Provide any and all bridging of trenches of work, barricades, etc., that may be required to comply with applicable safety regulations.

3.02. DEWATERING

A. The Contractor shall reroute surface water away from excavated area and not use excavated trenches as temporary drainage ditches.

B. The Contractor shall discharge of water within the project limits. If water cannot be discharged within the project limits due to site constraints, dispose of uncontaminated water in an area approved by the Twain Harte CSD.

C. The Contractor shall ensure that any dewatering discharge does not cause erosion, scour, or sedimentary deposits that could impact natural bedding materials.

D. The Contractor shall conduct all dewatering operations in accordance with the CalTrans *Field Guide to Construction Site Dewatering.*

3.03. ROUGH GRADING

A. Site rough grading will generate a graded soil surface to the appropriate tolerances. In addition, drainage terraces, swales, and other drainage structures necessary for the protection of existing structures at the site are to be installed.

B. Rough grading includes excavating pavements and other obstructions visible on the surface and 1-foot below the surface, removing underground structures, removing abandoned drainage pipes, and removing other materials as indicated.

C. Elevations and contours indicated on the drawings are to finish grade unless otherwise indicated. Make allowances for pavement thickness, bases, and landscape material where applicable.

3.04. EXCAVATION, GENERAL

A. Excavate materials of every nature to the dimensions and elevations indicated on the Plans. Use equipment of suitable type for the materials and conditions involved in the Work.

B. Where additional excavation is required to remove unsatisfactory materials that may be encountered, such additional work shall be paid for by means consistent with the terms outlined in the Contract.

C. Place backfill on subgrades free of mud, frost, snow, or ice.

D. Uniformly grade area to a smooth surface that is free of surface irregularities.

E. Remove materials not approved for use as topsoil or fill and excess excavated materials from the site.

F. Confine excavated materials to immediate area of stockpiled location designated by the Owner's Representative.

3.05. COMPACTION

A. **Parking and Pedestrian Walkway**: Compact soils below parking areas and walkways to 90 percent of the Modified Proctor maximum dry density for the full depth of fill.

B. **Landscape Areas**: Compact soils below all landscape, planting, and sod areas to 85% of the Modified Proctor maximum dry density for the full depth of fill unless otherwise noted on the Plans.

C. **Building Areas:** Compact soils below buildings (and for a distance of five feet beyond the perimeter footing) to at least 90 percent of the Modified Proctor maximum dry density for the full depth of fill. Proof roll from a level that is two feet above ambient water table. This may require locally filling low areas prior to using a vibratory compactor. Densify subsoils by making repeated overlapping coverages of roller as it operates at its full vibrational frequency and at a travel speed of no more than two feet per second.

D. **Utility Trenches:** Compact the initial backfill to a relative compaction of 95%.

3.06. TRENCH EXCAVATION

A. The Contractor shall excavate trenches for rainwater conveyance piping, stormwater conveyance piping, and other utilities indicated on the construction Plans.

B. The Contractor shall excavate trenches to uniform widths per ASTM D2321.

C. The Contractor shall excavate and shape trench bottoms such that they support pipes and conduit. The subgrade should be shaped to provide continuous support for bells, joins, pipe barrels, joints, and fittings. The Contractor shall remove all projecting stones and shape objects along the trench subgrade.

D. The Contractor shall excavate trenches six (6) inches deeper than the elevation of the pipe invert to allow for the placement of bedding course.

E. The Contractor shall place backfill on subgrades free of mud, frost, snow, or ice.

F. Barricade all open trenches during work hours and cover at the close of each day's work.

G. Maintain trenches and other excavations free of water while lines are being placed and until backfill has been completed and approved. Ensure adequate pumping equipment is available at all times for emergencies and dispose of water in such a manner as not to create a nuisance or cause damage to property. Do not allow water to migrate outside of the construction area and use Owner-approved methods to confine water to construction areas.

H. **Bracing and shoring** – Support excavations in accordance with all legal requirements. Set and maintain sheet piling and shoring timbers in a manner that will prevent caving of walls of excavations or trenches.

I. **Bedding** – Do not cover lines until they have been inspected and approved for alignment and grade and recording for "as-built" survey information by the Owner's representative. Commence bedding immediately after approval and survey information recording. Then carefully place bedding around utility lines so as not to displace or damage the line. Fill symmetrically on each side of the line. Compact bedding to 90 percent of the maximum dry density in accordance with ASTM D 1557 using mechanical equipment.

3.07. SOIL FILL

A. Place fill in uniform lifts not exceeding eight inches in loose thickness that will uniformly compact to the required densities.

B. Bring each layer to between $\pm$ 2 percent of optimum moisture content before compaction. Add water by uniformly sprinkling and mixing it with the soil. Add or blend additional fill materials or dry out existing material as required.

C. When moisture content and condition of each layer is satisfactory, compact to the specified density. Compact areas not accessible to motor-driven equipment with mechanical or heavy hand tampers.

D. Rework compacted areas failing to meet specified density as determined by tests. Recompact and retest as required to achieve property density.

E. Prior to placing fill material on existing surfaces, scarify to a depth of six inches and recompact to the same degree of compaction as the overlying fill material.

3.09. GRAVEL AND COBBLE PLACEMENT

A. Gravel and cobble placement in rain gardens and bioswales will be field directed by the Owner's Representative.

3.10. CLEAN UP

B. Keep project site and adjacent streets reasonably free from accumulation of debris resulting from work specified in this section.

C. Immediately remove dirt, debris, and overreaching construction clutter from buildings and structures, walls, pavements, and curbs.

END OF SECTION 31 20 00

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Clearing, grubbing, and stripping project site.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the CONTRACTOR'S responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR'S Work.
   3. The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
      a. Section 01 66 13 - Hazardous Material Procedures.
      b. Section 31 05 00 - Soils and Aggregates for Earthwork.

1.02 REFERENCES (NOT USED)

1.03 DEFINITIONS

A. Clearing: Consists of removal of natural obstructions and existing foundations, buildings, fences, lumber, walls, stumps, brush, weeds, rubbish, trees, boulders, utility lines, and any other items which interferes with construction operations or are designated for removal.

B. Grubbing: Consists of the removal and disposal of wood or root matter below the ground surface remaining after clearing and includes stumps, trunks, roots, or root systems greater than 1 inch in diameter or thickness to a depth of 6 inches below the ground surface.

C. Stripping: Includes the removal and disposal of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. The depth of stripping is estimated to be 6 inches, but the required depth of stripping will be determined by the ENGINEER.

1.04 QUALITY ASSURANCE

A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

B. Pre-construction conference: Meet with ENGINEER to discuss order and method of work.

1.05 PROJECT CONDITIONS

A. Environmental requirements:
   1. For suspected hazardous materials found, as specified in Section 01 66 13 Hazardous Material Procedures.

B. Existing conditions:
   1. Verify character and amount of clay, sand, gravel, quicksand, water, rock, hardpan, and other material involved and work to be performed.

1.06 SEQUENCING AND SCHEDULING

A. Clearing and grubbing: Perform clearing and grubbing in advance of grading operations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine site and verify existing conditions for beginning work.

3.02 PREPARATION

A. Protect existing improvements from damage by site preparation work. Install fence at drip line of trees to remain as indicated on the Drawings.

3.03 INSTALLATION

A. Clearing:
   1. Clear areas where construction is to be performed and other areas as indicated on the Drawings, or specified in this Section, of fences, lumber, walls, stumps, brush, roots, weeds, trees, shrubs, rubbish, and other objectionable material of any kind which, if left in place, would interfere with proper performance or completion of the work, would impair its subsequent use, or form obstructions.
   2. Do not incorporate organic material from clearing and grubbing operations in fills and backfills.

3. CONTRACTOR'S construction facilities: Fill or remove pits, fill, and other earthwork required for erection of facilities, upon completion of the work, and level to meet existing contours of adjacent ground.

B. Grubbing:
   1. From excavated areas: Grub stumps, roots, and other obstructions 3 inches or over in diameter to depth of not less than 18 inches below finish grade.
   2. Backfill and compact cavities left below subgrade elevation by removal of stumps or roots to density of adjacent undisturbed soil.

C. Stripping:
   1. Remove soil material containing sod, grass, or other vegetation to depth of 6 inches from areas to receive fill or pavement and from area within 5 feet outside foundation walls.
   2. Deposit stripped material in accordance with following requirements:
      a. At locations as accepted.
      b. Use accepted material in top 6 inches of areas to be used for future planting.
   3. Replace topsoil where indicated on the Drawings.

D. Special Techniques (Not Used)

END OF SECTION

SECTION 31 21 00
PEDESTRIAN PATHWAYS

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. Decomposed Granite Pathway material and construction in accordance with ADA standards.

1.02 RELATED SECTIONS

A. SECTION 31 21 00, EARTHWORK

1.03 CODES AND STANDARDS

A. ASTM C136-Sieve Analysis of Fine and Coarse Aggregates

B. ASTM D2419- Sand Equivalent Value of Soils and Fine Aggregates

C. Caltrans Standard Specifications for Public Works Construction

D. RIS-Redwood Inspection Services Grades of California Redwood

E. CalTrans Permanent Pedestrian Facilities ADA Compliance Handbook

1.04 SEQUENCING

A. Do not install work specified in this section prior to acceptance of earth moving. Coordinate work specified in this section with work specified in other sections to minimize cutting of - and operation of - heavy equipment over newly installed surfacing.

1.05 QUALITY ASSURANCE/FIELD QUALITY CONTROL

A. Installer

a. Installations 500 square feet and over up to 3,000 square feet – must be a recommended installer at a minimum. Installations 3,000 square feet and over – must be an Approved Installer.

b. The installation instructions in this Specification are meant as a guide for bidding purposes and will be superseded by the approved Submittal of installation instructions from manufacturer and any field direction.

c. The Contractor shall dig test pits to confirm the location of underground facilities. These test pits shall include dewatering, backfilling, and surface restoration when necessary. If test pits are excavated in paved areas, surface restoration will consist of temporary pavement.

B. Porous Base Rock Testing

a. Testing shall occur during installation at 1-ton increments of shipping for sieve conformance. Results shall be submitted prior to completion of the stone base installation.

i. The stone field area shall have a permeable rate no less than 14” per hour. The testing shall be per Din 8035 Part 7, ASTM 2434 (constant head), or ASTM F2898 testing methods.

ii. In addition to the lab testing, after installation of any aggregate base

cross-section, designed to conduct rainfall to the sub-soils and/or under-drain system, the finished aggregate base shall be tested, *in situ* for infiltration rate, using method ASTM F2898. **The test shall be performed by a registered Geotechnical Engineer or certified agronomist.**

b. The Contractor is responsible to meet this performance specification, before proceeding with installation, and shall bear the cost of the on-site testing and the cost of any additional work necessary to achieve compliance with the specification.

c. All test results shall be logged and documented by the Owner's Technical Representative or Geotechnical Engineer. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his expense, the processed stone base to the required grade, cross-section and density.

d. After the contractor has independently confirmed compliance with all the above tolerances (planarity and elevation verified by a licensed surveyor and compaction, gradation, & permeability verified by Geotechnical Engineer, he shall notify the appropriate party and schedule a final inspection for approval. The contractor shall make available an orbital laser system to the Inspection Team for the inspection process.

e. The compaction rate for porous base rock should be 88%. The compaction rate for non-porous base rock should be 95%.

