

SECTION 31 10 00**SITE PREPARATION AND DEMOLITION****PART 1 - GENERAL****1.1 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to site preparation, unless otherwise noted. This section applies to:
 - 1. Surface and subsurface demolition.
 - 2. Backfilling of excavations and depressions.
 - 3. Coordination, demolition and/or relocation of existing utilities.
 - 4. Prior to start of demolition of facilities, shut-off, disconnect, cut, and cap where required, underground utility services to facilities.
 - 5. Removal of A.C. pavement driveway and concrete pavement, concrete pads, and A.C. curbing.
 - 6. Removal of cyclone wire, wood fences and barricades.
 - 7. Removal of storm drainage piping, catch basins, and manholes.
 - 8. Removal of vegetation and trees as specified herein.
- B. Contractor shall provide labor, material and equipment required for demolishing, cutting, removing and disposing of existing construction as designated and shown on the drawings for the following as required, unless otherwise noted.
- C. Coordinate all work with capping or sealing of existing utilities.
- D. Related Sections:
 - 1. Section 31 22 00 – EARTHWORK AND GRADING.
 - 2. Section 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING.

1.2 SUBMITTALS

- A. Comply with requirements of Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Submit copies of all permits and certificates required for the project to the District's Representative, for record purposes.
- C. Permits and notices authorizing demolition.
- D. Submit copy of letters or certificates of severance of utilities services from the affected agencies or utilities.

- E. Submit copies of proposed haul route(s) from the demolition worksite to an authorized disposal site as approved by authority having jurisdiction.
- F. Submit copy of permit for transport and disposal of debris.
- G. Make arrangements of disposing of waste and excess materials at a legally licensed landfill/disposal facility outside worksite and pay cost thereof.
- H. Photograph existing conditions of existing structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File photographs with District's Representative prior to start of work.
- I. Submit proposed dust control measures and a copy of approved permit.
- J. Submit proposed noise control measures and a copy of approved permit.
- K. Work Schedule: Submit a proposed schedule of work items to be performed, and a description of how the work is to be accomplished, for the review by the District's Representative.
- L. Report of inspections conducted with the District's Representative and Architect both before and after performing work.

1.3 QUALITY ASSURANCE

- A. Comply with the following Standards: American National Standards Institute, Inc. "American National Standard Safety Requirements for Demolition" (ANSI A10.6 and A10.8).
- B. Regulatory Agencies:
 - 1. Comply with rules and regulations of State of California, California Code of Regulations, Title 8, Industrial Relations, Chapter 4, Subchapter 4, "Construction Safety Order."
 - 2. Comply with applicable local and state agencies having jurisdiction.
 - 3. Comply with governing EPA notification regulations.
- C. Secure all required Permits or Certificates for demolition or discontinuance of utilities, prior to beginning the work.

1.4 PROJECT CONDITIONS

- A. District's Representative assumes no responsibility for actual condition of the site to be altered.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by District's Representative as far as practical.
- B. Disposal of Existing Improvements:
 - 1. All materials indicated to be removed shall become the property of the Contractor; dispose of these outside the project site.

- a. Do not dispose of removed materials to the general public by sale, gift or in any other manner at the Site.
 - b. These provisions shall not be construed as limiting or prohibiting sale or disposal of such materials at the Site to duly licensed Contractors or material suppliers, provided materials are removed from the construction site by the Contractor.
 2. All removal of debris from the site, including removal of inventory to site of storage, is part of this Contract and shall be done by Contractor's employees and no others.
- C. Salvage and Reuse:
 1. Where units or items of existing work are designated in Section 01 31 13 - PROJECT COORDINATION or Contract Plans to be removed and reused in the new work or are to become salvage, remove such units or items carefully.
 - a. Use tools and methods that will not damage such units or items.
 - b. Protect underlying or adjoining work from damage.
 - c. Salvaged items shall be cleaned by the Contractor.
 2. Recycle AC pavement and Class II AB where practical.
 3. Recycle concrete where practical.
 4. Items indicated to be salvaged shall be removed carefully, cleaned, and returned to the District. Coordinate with the District's Representative.
- D. Protection:
 1. Erect and maintain temporary bracing, shoring, lights, and barricades, except construction barricades for subsequent new construction, warning signs, and guards necessary to protect public, the District's employees, finishes, improvements to remain and adjoining property from damage, all in accordance with applicable regulations.
 2. Wet down areas affected by this work as required to prevent dust and dirt from rising.
- E. Scheduling:
 1. Coordinate with the District's Representative in scheduling noisy or dirty work.
 2. Schedule work at the District's convenience to cause minimal interference with the District's normal operations.
 3. Jack hammering will be allowed only during the following time periods 7:00 AM - 6:00 PM on weekdays.

- F. Traffic Circulation: Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.
 - 1. Do not close or obstruct public thoroughfares without first obtaining the required permit or permission of the responsible jurisdiction.
 - 2. Where closing of a vehicular or pedestrian traffic circulation route is necessary, provide adequate directional signs to minimize the potential for confusion.
 - 3. Maintain emergency access routes and coordinate any interruptions with local entities.
 - 4. Provide pedestrian paths as necessary and coordinate with the District.

PART 2 – PRODUCTS

2.1. PIPE ABANDONMENT MATERIALS

- A. Slurry cement backfill conforming to Caltrans Standard Specification 19-3.02E.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas affected by work of this Section and verify following:
 - 1. Disconnection of utilities as required.
 - 2. That utilities serving occupied portions of buildings on and off the site will not be disturbed.
 - 3. Removal by the District of the District's personal property, movable furniture and equipment items not designated for relocation.
- B. Document video and/or photograph, as necessary, existing items to remain that are damaged and submit photographs to District.
- C. Where existing conditions conflict with representations of the Contract Documents, notify the District's Representative and obtain clarifications. Do not perform work affecting the conflicting conditions until clarification of the conflict is received.

3.2 PREPARATION

- A. Verify that the area to be demolished or removed has been vacated, or adequate space made available to perform the work.
- B. Arrange for, and verify, termination of utility services to include removing meters and capping of lines.
- C. Lay out cutting work at Job Site and coordinate with related work for which cutting is required.

3.3 DEMOLITION

- A. If known or suspected hazardous materials are encountered during operations, stop operations immediately and notify the District's Representative.
- B. Perform work in accordance with ANSI A10.6-1969 unless otherwise noted.
- C. Provide noise and dust abatement as required to prevent contamination of adjacent areas.
- D. Remove all materials not designated as salvage, in their entirety.
- E. Remove building foundations in their entirety, unless otherwise indicated on the plans.
- F. Fill voids in the land left by the removal of existing structures as follows:
 - 1. In accordance with the requirements of Section 31 22 00 – EARTHWORK AND GRADING. Grade finished remaining surface to the contours shown, or if not shown, to match the existing natural contours.
- G. Lower, or remove, heavy structural framing members by hoist or crane.
- H. Concrete and Masonry:
 - 1. Demolish concrete and masonry in sections, less than 3 feet in any direction.
 - 2. Method of cutting shall be limited to saw cutting and torch.
- I. If unknown items such as human remains are encountered during operations, stop operations immediately and notify the District's Representative.
- J. The District's Representative will provide a list of any items to be stockpiled for future use. Stockpile location will be a site on campus determined by the District's Representative.

3.4 DEMOLITION AND REMOVAL OF AC PAVEMENT:

- A. Saw cut pavement at edge of demolition area.
- B. Break pavement and remove.
- C. Remove any base material, gravel, and/or or any other non-native soil.

3.5 CUTTING

- A. Make new openings neat.
- B. Do not cut or alter structural members and any utilities including appurtenances unless indicated to do so in the Construction Documents or written approval is received from the Architect.
- C. Take care not to damage reinforcing or structural steel scheduled to remain in place.

- D. Concrete: Cut new openings in concrete by coring and saw cutting. Saw run-bys will not be permitted.

3.6 PREPARATION FOR NEW FINISH WORK

- A. Where demolished surfaces are scheduled to receive new finishes, Contractor shall restore such substrate to a condition ready to receive the scheduled new finishes, including grinding or leveling.