C. Standard Specifications:

a. Shall mean the California Department of Transportation Standard Specifications, latest active edition.

b. The pathway shall have a maximum longitudinal slope of 5% and a maximum cross slope of 2%.

1.06 MOCKUP

A. Construct mockup of crushed aggregate blended with surfacing, including base course and edging, at location approved by [Owner's Representative]. Build mockup 1 days prior to installation. The intent of the mockup is to demonstrate surface finish, texture, color, and standard of workmanship.

B. Notify Owner's Representative 1 day in advance of mockup construction.

C. Allow Owner's Representative to view and obtain approval of mock-up before proceeding with rest of crushed aggregate admixture surfacing.

D. Approved mock-up may remain as first in place construction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver all Admixture materials in original, unopened packaging. Protect materials and aggregate from contamination with foreign matter. Store under waterproof cover and

protect from dampness.

1.08 FIELD CONDITIONS

B. Do not install crushed aggregate blended with admixture surfacing when sub-base is wet at saturated field capacity.

C. Do not install materials when rain falls on it within 48 hours after the install, or when the temperature will go below freezing within the next five days following installation.

PART 2 – PRODUCTS

2.01. CRUSHED AGGREGATE BLENDED WITH ADMIXTURE SURFACING MATERIALS

A. Decomposed (DG), crushed aggregate.

a. DG shall have a 3/8" maximum gradation, produced from naturally friable rock/granite with enough fines to produce a smooth walking surface. Materials should be free from clay lumps, organic matter, and deleterious material. Blends of coarse sand and rock dust are not acceptable.

b. Use a single supply source for the entire quantity required.

c. Gradation, in accordance with ASTM C136:

i. Color: Should have gold to yellow hues. To be selected by Owner's Rep from manufacturer's standard colors.

B. Aggregate binder:

a. Provide Admixture. Color: Per Owner's Representative's decision.

2.02. BASE COURSE MATERIAL

A. Class II Permeable Base Rock.

B. Soft stone materials (i.e., sandstone, limestone, and shale materials) are not suitable. Stone supplier shall certify that all supplied stone will be clean of this type of stone. All types of stone shall meet the following stability requirements.

Test Method	Criteria
LA Abrasion (Calif. Test 211)	Not to exceed 40
Durability Index (Calif. Test 229)	Not less than 40

C. In addition, if stone stability to water and vehicles is in question, Owner has the right to perform additional testing to ensure material shall adhere to requirements of Caltrans Section 68, as well as additional applicable ASTM tests.

D. All testing fees shall be paid for by the Contractor.

E. **Permeable Stone:** Stone base materials shall be washed, 100% fractured, by mechanical means, with elongated characters on each individual particle larger than 1/4". Materials shall be devoid of mineral fines. All particles smaller than 1/4" shall be produced by manufactured means only. Rounded sands or aggregates are prohibited.

F. **Delivery Moisture Content:** Processed stone shall contain 90% to 110% of the optimum moisture content to ensure that fines do not migrate in transit or during placement and to facilitate proper compaction. The contractor shall ensure that the aggregate leaving the

source plant meets this requirement. The contractor is required to apply water to the processed stone on site to attain and maintain this minimum moisture content.

G. Aggregate or aggregate blends of permeable stone shall conform to the following gradation:

Sieve	Percent Passing by Weight (Intended Result)	Range
1”	100	100
3/4”	100	90 - 100
3/8”	78	40 - 100
No. 4	36	25 – 40
No. 8	26	18 – 33
No. 30	11	5 – 15
No. 50	6	2 – 10
No. 200	2	0 - 5

Durability Index (CTM #229) – 40 min
Sand Equivalent (CTM #217) – 70
LA Rattler (CTM #211) – 500 Revs, less than or equal to 40%

H. Specs for ⅜” minus and ¾” minus Crushed Aggregate Following ASTM D 1140-17:

I. 100% fractured on all sides with no rounded particles Sieve 200 - Non-expansive Clay Fines - not to exceed 18%

J. The below test is for ⅜” minus stone, at approximately 90% compaction when tested.

Sieve Size	% Passing	Sieve Ranges
1/2"	100	100
3/8”	95	98
No. 4	85	90
No. 8	75	85
No. 16	55	70
No. 30	38	57
No. 50	24	33
No. 100	15	24
No. 200	9	18
No. 400	0	9

2.03. ACCESSORIES

K. Water: Free from contaminants that would discolor or be deleterious to crushed aggregate blended with admixture surfacing.

L. Installation: Do not use a vibratory plate to compact the pathway. Use a lawn roller filled with water to compact. Use a 36" drum roller or dual-drum roller in static position for driveways and larger installations. It is highly recommended to use a volumetric truck for driveways and larger installations; if possible, the use of a paver is highly recommended as well.

PART 3 – EXECUTION

3.01. EXAMINATION

A. Examine grading and subsoil conditions. Do not proceed until conditions are acceptable.

3.02. PREPARATION

A. Excavation: Excavate to depth required so edges of crushed aggregate blended with admixture surfacing will match adjacent grades and have a maximum longitudinal slope of 5%.

B. Base Course Installation: Class II permeable base rock at 90% compaction.

C. Edging: Install flush with crushed aggregate blended with admixture. Provide sufficient stakes to secure in place.

3.03. INSTALLATION

A. There are two installation methods: “Dry” and “Wet.”

i. The dry method is for installations up to 500 square feet (most home applications).

ii. The wet method is appropriate for installations over 500 square feet (most large, commercial installations) and may require the use of a volumetric truck.

B. Mixing Method

i. Installations of less than 500 square feet may be mixed on-site.

ii. Installations of 500 square feet and over up to 3,000 square feet, must be delivered pre-mixed to the site.

iii. Installations 3,000 square feet and over up to 5,000 square feet must be supplied by an approved pre-mix facility.

iv. Installations over 5,000 square feet require the use of a volumetric truck.

C. Installation Depth (also known as “lift”)

i. For residential/pedestrian applications, 3-inch-thick layer (“lift”) over a 4-inch subgrade of compacted Class II base rock. Compaction rates for all applications are 88% to 92%.

D. Measurements

i. CRUSHED AGGREGATE BLENDED WITH ADMIXTURE SURFACING MATERIALS

1. Residential/Pedestrian Application - (2 bag mixture) One cubic yard of aggregate/decomposed granite and two (85 lbs) sacks of admixture combined shall cover 108 square feet at a 3-inch thickness.

Note: Aggregate/decomposed granite should be 3/8” minus material and follow our sieve percentages in this Specification Guide within a +/- 5% range.

ii. Class II Base Rock:

1. Residential/Pedestrian Application - After final compaction, base rock should have a 4-inch depth.

E. Mixing Ratios

i. Residential/Pedestrian Application – (2 bag mixture) The aggregate/decomposed granite (DG) is mixed with admixture at a 19:1 ratio (19 units of DG to 1 unit of admixture, measured in volume).

F. DRY METHOD INSTALLATION

i. **Class II Base Rock:** Moisten and compact base rock on the entire installation area to an even depth of 4-inch application. A vibratory plate can be used to compact the base rock; it should not be used to compact the admixture for residential installations.

ii. **Admixture:** Wheelbarrow the prepared Admixture/DG mixture to the installation site and place a layer of the mixture to one-half of the desired final lift. Be sure to spread the mixture out before proceeding to step 3; this will ensure the mixture is moistened and mixed thoroughly.

iii. Moisten the material with a hose end trigger sprayer attachment, avoiding puddling - oversaturation is detrimental and will negatively affect the integrity of the finished product. Rake area lightly to evenly distribute water throughout the mix or "lift". Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners.

iv. Install a second lift as above; when doing this, make sure to pay particular attention to the edges to ensure even material height, and moisten to dampen mixture.

v. Moisten until both lifts are damp. Proper moisture content can be checked by clenching your fist, when the mixture just stays together and the color just starts to transfer to your hand, it is ready to compact.

vi. Compaction: After proper moisture is achieved for compaction, hand tamp (with a 10” hand tamp) around benches, signposts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.

vii. Make several passes with a 36” lawn roller (filled with water), or for larger installations, a 36” walk-behind or drum roller in static position. Hand tamp out any imperfections with a 6” wooden masonry float.

Make sure to keep your 10” hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match existing finish.

viii. When laying admixture in batches, be sure to use the cold joint method below to ensure a blemish-free installation.

ix. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a medium-bristled push broom. Then make several more passes with the lawn roller until the desired surface texture is achieved. With larger installations, a roller in a static position can be used, making sure to keep the drum clean at all times. Remove spoils off the surface.

x. DO NOT ALLOW MIXTURE TO DRY DURING INSTALLATION. MIST LIGHTLY WITH A HOSE END SPRAY HEAD AS NECESSARY OR COVER WITH A PLASTIC TARP.

xi. The final step for installation is a dampening with water of all newly installed and compacted materials. Using a shower head/spray hose attachment, moisten the entire newly installed area - avoid puddling. For the best results, moisten all newly installed paving a second time for the following 1 to 5 days, as practical. Slow curing is important to avoid cracking.

xii. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.

G. WET METHOD INSTALLATION

i. After DG and admixture have been mixed but BEFORE installation has begun: Mix thoroughly and moisten with water until the mixture begins to marble or clump together. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it’s ready for installation.

ii. **Class II Base Rock:** Moisten and compact base rock on entire installation area to an even depth of 4-inch application. A vibratory plate can be used to compact the base rock; it should not be used to compact for residential installations.

iii. **Admixture:** Wheelbarrow the prepared admixture/DG to the installation site and spread the mixture over the compacted base rock.

iv. **Compaction:** Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners. Rake or grade area with the flat side of a landscape or asphalt rake (Do not use tine side), until the admixture is one inch above finish grade.

v. Once initial compaction has been completed, hand tamp (with a 10” hand tamp) around benches, signposts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.

vi. Make several passes with a 36” lawn roller (filled with water), or for larger installations, a 36” walk-behind or a dual-drum roller in static position. Hand tamp out any imperfections with a 6” wooden masonry float.

Make sure to keep your 10” hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match existing finish.

vii. When laying in batches, be sure to use the cold joint method below to ensure a blemish-free installation.

viii. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a medium-bristled push broom. Then make several more passes with the lawn roller until the desired surface texture is achieved. With larger installations, a dual-drum roller in a static position can be used, making sure to keep the drum clean at all times. Remove spoils off the surface.

ix. DO NOT ALLOW MIXTURE TO DRY DURING INSTALLATION. MIST LIGHTLY WITH A HOSE END SPRAY HEAD AS NECESSARY OR COVER WITH A PLASTIC TARP.

x. The final step for installation is a dampening with water of all newly installed and compacted materials. Using a shower head/spray hose attachment, moisten the entire newly installed area - avoid puddling. For the best results, moisten all newly installed paving a second time for the following 1 to 5 days, as practical. Slow curing is important to avoid cracking.

xi. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.

H. The following information is applicable to BOTH installation methods.

i. You may walk on pathways immediately after installation. However, the pathway gets stronger with time. Ideally, stay off the newly installed areas for at least one day; after that, foot traffic is allowed. Vehicular traffic should avoid newly installed areas for 5 – 7 days.

ii. Newly installed paving surfaces will be fully cured in 28 days. At that time, the entire surface should be blown or swept off to eliminate loose surface materials. Minor cracking may take place. However, over time, the aggregate fines will fill in the minor cracks and they should disappear. Occasional blowing off the surface will help to minimize loose surface materials.

I. Cold Joint Methods

i. Cold joints can be used at the end of the workday.

ii. Place a 2”X4” or 2”X6” piece of wood or metal edging across the installation, loosely stake it, and finish compacting the material. Leave the board in place overnight.

iii. The next day, carefully lift the wood up and away.

iv. Continue with installation: Dampen the prior installation area. Place newly mixed admixture into the area, being careful not to overlap existing compacted

material. Place a three-foot length of 2"x4" carefully along the edge of the new pour and compact by hitting/tapping the board with a single jack. Then, take a medium-bristled push broom and very lightly "feather" the two pours together.

J. Installing for Vehicular Traffic

i. Installing for vehicular traffic is nearly identical to the method above, EXCEPT you will use a vibratory plate or static dual-drum roller to compact the admixture after final compaction by a lawn roller. Make sure to keep the plate clean. If any ridges or ruts occur, fill in with a hand tamp, compact, and broom over it as the finishing instructions above.

K. Recommended Equipment

Tools	Materials
(3) Rounded point or flat edge shovels for moving product	Admixture bags (85 lbs.)
6 cubic foot cement mixer for mixing small installations	3/8” minus aggregate/ decomposed granite
Wheelbarrow for moving material	Class II Base Rock or Class II Permeable Base
8” or 10” hand-tamps for compacting edges and corners, step back fills, and small areas	Curbing or Header Board materials (if desired)
Hose with a shower spray nozzle for moistening dry product	Water source
Landscape and asphalt rake with flat edge for finish grading	
Heavy lawn roller filled with water to compact	
Medium bristled push broom for finishing	
(2-3) 6”-9” wooden masonry float for finishing (1) 6”-9” steel float for cleaning hand tamp and roller	

3.04. CURING PERIOD/PROTECTION

A. For Driveway Installations: Do not allow traffic on crushed aggregate blended with admixture surfacing for 5 days after placement or until compacted crushed aggregate blended with admixture surfacing has fully cured.

B. Protect crushed aggregate blended with admixture surfacing from damage until project completion. Repair damaged areas to match specified.

3.05. MAINTENANCE & REPAIRS

A. Follow manufacturer’s recommendations.

B. Maintenance: Depending on the end users desired finish surface, maintenance may require occasional blowing off or brooming of paved surface - DO NOT use a pressure washer to clean. Depending on quality of compaction at time of installation, a thin

veneer of loose aggregate material is typical after the full 28 days cure period. If cracking appears in a surface, broom loose aggregate “fines” into cracks and compact with a rubber mallet.

C. Repair: When repairing it is important to use the original aggregate/decomposed granite and the original Admixture color to match previously installed materials. If the paved surface has large areas of raveled material (loose aggregate/decomposed granite) the initial installation may not have been properly compacted, or blended materials did not have optimum moisture content during installation. The following are suggestions for repair of raveled materials:

    i. For the large loose areas, a minimum of a 3-inch admixture can be installed. The repair areas need to be saw-cut at the agreed length, removed, and re-installed. A portable concrete mixer or wheelbarrow can be used.

    ii. In areas that collapse/fail due to equipment weight, re-form and re-install with original materials as per specifications.

    iii. Cracks: Repair by brooming existing surface fines into the cracks. Compact with rubber mallet, moisten, and “feather” material into the final finish. This may have to be done several times. Another method is to sieve the existing decomposed granite to eliminate all aggregates higher than 1/16". Mix with Admixture to a 13 to 1 ratio, fill the crack. moisten and follow the above application. The third method of application is to get "playground" sand and proceed as with the above ratio and application.

END OF SECTION 31 21 00

SECTION 31 23 13

SUBGRADE AND ROADBED

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Subgrade preparation for all paving and surfacing.

1.02 RELATED WORK

A. Section 31 20 00 - Earthwork.

1.03 MEASUREMENT AND PAYMENT

A. No separate payment or compensation shall be made for work of this Section.

B. Full compensation and payment for work of this Section shall be considered as part of and included in payment for each bid item for which the work is executed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Comply with requirements of Section 31 20 00 Earthwork.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify established grades are in conformance with requirements.

3.02 PREPARATION

A. Adjust utility boxes, risers, lids and other appurtenances as required to meet and match proposed finish surface grades.

3.03 SUBGRADE

A. Excavate and shape subgrade to line, grade, and cross section.

B. Roll subgrade with an approved roller until the top 12 inches is compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 1557.

C. Remove all soft or otherwise unsuitable material and replace with suitable material.

D. Fill holes and depressions to the required grade and cross sections with material from the excavation.

E. The finished subgrade shall be within a tolerance of plus or minus 0.05 of a foot of the grade and cross section shown, shall be smooth and free from irregularities and at the specified density.

F. Extend compaction one foot beyond the edge of paving, curb, or form.

3.04 PROTECTION OF SUBGRADE

A. Protect and maintain the prepared subgrade in the finished condition until the first succeeding course is placed.

B. Restore and correct damaged subgrade as specified above. Verify compliance with subgrade requirements.

END OF SECTION

SECTION 32 14 33
PERMEABLE PLASTIC PAVING

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. The work described in this specification is intended for the constructability and installation of TrueGrid (or approved equal) parking area.

B. Provide and install sub-base material as shown on drawings or per recommended sub-base alternatives as provided from additional manufacturer's information. See 'Materials'

C. Provide all products and installation per the manufacturer's instructions provided on this specification sheet and other available specification material.

D. Provide and install specified fill material for gravel fill option.

1.02 RELATED SECTIONS

A. SECTION 31 20 00, EARTHWORK

1.03 SITE CONDITIONS

A. Verify site conditions where the permeable pavers are to be installed and ensure constructability and installation access is free and clear of obstructions.

B. Review installation and coordinate permeable paver work with other work affected.

C. Notify project manager/site-supervisor of any open depressions and excavations made as part of the demolition/grading work for system installation and post warning signs if applicable.

D. Protect active sewer, water, gas, electric, drainage, and irrigation indicated or, when not indicated, found, or otherwise made known to the Contractor before or during installation work. If a utility is damaged, immediately notify the Twain Harte Community Services District (CSD) for corrective action.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:

a. Minimum of 10 years of experience of this Section.

b. Successful completion of three (3) previous projects of similar scope and complexity.

c. Manufacturer signed certificate stating the product is MADE IN THE US

B. Installer Qualifications:

a. Successful completion of (1) previous project of similar scope of complexity.

b. Maintains trained technicians on staff providing field service and warranty related work.

c. Minimum of (3) years of experience in work of this Section.

C. Installation and Excavation Safety: In accordance with OSHA requirements.

1.05 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the work in this Section. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver (unless otherwise specified) system components until time needed for installation and after proper protection can be provided for materials.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

C. Protect from damage due to weather, excessive temperature, and construction operations.

D. Leave protective coverings in place until just prior to installation.

E. Protect materials during handling and installation to prevent damage.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within manufacturers limits for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. All hard surface paving adjacent to permeable paver areas, including concrete walks and asphalt paving should be completed prior to installation of permeable pavers.

C. In wet weather, do not build on wet, saturated, or muddy subgrade.

D. In cold weather, do not use frozen materials or materials mixed or coated with ice or frost, and do not build on a frozen base or wet, saturated, or muddy subgrade.

E. Protect partially completed paving against damage from other construction traffic when work is in progress.

1.08 TRANSITION FROM HARDSCAPE

A. When transitioning to an adjacent hardscape, create a clean edge with existing pavement and ensure permeable pavers are flush or slightly recessed below the surrounding grade.

B. In the case when permeable pavers are against broken asphalt, cut out a small section and pave a clean line. Then ensure permeable pavers are flush or slightly recessed below the surrounding grade.

1.09 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty (at least 10 years) against defects in materials and workmanship.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer(s) for Permeable Pavers:

a. Airlite Plastics Co. DBA TRUEGRID Pavers or approved equal.

B. Substitutions: Not permitted unless approved by Owner's Rep.

2.03 PERMEABLE PAVER SYSTEMS

A. Permeable Pavers, TRUEGRID PRO PLUS for gravel applications.

B. AASHTO H20, HS20 Rated.

C. Manufactured in the USA.

D. High density polyethylene (HDPE): 100 percent post-consumer recycled materials

E. Recycled and recyclable content: 100 percent.

F. S-Flexural joints molded in for soil seasonal expansion and contraction.

G. Color: black- carbon black additive for long-term UV stabilization.

H. Paver size: 24 inches by 24 inches by 1.8 inches.

I. Pre-assembled: 4-foot by 4-foot sections.

J. Cylindrical cell design for column strength. Cell size: 3.30 inch inside diameter.

K. Co-joined cells at 48 places for strength.

L. Wall thickness: 0.150 inches /.250-inch nominal.

M. A minimum of 2 co-joined common walls per cell for structural integrity.

N. Connections:

a. No clips or stakes necessary.

b. No additional parts or tools needed.

c. Integral male-female three-point locking system.

d. Wall thickness at tabs: 0.290 inch.

O. Molded in X-anchors to stabilize pavers: no stakes necessary.

P. Nominal Coverage per Paver: 4 square feet.

Q. Weight per paver: 5.25 lbs.

R. Permeability of System: 100 percent.

S. Compressive Strength (filled): 17,729 psi.

T. Material Safety: Groundwater neutral, 100 percent inert.

U. Chemical Resistant: Excellent: highly resistant to hydrocarbons, oils.

2.04 PARKING DELINEATORS

A. TRUEGRID SnowSpots for gravel applications or approved equal.

2.05 ADA, Traffic, and Parking Identifiers: TRUEGRID Plates for gravel applications or approved equal.

2.06 Base Material:

A. TRUEGRID PRO PLUS was developed to accept multiple acceptable base materials. Locally sourced angular stone/clean for base material. Crushed granite, sandy gravel material, crushed concrete, limestone rock, and crushed lava are some of the acceptable materials. Common base materials include:

   a. AASHTO #57 Stone.

   b. Hard, clean, angular, and open-graded (uniform size) drain rock -- from 3/4" to 1-1/2".

   c. Base Course: Graded aggregate base course conforming to the following sieve analysis and requirements:

      i. Percent Passing: 100 - Sieve Size: 3⁄4 – 1 inch

      ii. Percent Passing: 85 - Sieve Size: 3/8 inch

      iii. Percent Passing: 60 - Sieve Size: #4

      iv. Percent Passing: 30 - Sieve Size: #40

      v. Percent Passing: <3 - Sieve Size: #200, or 3 to 8 Percent for Grass Infill

B. Gravel Fill: Obtain clean, washed angular rock to fill the 1.8-inch-tall TRUEGRID PRO PLUS cells and spaces between. TRUEGRID PRO PLUS can be filled to top of cells and exposed or overfilled to hide cells. Fill rock should be 5/8 inch to 3/4-inch diameter.

   a. TRUEGRID PRO PLUS's design does not require anchors on level ground or slopes up to 10 degrees. TRUEGRID PRO PLUS is designed for slopes above 10 degrees. However, as a precaution, anchors/staking may be considered per each sloped install above 10 degrees.

   b. Fill rock, level to the top of cells for ADA compliance.

PART 3 – EXECUTION

3.01 EXAMANATION AND PREPARATION

A. Place base course material over prepared subbase to grades shown on plans or from manufacturer's recommended depths per application type, in lifts not to exceed 6", compacting each lift separately to 95% Modified Proctor. Leave minimum 1.8" for Permeable Paver unit. Fill to final grade.

B. When applicable, backfill and compact depressions caused by excavations, demolition, and removal in accordance with the requirements outlined in SECTION 31 00 00, EARTHWORK.

3.02 INSTALLATION

A. Install Permeable Paver units by placing cells face up. Sheets come preassembled in 4'x4' sheets and connect with friction fit interlocking connectors. No tooling required to connect or disconnect paver units. (9) Individual 16"x16" pieces can be disconnected from each 4'x4' sheet and reconfigured as needed.

B. Units can be cut around curves and organic shapes on the job site with any electrical handsaw.

C. Maintain 1" clearance to any pre-installed object or surface structure. Top of cells shall be between .25" to .5" below the surface of adjacent hard-surface pavements.

D. Rock or soil fill aggregate can be driven directly on pre-filled pavers to be dumped and spread.

E. Gravel-Fill Applications:

a. Install Gravel into paver cavities by back dumping directly from dump truck or from buckets mounted to tractors. Hand shoveling fill gravel into the cells is also acceptable for smaller jobs.

b. Direct exit the site by driving forward. Pavers can handle high load capacities while empty, avoid sharp turns over unfilled rings.

c. The gravel fill can then be spread from the pile using steer loaders, power brooms, blades, flat bottomed shovels, and/or wide "asphalt rakes" to fill the cells. The gravel should then be compacted when the cells are at capacity by using a roller for larger areas or a vibrating plate for smaller areas.

d. If fully covering pavers, typical coverage is .25" - .5" above cells.

3.03 FIELD QUALITY CONTROL

A. Any damaged sections of pavers during installation shall be removed and replaced with no evidence of replacement apparent.

3.04 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

A. Remove all excess materials, debris, and equipment from site upon completion of installation.

B. Clean and protect products in accordance with manufacturer's recommendations.

C. Touch-Up, repair or replace products before substantial completion.

D. Dispose of scrap materials, waste, trash, and debris from the installation of the rainwater harvesting system in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by the Twain Harte CSD.

E. Burying or burning trash and debris on site will not be permitted.

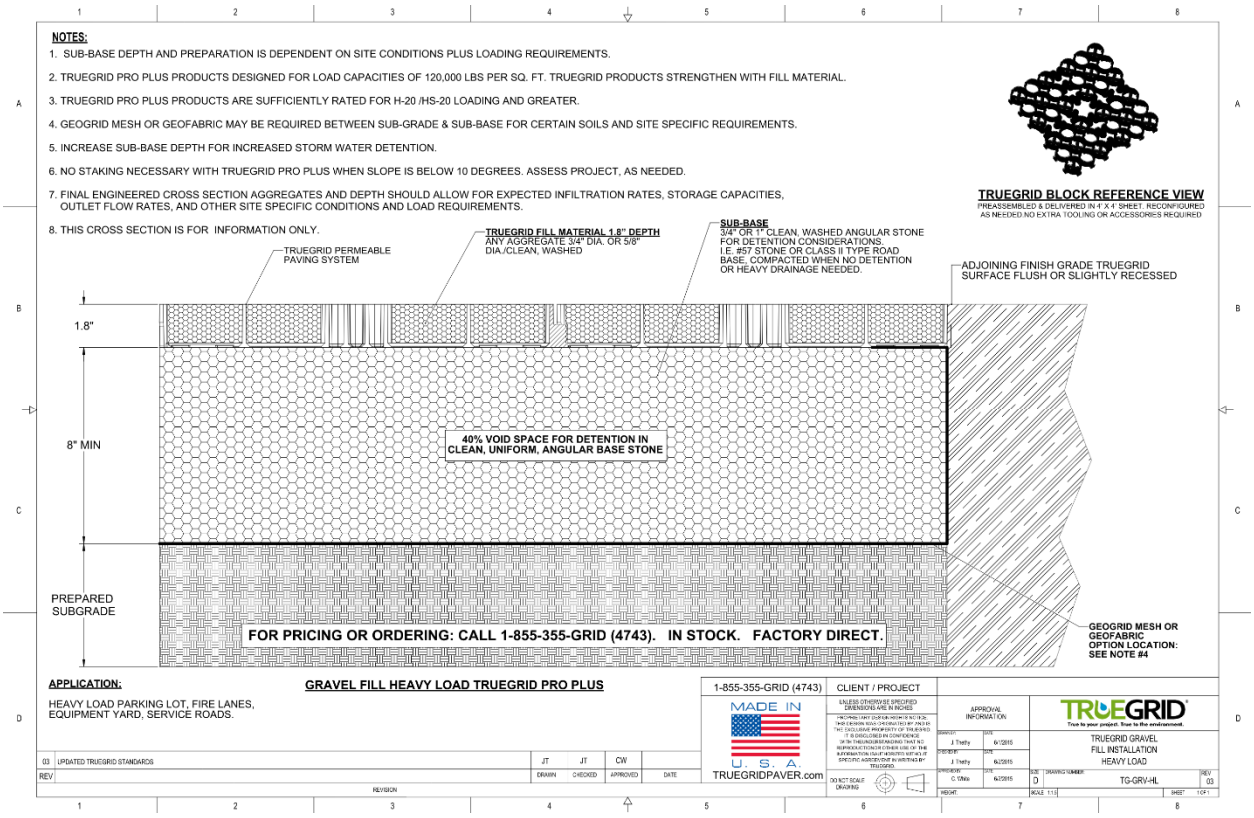
F. Scrap materials, trash, and debris shall become the property of the CONTRACTOR and shall be removed from the site and be disposed of in a legal manner. Location of the disposal site and length of haul shall be the CONTRACTOR's responsibility.

3.05 MAINTENANCE

A. Gravel Fill: If the installation is one that is initially a cell covered installation, raking gravel back over exposed cell tops may be necessary if over fill aggregate migrates.

B. When snow removal is required, keep the edged plow blade a minimum of 1" above the paver surface to avoid damage to the paver surface.

3.05 INSTALLATION DETAIL



END OF SECTION 32 12 43

SECTION 32 84 00
IRRIGATION SYSTEM

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. The work described in this specification is intended for the constructability and installation of the Irrigation system per applicable codes and standards. This section includes specifications for the Irrigation system and its components, quality assurance and inspection.

B. Irrigation System:

a. Irrigation Materials and Components

b. Installation Codes and Standards

c. System Location and Layout

d. Installation of Pipe, Equipment and Components

e. Irrigation Controller

f. Field Quality Control

g. Plant Establishment Period

1.02 RELATED SECTIONS

A. SECTION 31 20 00, EARTHWORK

B. SECTION 32 90 00, PLANTING

1.03 APPLICABLE CODES AND STANDARDS

A. International Organization for Standardization (ISO):

a. ISO 9001 – Quality management systems requirements.

B. California Plumbing Code (CPC-2022)

a. Title 24, Part 5

b. Chapter 15: Alternate Water Sources for Non-Potable Applications

c. Chapter 16: Non-Potable Rainwater Catchment Systems

C. ASTM A53 – Specifications for Pipe, Steel

D. ASTM D1784 – Specification for Rigid Poly (PVC)

E. ASTM D1785 - Specification for Poly (PVC) Schedule 40, 80, and 120

F. ASTM D2241 - Specification for Poly (PVC) SDR-Series

G. ASTM D2464 - Specification for threaded Poly (PVC)

H. ASTM D2466 - Specification for Poly (PVC) Fittings

I. ASTM D2564 - Specification for Solvent Cements for Poly (PVC)

1.04 SITE CONDITIONS

A. Verify site conditions where the Irrigation system is to be installed and ensure constructability and installation access is free and clear of obstructions.

B. Notify project manager/site-supervisor of any open depressions and excavations made as part of the demolition/grading work for system installation and post warning signs if applicable.

C. Protect active sewer, water, gas, electric, drainage, and irrigation indicated or, when not indicated, found, or otherwise made known to the CONTRACTOR before or during installation work. If a utility is damaged, immediately notify the Twain Harte Community Services District (CSD) for corrective action.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

a. Minimum of 10 years of experience of this Section.

b. Successful completion of previous projects of similar scope and complexity.

c. Maintain ISO-9001 production facilities including quality management protocols for production.

B. Installer Qualifications:

a. Successful completion of (3) previous projects of similar scope of complexity.

b. Maintain trained technicians on staff providing field service and warranty related work.

c. Minimum of (3) years of experience in work of this Section.

C. Installation and Excavation Safety: In accordance with OSHA requirements.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's product data of the following items:

a. Irrigation Controller

b. Master Shut-Off Valve

c. Remote Controlled Valves

d. Backflow Preventer Assembly

e. Valve Boxes

f. Irrigation Heads and Emitters

g. Related Equipment

B. Operation and Maintenance (O&M) Manual: Provide an operations and maintenance manual for the following items:

a. Remote Controlled Valves

b. Irrigation Controller

c. Maintenance Schedule

C. Manufacturers Installation Instructions: Submit installation instructions for control valves, meters, and irrigation controllers.

D. Irrigation Map and Schedule: Provide an Irrigation Zone Map along with the watering schedule (O&M) Operations and Maintenance Manual.

1.07 EXISTING IRRIGATION SYSTEM

A. Not Applicable

1.08 PRE-INSTALLATION CONFERENCE, SEQUENCING AND SCHEDULING

A. Convene a conference before the scheduled commencement of the work in this Section. Attendees shall include Architect, Irrigation Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

B. Coordinate layout and installation of Irrigation Sleeves, conduits, and piping under paved areas and other features prior to their construction.

C. Coordinate installation of Irrigation System with excavation of planting areas. Refer to SECTION 32 09 00, Planting for requirements. Typically, the irrigation system shall be installed after planting areas have been excavated and graded.

D. The Irrigation System shall be installed and tested prior to installation of plant material. Coordinate layout and installation of irrigation system with location and installation of plant material to assure that there will be complete uniform irrigation coverage of plating as indicated.

E. Tree and shrub locations shall be staked in the field prior to installation of irrigation pipe and heads. Refer to the plant list on the construction drawings for plant setbacks and spacing requirements.

1.09 WRENCHES AND KEYS

A. Furnish and deliver to Twain Harte CSD, two each of the following items upon completion of the work of this Section:

   a. Wrench for each type of valve

   b. Keys for valve box covers, controller panels, enclosures and backflow preventer assembly enclosure.

1.10 DELIVERY, STORAGE AND HANDLING

A. Do not deliver (unless otherwise specified) system components until time needed for installation and after proper protection can be provided for materials.

B. Store and handle in strict compliance with manufacturer’s written instructions and recommendations.

C. Protect from damage due to weather, excessive temperature, and construction operations.

D. Leave protective coverings in place until just prior to installation.

E. Store irrigation components inline with manufacturers recommended handling during transportation and site construction. System components shall be protected from damage during delivery.

1.11 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within manufacturers limits for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.12 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.

PART 2 – PRODUCTS

2.01 IRRIGATION MATERIALS, EQUIPMENT, AND FACILITIES

A. The CONTRACTOR shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required to perform the installation of the irrigation system as shown in the construction drawings and described in the specifications.

B. The landscape irrigation system shall consist of a completely automatic, electrically controlled drip emitter and spray irrigation system. The system shall be designed to provide complete coverage with minimum maintenance. The system shall be designed to prevent overspray.

C. The irrigation system shall be furnished and installed complete, including the following functions and features: connection to irrigation stub-out (point of connection), backflow preventer assemblies and enclosures, all pipe, fittings valves, electric automatic valves, irrigation heads and emitters, valve boxes, and any accessories required for a complete install.

D. Irrigation materials and equipment shall be new, non-corroded, non-defective, that meet the specified standards.

E. Piping: Above grade piping shall be galvanized steel or an approved equivalent. Below grade mains and laterals shall be rigid polyvinyl chloride (PVC).

a. Galvanized Steel Pipe: Galvanized steel pipe shall be Schedule 40, conforming to ASTM A53, Grade B, with 150 pound banded, galvanized malleable iron screwed fittings.

b. Plastic Pipe: Shall be solvent welded PVC 1120 or 1220 pressure-rated pipe. Supply lines shall be ASTM D1785, Class 12454-B, PVC1120 or PVC1120, Schedule 40.

c. Irrigation Laterals: Shall be ASTM D2241, Standard Dimension Ratio (SDR) 13.5 (Class 315), for ½ inch and smaller and ASTM D1785, Class 12454-B (schedule 40), for pipe ¾ inch and larger.

d. Fittings: Shall be molded PVC, Schedule 40, conforming to ASTM D2466, Class 1433. Fittings shall be capable of withstanding maximum pressure rating of the pipe with which it is used. Provide Schedule 80 fittings conforming to ASTM D2464 where indicated or required.

e. Pipe thread sealant compound: Shall comply with requirements of ASTM D1784 or ASTM D2564, as applicable.

F. Conduit: Provide rigid non-metallic conduit conforming to UL Standard No. 651 for rigid non-metallic conduit, such as Schedule 40 PVC conduit, unless otherwise indicated.

G. Remote Control Valves: Remote control valves shall be Rainbird Series or approved equivalent for 2" and 1" sizes.

a. Valves shall have a contamination proof (CP) self-flushing nylon screen located at the valve inlet to filter out grit and prevent clogging of hydraulic control ports and assure reliable operation.

b. Valves shall be normally closed and be of the size indicated.

c. Valves shall be serviceable from the top without removing the valve body from the system.

d. Valves shall be equipped with a device that will regulate and adjust the flow of water, and with a manual shut-off.

e. The automatic closing time shall not be less than 5 seconds.

f. Valves shall be compatible with the electric automatic controllers.

g. Valve solenoid shall be designed for operation at 24-volts, AC, at 0.41 amps maximum in-rush current.

H. Unions: Unions shall be a minimum of 150-pound galvanized malleable iron with ground joints for above grade locations, and PVC schedule 80 threaded for below grade locations, and shall be provided on both sides of the wye strainer, control valves, and pressure reducing valve. Valves or strainers having integral union(s) are acceptable substitutes for union(s).

I. Irrigation Controller: Controller shall be having the following features:

a. Independent control over each station start and stop time (dwell time), and number of cycles per day.

b. 24-hour timer; 14-day minimum calendar period; dwell times adjustable in one minute increments for 1 to 360 minutes and cycles of minimum 4 starts in 24 hours.

c. 24-volt, 1.5-amp minimum output capacity with circuit breaker and with automatic reset and controller and valve surge protection.

d. Number of stations as indicated.

e. Six repeat watering program (cycles, windows) per day capability.

f. Two-minute dwell time for each station in event of power interruption.

g. Simple "user friendly" keyboard programming with messages flashed on display screen to prompt entries by user.

h. Retention of volatile program memory setting, time, and date for up to 18 hours in event of power failure with rechargeable battery and trickle charger provided. Non-volatile, entry erasable programmable memory (EEPROM) is preferred.

i. Shutdown and bypass of station in event of excess flow.

j. Manual actuation of each valve locally at the controller. This is in addition to the capability requirements for valve control by transceiver and remote control, statistical reporting to, and random access and reprogramming from the central computer.

J. Control, Common and Spare Wires:

a. Low voltage control wire shall be Type UF, 600-V size as recommended by the manufacturer of the controller furnished for this project, but not smaller than No. 14 AWG. Common wire shall not be smaller than No. 12 AWG. Insulation shall be of a type approved by the California Electrical Code for underground direct burial, Class 2 wiring, 24-volt, 60 cycle, A.C. service.

b. Controller valve main wire insulation shall be black or red. Furnish different color control wire for each controller. Each common line shall be white with a color stripe to match the color of control wires it serves. Spare wire shall be a color different from control and common wires.

c. Control wire identification tags shall be 2-1/4 inches by 2-3/4 inches in size.

d. All splices made to electrical wires shall utilize waterproof connectors. This includes a twist-on connector for making a UL-listed mechanical connection. Once the mechanical connection is made, it shall be inserted into a gel-filled tube and the twist-on connector shall lock in place when it reaches the bottom of the tube. The lid of the tube shall then be closed such that it applies pressure on the insulation of the wires and creates strain relief. Splices shall be capable of satisfactory operations under continuous submersion in water.

K. Shut Off Valves: Valves for underground service shall be, at a minimum, 125-pound rating with non-rising stem. Valves shall be easily accessible, housed in a valve box as specified.

L. Valve Boxes and Control Wire Junction Boxes: Commercial grade valve boxes shall be sized adequately to house the specific irrigation components indicated, including the electric remote-control valve, shut off valves furnished with a lockable cover with lift handle.

M. Valve Boxes for flush and air relief valves: Commercial grade round boxes shall be sized adequately to house the specific valves indicated.

N. Backflow Assembly Enclosure:

a. A vandal-resistant solid aluminum cover shall enclose the backflow preventer, filter unit, and pressure-reducing valve. The filter shall be mounted upstream of the backflow preventer and provide 9-inches clearance between the filter drain valve and pad surface. The pressure reducing valve shall be provided downstream of the filter. Unions shall be provided on both sides of each component.

b. The cover shall be equipped with all stainless steel hardware and flush-mounted lockable hatch assembly designed for ease in handling. The cover shall be 3 inches clear

of valve operating handles and appurtenances and shall be constructed of aluminum, with rigid, reinforced construction having a minimum corner angle, mid-section reinforcement and pre-punched viewing ports with rolled or relieved edges. The cover shall be bolted to a 4-inch thick reinforced poured-in-place concrete pad that shall extend a minimum of 3 inches beyond the cover. The cover shall be anchored to the pad at each corner using minimum 1/4 x 2-1/2-inch anchor bolts of galvanized steel.

c. The padlock will be furnished by Twain Harte CSD.

O. **Filters:** The filter unit shall have a removable cylinder and integral resilient seat ball type drain valve. The free flow principle shall be intrinsic in the unit design, causing the water flowing along the cylinder to seep through the cylinder perforations, allowing particles to drop to the bottom for accumulation. The filter shall be suitable for 75 psi operating pressure and equipped with 155 mesh media. The unit shall have a factory-applied label affixed to the housing indicating media size and a flow arrow cast on the housing. The filter inlet and outlet for 2-inch and smaller units shall be male pipe thread and for 3-inch and larger units shall be 150 psi flanged.

P. **Sleeves for Conduit and Water Lines:** For pipe 3/4 inch through 4 inches in diameter, provide PVC Schedule 40 pipe, two pipe sizes larger than the water line and two pipe sizes larger than conduit. For pipe 6 inches in diameter and larger, provide corrugated metal pipe (galvanized) a minimum of one pipe size larger than the sleeved pipe.

Q. Irrigation Heads and Drip Emitters: The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic.

a. **Sprinkler Heads and Bodies:** Sprinklers shall be as specified on Irrigation Plans. Sprinkler shall have a 12-inch popup height, an integral check valve that holds up to 8 feet of head (3.50 psi), a heavy-duty stainless steel retraction spring, pressure regulation capability, flow shield build into the stem, a soft elastomer pressure-activated wiper seal, and a ratcheting system for easy alignment of the pattern. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body. Or approved equal determined by the Owner's Representative.

b. Drip Emitters shall be 0.5 GPH pressure compensating and installed on 1/2 inch poly drip line as specified. Tubing shall be 1/2 inch minimum nominal diameter with a minimum wall thickness of 0.050. Or approved equal determined by the Owner's Representative.

c. **Line Flushing Valves:** 1/2 inch PVC.

R. **Backflow Preventer:** 1" Zurn 375-XL Reduced Pressure Backflow Preventer. Or approved equal determined by the Owner's Representative.

S. **Water Flow Meter:** The water flow meter shall be a line-mounted, corrosion-resistant construction.

2.02 MANUFACTURERS

A. Acceptable Manufacturer(s) for Irrigation System:

a. DripWorks USA

b. Rainbird

c. Hunter

B. Substitutions: Any substitutions shall be equal to the equipment specified, as determined by the Owner's Representative.

PART 3 – EXECUTION

3.01 EXAMANATION AND PREPARATION

A. Do not proceed with installation until project site have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. When applicable, backfill and compact depressions caused by excavations, demolition, and removal in accordance with the requirements outlined in SECTION 31 20 00, EARTHWORK.

3.02 INSTALLATION STANDARDS

A. The landscape irrigation system shall be installed in accordance with applicable requirements of the California Plumbing Code and California Electrical Code, and the requirements of the jurisdictional water company or utility district.

B. Manufactured materials and equipment shall be installed in accordance with the respective manufacturer's instructions for the location and conditions.

C. Electric automatic controller, electric remote control valves, electrical wiring, and the installation thereof shall conform with applicable provisions and codes.

3.03 SYSTEM LAYOUT

A. It shall be the Contractor's responsibility to lay out the irrigation system. Location of facilities indicated on Contract Drawings are approximate and diagrammatic and may require adjustment. Work shall be laid out as accurately as possible to conform with the construction drawings. Provide additional offsets, fittings, sleeves, and other devices that are required to complete the installation.

B. Irrigation system shall avoid conflicts with plant materials, lighting standards, signposts, architectural features, above and below ground utilities, and drainage system. Irrigation piping layout is schematic, showing location of pipes and fittings approximately. For example, where pipe is shown parallel or close to planting bed areas, it is intended that pipe be located inside the planting bed area.

C. Minimum flow through any spray valve shall be eight gallons per minute with 30 psi at the downstream side of the remote-control valve and pressure-reduce valve.

D. Minimum flow through any drip circuit valve shall be 3 gallons a minute with 25 psi at the downstream side of the remote-control valve and pressure valve.

E. Sprinkler head spacing shall be in accordance with manufacturer's recommendations for overlapping coverage. All sprinkler heads shall provide head-to-head coverage with a minimum of one foot overlap.

F. Laterals shall be installed not less than 12 inches from fences, curbs, sidewalks, and pavement, unless otherwise indicated.

G. Modifications: Provide modifications to the irrigation system to avoid blockage of sprinkler irrigation patterns, to prevent overspray and excessive runoff onto walkway and parking areas, and to provide full irrigation coverage to the planted areas. Such modifications also include trimming and adding heads as required to spray around trees, light poles, sign posts, other objects that obstruct spray pattern, and adjustments required as a result of trees being relocated or removed due to underground utility or drainage problems.

3.04 TRENCHING AND BACKFILL

A. Trenches shall be only wide enough to provide sufficient working space on each side of the pipe for making joint and compacting bedding materials and backfill. The bottom of trench shall be graded and prepared to provide a firm and uniform bearing throughout the length of the pipe, sleeve, or conduit.

   a. Trenches for lateral piping shall provide for a minimum of 12 inches of cover.

   b. Trenches for mains and conduits shall provide for a minimum of 18 inches of cover.

   c. Trenches under paving shall provide for a minimum of 24 inches of cover.

   d. Trenches for subsurface drip lines/tubes shall be 6 inches deep, or as recommended by the drip line manufacturer.

B. After trenches have been excavated, pipe shall be installed, tested, and inspected, and the trench shall be backfilled without undue delay.

C. Before pipeline trenches are backfilled, the irrigation system shall be pressure tested and the location of irrigation heads modified as required to obtain complete and uniform coverage of each plant's root ball.

3.05 FIELD QUALITY CONTROL

A. **Field Inspection:** Coordinate filed inspection in accordance with appropriate sections and the California Plumbing Code.

B. System Testing:

   a. Installation oversight and technical support.

   b. Terminate and test control system wiring and operation of electrical components.

   c. Demonstrate proper pump and controls operation.

   d. Make adjustments to meet user-defined system performance.

   e. Review operation and maintenance procedures with Twain Harte CSD.

C. Each system shall be tested and approved by Owner's Representative before backfilling trenches. Electrical circuits shall be tested and operative prior to backfilling of trenches. Leaks in the irrigation system shall be repaired, defective materials replaced, and the test shall be performed again.

D. Prior to testing, sufficient backfill materials may be placed on pipes between fittings, couplings, and connections to ensure stability of the line. Fittings, couplings, and connections shall remain visible for the full period of the test. Before pressure testing, the system shall be flushed with control valves open. Pipe shall be plugged or capped where irrigation heads are to be installed, while testing the system.

E. The entire system shall be checked for uniform and complete coverage after installing and testing.

F. Mains, laterals, valves, fittings, and automatic electrical control valves shall be pressure tested. After assembly and installation, and after joints have cured for 24 hours, test main first, then capped laterals (before installation of heads). For mains, pump to 100 psi static pressure, then disconnect pump. Pressure gages shall be located at two points in the system and shall show no loss after a period of six hours. Laterals shall be tested at line pressure.

G. Pipes, where pavement will be installed above, shall be retested, after subbase and base course material have been installed.

H. Irrigation System Function Test: Function tests shall be performed for each electric automatic controller and associated automatic irrigation system. The function test shall consist of not less than five consecutive working days during which time each controller shall have completed at least ten complete cycles automatically for each station controlled by said controller. If unsatisfactory performance of the system develops, the condition shall be corrected, and the test repeated until continuous satisfactory operation for five consecutive working days is obtained.

I. Backflow Preventer Test:

   a. Testing of back flow preventers shall be conducted by a certified back flow preventer tester. The tester shall hold a valid certification as a back flow preventer tester from the county or other jurisdictional authority in which the device to be tested is located.

   b. Test for back flow preventers shall be satisfactorily completed after installation of the back flow preventer assemblies and before operation of the irrigation system. Back flow preventers that fail the required tests shall be repaired or replaced and retested.

J. Final Inspection: Prior to acceptance of the work, clean and adjust all systems. Operate all systems under the observation of the Architect. Irrigation heads shall be visually inspected for coverage. Remote control valves shall be properly balanced.

3.06 PLANT ESTABLISHMENT PERIOD

A. The plant establishment period shall be as specified in Section 32 90 00, Planting.

B. Timing of irrigation controllers shall be adjusted for optimum performance and, to prevent flooding, on a cycle to end not later than 6:30 a.m.

C. Upon completion of landscape planting and clean-up operations, the Contractor shall request a final inspection by the Architect. The Contractor will not be permitted to begin the plant establishment period until after the Engineer has approved the landscape irrigation system installation in writing.

D. The Contractor shall maintain electrical and irrigation systems throughout the plant establishment period. Defective equipment shall be replaced.

E. The Contractor shall provide a summary of the recommended irrigation schedule after completion of the establishment period.

3.07 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

A. Clean and protect products in accordance with manufacturer's recommendations.

B. Touch-Up, repair or replace products before substantial completion.

C. Dispose of scrap materials, waste, trash, and debris from the installation of the irrigation system in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by the Twain Harte CSD.

D. Burying of trash and debris on site will not be permitted. Similarly, burning of trash and debris at the site will not be permitted.

E. Scrap materials, trash, and debris shall become the property of the CONTRACTOR and shall be removed from the site and be disposed of in a legal manner. Location of the disposal site and length of haul shall be the CONTRACTOR's responsibility.

END OF SECTION 32 84 00

SECTION 32 90 00
PLANTING

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. The work of this Section consists of:

I. Providing labor

II. Equipment and materials for the acquisition and installation of:

i. Soils

ii. Plant materials

iii. Plant establishment maintenance.

1.02 RELATED SECTIONS

A. SECTION 31 23 00, EARTHWORKS

1.03 CODES AND STANDARDS

A. All local, municipal, and state laws, codes and regulations relating to all portions of this work are to be incorporated as part of these Specifications. These specifications shall not be construed to conflict with any of the below codes, regulations, or requirements. The Specifications and Drawings shall take precedence when they call for materials, workmanship or construction of a better quality or higher standard than required by the above-mentioned codes and regulations. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.

B. State of California Model Water Efficient Landscape Ordinance (MWELO)

C. Public utility agency having jurisdiction over the project work.

D. "Sunset Western Garden Book," current edition.

E. "American Standards for Nursery Stock," American Association of Nurseryman, 230 Southern Building, Washington, D.C. 20005.

F. International Society of Arboriculture, Guide for Plant Appraisal, latest version.

G. United States Composting Council Compost Analysis Program (CAP)

H. United States Composting Council (USCC) Seal of Testing Assurance (STA) program.

I. Test Methods for the Evaluation of Composting and Compost (TMECC)

J. Manufacturer's recommendations.

1.04 QUALIFICATIONS:

A. **Labor Force:** Provide a foreperson and landscape installation and maintenance force thoroughly familiar with, and trained in, the work necessary to complete the tasks described herein in a competent, efficient manner acceptable to the Owner's Representative.

1.05 REQUIREMENTS

A. **Site Visit:** At beginning of work, visit and walk the site with the Owner's Representative and all sub-consultants to clarify scope of work and understand existing project/site conditions.

B. **Supervision:** The foreperson shall directly supervise the work force at all times and be present during the entire installation. Foreperson shall notify Owner's Representative of all changes in supervision.

C. **Identification:** Provide proper identification at all times for landscape maintenance firm's vehicles and a labor force uniformly dressed in a manner satisfactory to Owner's Representative.

D. Protect all existing and new plants from construction activities, deer, and rodents: Contractor shall be responsible for protection of all planting per Part 3.

E. All material substitutions shall be reviewed and approved by the Owner's Representative.

1.06 SITE PREPERATION FOR PLANTING AREAS

A. Prior to digging for the purpose of soil amending and planting, Contractor shall be aware of all underground utilities, pipes and structures. Contractor shall contact all utility companies for field location of underground utility lines prior to any excavation. Contractor shall take sole responsibility of any cost.

B. Do not proceed with planting installation as designed if obstructions and/or grade differences exist that may not have been known during design. Such conditions shall be immediately brought to the attention of Owner's Representative. The Contractor shall assume full responsibility for all necessary revisions due to failure to give such notification.

C. Contractor shall be responsible for any coordination with subcontractors as required to accomplish planting operations.

D. Coordinate installation of large plant material with installation of structures such as wall footings, pavements, and curb and gutter.

1.07 PLANT MATERIAL STANDARDS

A. Quality and Size of Plants: Conform to the State of California Grading Code of Nursery Stock, No. 1 grade.

B. The contractor shall provide healthy, vigorous plant stock grown under climatic conditions similar to the conditions in the locality of the project.

C. Contractor shall furnish plant material free of insect pests or plant diseases. The Contractor shall comply with federal and state laws requiring inspection for plant diseases and infestations. The Contractor shall submit inspection certificates required by law with each shipment of plants, and deliver certificates to the Owner. Finally, the Contractor shall obtain clearance from the County Agricultural Commissioner as required by law, before planting plants delivered from outside the County in which planted.

D. Contractor shall warranty all plant materials per the specifications.

E. Contractor shall do their own quantity take-offs for all plant materials and sizes shown on plans.

F. See details and specifications for staking method, plant pit dimensions and backfill requirements.

G. Plant crown elevations relative to finish grade are shown on planting details and shall be strictly adhered to. Proper compaction of backfill to prevent settlement shall be required.

H. Trees and shrubs shall be installed prior to planting groundcover.

1.08 SOIL AMENDMENTS

A. Remove rocks larger than three inches from planting areas.

B. For soils less than six percent organic matter in the top six inches of soil, compost at a rate of a minimum of four cubic yards per 1,000 square feet of permeable area shall be incorporated to a depth of six inches into the soil.

C. On-site soils with an organic content of at least five percent can be properly stockpiled (to maintain organic content) and reused.

D. Contractor to loosen compacted soils and mix soil amendments and conditioners to a minimum depth of 12 inches in planting areas.

1.09 FINISHED GRADES IN PLANTING AREAS

A. The Contractor shall allow for the addition of specified quantities of soil amendments and conditioners in soil preparation and finish grading.

B. The Contractor shall be responsible to establish the specified finished elevation, including importing soil or excavation, removal and disposal at an approved location. The Contractor shall furnish and install supplementary amended import soil in any planting areas as necessary to achieve the specified finish planting grades. Imported soil shall be free of unwanted seeds.

1.10 WARRANTY AND REPLACEMENT

A. Maintenance Period: See Part 3.

B. Warrant all plants to be in a healthy, thriving condition until the end of the maintenance period, and deciduous trees, shrubs and vines beyond that time until active growth is evident.

C. Replace all dead and damaged plants and plants not in a vigorous condition immediately upon discovery and as directed by the Owner's Representative and at no cost to the owner. Install replacement plants before the final acceptance of the maintenance period in the size specified.

PART 2 – PRODUCTS

2.01. EXISTING PLANTING SOIL (TOPSOIL)

A. Existing Planting Soil is defined as on-site topsoil that is either to be removed and stockpiled for reuse or to remain in place during construction. Satisfactory planting soil shall be free of subsoil, clay, lumps, stones, and other objects over 3" in diameter, and without weeds, roots, and other objectionable material. The soil shall be fertile, friable, natural, productive soil containing a normal amount of humus, and shall be capable of sustaining healthy plant life. Soil shall not be infested with nematodes or with other noxious animal life or toxic substances. Soil shall be obtained from well-drained, arable land, and shall be of an even texture. Soil shall not be taken from areas on which are growing any noxious weeds listed in Cal IPC (California Invasive Plant Council) such as morning glory, equisetum, or Bermuda grass, etc.

B. Minimize the extent of disturbance activities to minimize impacts to soil outside the project's construction limits.

C. Mitigate construction-related soil compaction in vegetation areas.

D. Stockpile and reuse native soils in construction impact areas. When stockpiling topsoil, store on a flat site, mound soil no higher than 4 feet high for less than 12 months, ideally 6 months. Regardless of time stockpiled onsite, cover to prevent soil erosion and contamination by weeds.

E. Mitigate construction-related soil compaction in vegetation restoration areas by ripping the soil to loosen its structure. After final slope grading and prior to placement, cut slopes should be cross-ripped horizontal to the slope to assist in anchoring the topsoil. The spacing of the ripping shanks should be three feet and penetration should not exceed 12 inches in depth. Where embankments are constructed, offsetting lifts of material to create an uneven surface prior to topsoil placement should be considered. Smooth slopes are not acceptable. Alternative approaches to soil ripping will be considered for terrain which is inaccessible by machine. Proposed alternate methods must be submitted to Owner's Representative for approval prior to implementation.

F. Use only well composted soil amendments and incorporate them per manufacturer recommendations unless otherwise specified by soil lab.

G. Following construction, stockpiled topsoil should be uniformly redistributed (placement) to a depth of six inches. Placed topsoil should be cat tracked vertically to the slope to compact the topsoil and to create horizontal pockets (safe sites) to hold seed and water.

H. The contractor shall avoid walking, operating equipment or driving vehicles on planting areas after soil preparation is complete.

2.02. COMPOST AMENDMENT FOR PLANTING SOILS

A. Compost shall be well decomposed, stable and weed free. It shall be derived from one or more locally sourced organic materials such as: food waste or urban plant debris, agricultural crop residue or herbivore animal manures with a preference for urban plant debris and food waste. It shall not contain mixed solid waste. The product shall contain no substances toxic to plants and will possess no objectionable odors.

B. The composted yard waste amendment shall be a mixture of feedstock materials including green material consisting of chipped, shredded, or ground vegetation and mixed food waste, or clean processed recycled wood products. Single source, biosolids (sewage waste) compost will not be acceptable.

C. Composted Yard Waste Soil Amendment properties to conform to the following:

1. Moisture Content: 35-60%.
2. Contaminants: The compost shall be free of contaminants such as glass, metal and visible plastic. Heavy meals, fecal coliform and Salmonella shall not exceed levels outlined as acceptable in the California integrated waste management regulations.
3. Maturity: Physical characteristics suggestive of maturity include:
    i. Color: Dark brown to black.
    ii. Acceptable Odor: None, soil-like, or musty.

iii. Unacceptable Odor: Sour, ammonia or putrid.

iv. Particle Characterization: Identifiable wood pieces are acceptable, but the balance of the material shall be soil-like without recognizable grass or leaves.

2.03. PLANTS

A. Plant the variety, quantity and size indicated on drawings. The total quantities indicated on the drawings are considered approximate and furnished for convenience only. Contractor shall perform plant quantity calculations and provide all plants shown on the drawings.

B. Take precautions to ensure that the plants will arrive at the site in proper condition for successful growth. Protect plants in transit from windburn and sunburn. Protect and maintain plants on site by proper storage and watering.

C. Install healthy, shapely and well rooted plants with no evidence of having been root-bound, restricted or deformed.

D. Tag plants of the type or name indicated and in accordance with the standard practice recommended by the American Association of Nurserymen.

E. If plant species shown on drawings are not obtainable, proposed substitutions of nearest equivalent size or variety and with an equitable adjustment of contract price must be submitted in writing to and approved by Owner's Representative in writing.

F. Tree Form – Large Container

1. Trees shall have a symmetrical form as typical for the species/cultivar and growth form.
2. Central Leader for Single Trunk Trees: Trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous, upright branches that compete with the central leader. Preferably, the central leader should not have been headed; however, in cases where the original leader has been removed, an upright branch at least ½ the diameter of the original leader just below the pruning point shall be present.
3. Potential Main Branches: Branches shall be evenly distributed radially around and appropriately spaced vertically along the trunk, forming a generally symmetrical crown typical for the species.
4. Headed temporary branches should be distributed around and along the trunk as noted above and shall be no greater than 3/8" diameter, and no greater than ½ diameter of the trunk at point of attachment.
5. Measure trees with branches in normal position. Height and spread dimensions indicated refer to the main body of the plant, and not from branch tip to tip.

G. Tree trunk – Large Container

1. Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.
2. Trunk shall be free of wounds (except properly made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.
3. Tree trunks shall be undamaged and uncut with all old abrasions and cuts completely callused over. Do not prune plants prior to delivery.

H. Tree Roots – Large Container

1. Trunk root collar (root crown) and large roots shall be free of circling and/or kinked roots. Contractor may be required to remove soil near the root collar to verify that circling and/or kinked roots are not present.
2. The tree shall be well rooted in the container. When the trunk is lifted the trunk and root system shall move as one and the root ball shall remain intact.
3. The top-most roots or root collar shall be within one inch above or below the soil surface. The soil level in the container shall be within the limits shown in above table.
4. The root ball periphery shall be free of large circling and bottom-matted roots.
5. On grafted or budded trees, there shall be no suckers from the root stock.

I. All seed shall conform with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test.

2.04. TREE STAKES

A. Provide three-inch (3") diameter by ten feet (10') long for trees greater than 8' high and 1" caliper.

2.05. MULCH

A. A minimum 3-inch layer of organic wood chip mulch shall be applied on all exposed soil surfaces of planting areas except grass areas, creeping or rooting ground covers, or direct seeding applications where mulch is contra-indicated.

PART 3 – EXECUTION

3.01. PREPARATION

A. If project timeline allows, planting shall occur during the wet season to maximize the benefit of seasonal rains. Avoid planting during extreme heat or freezing temperatures.

3.02. PLANT PROTECTION AND REPLACEMENT

A. Inspect and protect all existing and new plants and trees against damage from construction activities, erosion, trespass, insects, rodents, deer, disease, etc. and provide proper safeguards, including trapping of rodent and applying protective sprays and fencing to discourage deer browsing. Maintain and keep all temporary barriers (Tree Protection Fencing) erected to prevent trespassing.

3.03. GENERAL PREPARATION OF PLANTING SOIL

A. All planting soils to be amended as specified in soil laboratory analysis report(s).
B. Provide a minimum of three-inch depth of amended planting soil in all planting areas, or more where shown or specified otherwise. Install soil in maximum six-inch to nine-inch lifts. Compact each lift prior to installing subsequent lifts.
C. Thoroughly wet down the planting areas to settle the soil and confirm irrigation coverage and operation. Allow soil to dry to be workable as described herein.
D. Prior to planting, soil shall be loose and friable to a minimum depth of 12 inches with a relative maximum compaction of 85%.

E. Prior to planting, soil shall be moist, but not so moist that it sticks to a hand shovel. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.

F. Finish Grade: Hold finish grade surface in planting areas 1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc. Drag finish grade to a smooth, even surface. Grade to form all swales and berms. Pitch grade with uniform slope to catch basins, streets, curb, etc., to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly sloped between finish elevations. Slope surface away from walls so water will not stand against walls or buildings. Control surface water to avoid damage to adjoining properties or to finished work on the site. Take required remedial measures to prevent erosion of freshly graded areas.

G. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.

3.04. PLANT DELIVERY

A. If plant materials are not acquired from a local nursery, they shall be delivered to a temporary nursery/ staging area at the project site up to one month prior to implementation. This will facilitate proper acclimatization and "hardening off" of plants to local conditions prior to planting. Staging/nursing area location will be as instructed by the Owner's Representative.

B. Temporary nursery shall have adequate space to stage all the plant materials in one location. The temporary nursery shall be equipped with sufficient water for irrigation, fencing to exclude rodents and tampering, and frost blanket to protect against temperature extremes.

3.05. TREE, SHRUB AND PERENNIAL PLANTING

A. Layout plants per the planting plan for approval by Owner's Representative prior to planting.

B. Tree and Shrub Planting:

1. Plants are to be hand planted with the planting hole excavated to 1-1/2 times the depth and 3 times the diameter of the plant container. Fill holes with water to saturate the surrounding soil.
2. The plant shall be centered in the hole and placed to a depth equal to the soil level within the container. Previously excavated native subsoil may be properly amended and used as planting soil, then backfilled into the planting hole prior to placing the plant in order to achieve proper planting depth and to center the plant within the hole. Once the plant is properly placed within the planting hole, the remainder of the planting soil shall be placed back into the hole. The soil shall be lightly tamped and firmed into place, such that voids and air pockets do not exist within the planting hole. Soil shall be replaced only to the level of the surrounding undisturbed soil and shall not be mounded around the stem of the plant.
3. Create a shallow watering basin for each plant (1 to 2 inches deep x 12 inches wide), except in Riparian Corridor planting areas.
4. ADD ALT: Protect each plant with a cage. Add stakes or staples to ensure cage will be stable and secure.

3.06. MULCH

A. Mulch all new planting with organic wood chip mulch to a minimum 3-inch depth.

B. Keep mulch away from base (trunk) of plant by a minimum of four inches.

3.07. WATERING

A. Water all plantings immediately after planting. Apply water to all plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the establishment period.Do supplemental hand watering through the plant establishment maintenance period.

3.08. MAINTENANCE OF PLANTING

A. Maintain plants from time of delivery to site until final acceptance of landscape installation.

3.09. PRE-MAINTENANCE PERIOD REVIEW AND APPROVAL OF PLANTING

A. Receive approval of the installed planting prior to commencement of planting establishment maintenance period. Notify the Owner's Representative a minimum of seven (7) days prior to requested review. Before the review, complete the following.

1. Complete all construction work.
2. Present all planted areas with all plants installed and appearing healthy.

3.10. PLANTING ESTABLISHMENT MAINTENANCE

A. Approach

1. Plantings shall be maintained in a manner consistent with the establishment and long-term sustainability of native vegetation.
2. Plantings are intended to be informal in appearance, to promote a naturalized setting, and to help blend the facilities in with the surrounding landscape. Excessive manicuring or tidying is inappropriate and not required.

B. Method

1. Plant establishment maintenance period shall be for a period of 120 days from approval of plant installation.
2. Pruning of planted materials shall be avoided, except where stems and branches interfere with pedestrian or vehicular circulation, walls, and eaves of buildings, or where a line-of- sight needs to be maintained.
3. Raking and leaf removal within planted areas shall be avoided. Accumulated litter and duff will create a more natural appearance, help to build soil fertility, retain soil moisture and help preclude the establishment of weeds. However, litter and duff materials removed from other areas (after planting and during regular maintenance) shall not be applied to planted areas to avoid over-accumulation and deleterious effects to planted materials.
4. Keep all walks and paved areas clean. Keep the site clear of debris resulting from landscape work or maintenance.
5. Keep watering basins in good condition.
6. Remove non-native weeds by hand only.

C. General Requirements

1. Establishment Period: The planting establishment maintenance period required shall be 120 calendar days after all planting and irrigation is complete, seed is installed/seeded, and as approved by Owner's representative. A longer period may be required if the plants are not thick, vigorous and even, or if the plant material is not acceptably maintained during the maintenance period. The start of the maintenance period to be confirmed by Owner's Representative. Contractor to notify Owner's Representative of start and end dates of maintenance period.
2. Planting establishment maintenance immediately follows, coincides with, and is continuous with the planting operations, and continues through seed installation, and after all planting is complete and accepted; or longer where necessary to establish acceptable stands of thriving plants.
3. Protect all areas against damage, including erosion, trespass, insects, rodents, disease, etc. and provide proper safeguards. Maintain and keep all temporary barriers erected to prevent trespass.
4. Keep all walks and paved areas clean. Keep the site clear of debris resulting from construction or maintenance activities.
5. Repair all damaged planted areas and replace plants and reseed immediately upon discovery of damage or loss, except during periods of extreme heat or freezing, in which case replanting shall resume once conditions improve.
6. Keep contract areas free from weeds by cultivating, hoeing or hand pulling. Contractor shall not use chemical weed killers or line trimmers.

D. Tree and Plant Maintenance

1. Maintain during the entire establishment period by regular watering, cultivating, weeding, repair of stakes and ties, and spraying for insect pests. Prune when requested by the Owner's Representative.
2. Keep watering basins in good condition and weed-free at all times. Replace all damaged, unhealthy or dead trees, shrubs, and grasses with new stock immediately; size as indicated on the drawings.

3.11 PLANT REPLACEMENT

A. Approach

1. Plant Replacement shall occur during the planting establishment maintenance period.
2. Dead plants shall be replaced in roughly the same location and species selection as originally planted, as informed by monitoring activities and site observations.
3. Replacement plants shall be provided at the Contractor's expense. Coordinate with the Owner's Representative.

3.12 FINAL PLANTING REVIEW AND ACCEPTANCE

A. At the conclusion of the planting establishment period, schedule a final review with the Owner's Representative. On such date, all project improvements and all corrective work shall have been completed. If all project improvements and corrective work are not

completed, continue the planting establishment, at no additional cost to the Owner, until all work has been completed. This condition will be waived by the Owner's Representative under such circumstances wherein the Owner has granted an extension of time to permit the completion of a particular portion of the work beyond the time of completion set forth in the Agreement.

B. Submit written notice requesting review at least 10 days before the anticipated review.

3.13 CLEANUP AND PROTECTION

A. Contractor shall exercise caution to avoid washing or sweeping dirt and debris into the storm drain system.

3.14 DISPOSAL

A. Recycle all waste. Reuse or return unused items such as palettes, flats and pots. All plant debris shall be separated from other refuse and taken to a facility where it will be recycled i.e., to produce compost or mulch.

END OF SECTION 32 90 00

SECTION 33 14 00
SITE WATER DISTRIBUTION

PART 1 – GENERAL

1.01 SPECIFICATION INCLUDES

A. On-site potable water distribution systems, including connections to existing systems, sterilization, testing of water mains, and all appurtenances required for the complete systems. Refer to Section 22 14 53 for the piping and plumbing specifications associated with the rainwater conveyance and collection system .

B. System design pressure is 125 psig.

1.02 REQUIREMENTS

A. Comply with all requirements of the Twain Harte CSD, including:

a. No connection shall be made to potable, fire, or industrial water lines without written approval from the Twain Harte CSD.

b. If construction water is needed by the Contractor, no connection to the existing main shall be used until an approved backflow prevention device is installed by the Contractor.

c. Valves of existing public systems shall not be operated by any person other than District personnel.

d. No connection will be allowed from new to existing water mains until a pressure test has been conducted successfully.

e. All new potable water and/or fire systems shall be sterilized (chlorinated) by the Contractor.

1.03 SPECIFICATIONS AND STANDARDS

A. Twain Harte Community Services District (CSD) Water Standard Specifications and Details, November 2006

B. AWWA C900 - High Pressure Water Pipe

C. ASTM D1785 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

D. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

E. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F. AWWA C111/A21.11 – Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

G. AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings

H. AWWA C153/A21.53 – Ductile-Iron Compact Fittings

I. AWWA C104/A21.4 – Cement-Mortar Lining for Ductile Iron Pipe and Fittings

J. AWWA C601-68 – Standard for Disinfecting Water Mains

1.04 SUBMITTALS

A. Submit brochures and shop drawings. Allow ample time for review and correction procedures.

B. Shop drawings and detailed descriptions for items which are not manufactured, and which have to be specially fabricated for work associated with this Contract.

C. Provide product data to the Owner's Representative. Specifically, provide the name or other identification of each item to be provided as part of work of this Contract. The assembled brochures shall show saw cuts and fully detailed descriptions of all manufactured items furnished.

PART 2 – PRODUCTS

2.01. ACCEPTABLE MANUFACTURERS

A. Ductile Iron Pipe shall be a US pipe as specified or equivalent by American.

B. Shut-off valves: Mueller as specified or equivalent by Clow, Dresser, Kennedy, or Stockham.

2.02. MATERIALS AND METHODS

A. Water Piping

a. 4 inches and larger: Polyvinyl chloride (PVC) pipe in conformance with all requirements of AWWA C900, Class 200.

b. 3 inches and smaller: Schedule 80 PVC pipe in conformance with requirements of ASTM D1785, Type 1, Grade 1.

B. Fittings

a. For all ductile iron pipe and PVC pipes that are four inches and larger: Cement-lined ductile or cast iron, 250 lb.

i. Use tapped tees or flanged adapters at connections of copper piping to ductile iron or PVC piping.

b. For PVC pipe 3 inches and smaller, use PVC socket fittings for solvent welding.

C. Joints for pipe and fittings:

a. PVC piping:

i. 4 inches and larger: integral bell containing a lock-in ring and spigot.

1. Pipe joints shall be push-on as specified as ASTM D3139.

2. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling installation.

3. Gaskets for push-on joints for pipe shall conform to ASTM F477.

4. Gaskets for push-on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11.

5. Polyvinyl chloride (PVC) Water Main Fittings shall be gray-iron or ductile iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement mortar lining conforming to AWWA C104/A21.4, standard thickness unless otherwise indicated on Drawings. Fittings shall be mechanical joints.

6. 3 inches and smaller: Solvent welded per manufacturer's recommendations.

b. Flanges

i. For ductile iron pipe: 125 lb., ductile or cast iron, threaded, ASTM A126 and ANSI B16.1.

ii. Gaskets: Non-asbestos type composition, 1/16-inch thick, equivalent to Garlock Style 3000.

iii. Bolting Materials: Carbon steel heavy hex bolts and nuts, ASTM A307, Type B.

c. Valves, hydrants, and accessories:

i. Shut-off valves: Mueller as specified or equivalent by Clow, Dresser, Kennedy, or Stockham.

1. Valves 4 inches and larger: AWWA approved, 200 lb.

2. Valves 14 inches and larger: AWWA approved, 150 lb.

a. Buried: Mueller #A-2360-23, with 2-inch square operating nut, and mechanical joint ends provided with retainer glands as specified under paragraph “Joints for pipe and fittings” section for ductile iron piping. Provide concrete support block under buried valve.

i. Provide cast iron adjustable type valve box with proper extension to six inches below bottom of grade and cast-iron collar and cover. Cast “WATER” in cover.

b. Above grade: Mueller #A-2380-6, with wheel handles and flanged ends.

3. Valves less than four inches in size: Federal Specifications WW-V-54, Class A, Type III, bronze, double wedge, non-rising stem, screwed bonnet, 200 psi W.O.G working pressure, stuffing box repackable under pressure, all parts renewable.

ii. Provide backflow preventers where indicated on the plans.

iii. Pressure regulating valve: Applies to valves that are pressure reducing, pressure sustaining, and check valves. Size shall be 8-inch, 125 lb., flanged, rated for 15 to 75 psi downstream and 20 to 200 psi upstream.

d. Pipe guards shall be 4-inch Schedule 40 galvanized steel pipe filled with concrete. Pipe guards shall be seven feet long, extending four feet above finished grade, and set in a concrete footing (1.5 feet in diameter by 3.5 feet deep).

e. Corrosion protection: All buried, uncoated, and/or otherwise unprotected valves, clamps, flanges, bolts, nuts, etc., shall be cleaned, primed, and coated with a coal tar base protective coating (1/32 inch thick). Apply protective coating in accordance with the manufacturer's instructions.

PART 3 – EXECUTION

3.01. EXCAVATION, TRENCHING, BACKFILL, AND COMPACTION

A. Perform in accordance with the requirements outlined in Section 31 20 00.

3.02. INSTALLATION

A. Coordinate the installation at this part of the work with the overall construction schedule.

B. Provide concrete thrust blocks at all buried fittings and stub ends on 4-inch and larger PVC lines and as indicated on the Drawings.

C. Repair all damaged lines according to AWWA C104.

D. Connect to existing system where indicated.

E. Test the entire system at 1.5 times system design pressure. Maintain test pressure for at least four hours or longer as directed by Owner to prove tightness without leaks.

F. Install pipes and fittings in accordance with manufacturer's recommendations. Provide 30 inches cover from top of pipe to finish grade.

3.03. DISINFECTION

A. Thoroughly clean, chlorinate, drain, and flush all pipes, fittings, valves, and appurtenances which have been exposed to contamination by construction in accordance with AWWA Specification C601-68.

B. Owner's Representative should be notified 24 hours in advance of disinfection of all new potable water lines.

i. Flush line prior to disinfection. Flushing shall produce minimum velocity of 2.5 feet per second in pipe.

ii. Disinfect pipe using sodium hypochlorite to produce a dosage of 50 mg/L for a 24-hour contact period.

iii. Open and close all valves several times during disinfection period.

iv. After a 24-hour retention period, flush chlorinated water from the line until chlorine concentration of water leaving the main is no higher than that generally prevailing in the existing system, or less than 1.0 mg/L.

v. Provide corporation stoop or similar connection and obtain sample for bacteriological analysis.

vi. Repeat disinfection procedure until bacteriological analysis results are acceptable to Owner's Representative.