3.7 UTILITY REMOVAL:

- A. Where utility removal is shown on the plans, excavate to expose existing utility, demolish and remove section of pipe or conduit indicated. Cap section of pipe or conduit to remain. Mark end of utility with stake, rebar, or Surveyor's marker.
- B. Provide thrust block or other mechanical restraint where dead end is created on pressurized pipe systems. Thrust blocks shall be per NFPA 24 Standards.
- C. Included in demolition are any appurtenances, including but not limited to valves, valve boxes, and irrigation system components.
- D. Backfill trench in accordance with requirements of Section 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning of demolished materials on-site is prohibited. Burning may be performed off-site of District's property provided it is done in a legal manner.

3.9 FIELD QUALITY CONTROL

- A. The District's Representative and Architect will accompany the Contractor before and after performance of work to observe physical condition of existing structures or improvements involved.

END OF SECTION

SECTION 31 22 00

EARTHWORK AND GRADING

PART 1 - GENERAL

1.1 SUMMARY:

- A. This section describes general requirements, products, and methods of execution relating to on-site earthwork. Any work within the public right-of-way shall be constructed to the standards of the County of Santa Cruz and State of California Department of Transportation. Work includes, but is not limited to, the following:
 - 1. Grading.
 - 2. Material.
 - 3. Excavation.
 - 4. Filling and backfilling.
 - 5. Soil Sterilant.
 - 6. Termiticide.
- B. Provide labor, material and equipment and services necessary to complete the excavations, re-compaction and finish grading as specified and indicated on Drawings.
 - 1. Obtain permit from local authorities.
 - 2. Provide surveying for grading operations.
 - 3. Provide shoring design.
 - 4. Provide dewatering operations.
 - 5. Provide site grading, cut, fill and finish.
 - 6. Provide excavation and backfill for filling construction, including trenches within building lines.
 - 7. Preparation for subgrade for building slabs, walks, pavements, and landscaping.
 - 8. Provide distribution of stockpiled topsoil.
 - 9. Provide sub-base course for walks and pavements.
 - 10. Provide engineered fills for building slabs and foundations.
 - 11. Provide sand and gravel for capillary break/moisture barrier under building slabs.
 - 12. Provide sub-surface drainage backfill for walls and trenches.
- C. The work includes removal and legal disposal off the site of debris, rubbish and other materials resulting from clearing and grubbing operations.

D. Work specified in Related Sections:

1. Section 31 10 00 – SITE PREPARATION AND DEMOLITION.
2. Section 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING.

1.2 DEFINITIONS:

A. Select Fill:

1. Soil or soil-rock material approved by District's Representative used by the Contractor in order to raise grades or to backfill excavations.
2. The District's Testing Agency will make sufficient tests and/or observations for the purpose of issuing a written statement that material meets or exceeds the specification requirements.

B. On-site Material: Soil or earth material obtained from required on-site excavation.

C. Excavation: Consists of the removal of material encountered to subgrade elevations and the re-use or disposal of materials removed.

D. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, rock base course, or topsoil materials.

E. Import Material: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

F. Base Course: The layer placed between the sub-base and surface pavement in a paving system.

G. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure American Society for Testing and Materials (ASTM) D1557.

H. Over-excavation: Removal of material below required subgrade elevations.

1.3 SUBMITTALS:

A. Comply with provisions of Section 01 33 00 – SUBMITTAL PROCEDURES.

B. Product Data: Manufacturer's literature and data, including, where applicable, capacity, labels, or other markings on equipment made to the specified standards for materials, for the following:

1. Imported materials.
2. Class II aggregate base (Caltrans Section 26).
3. Soil Sterilant.
4. Termiticide.
5. Cement Treatment.

6. Geotextiles.
 7. Subdrainage Pipe.
 8. Aggregate for Structural Soil Mix.
- C. Test Reports: Submit the following reports for import material directly to Architect from the Contractor's testing services:
1. Test reports on borrow material.
 2. Density test reports.
 3. One optimum moisture-maximum density curve for each type of soil encountered.
 4. Not used.
 5. Not used.
 6. Soil percolation rate test for soils to be used in storm water treatment zones.
 7. Structural Soil Mix Testing: Provide a two-gallon representative sample to approved testing laboratory for an analysis of the structural soil mix indicating the following:
 - a. Particle size analysis, including the following gradient of mineral content (USDA Designation Size in mm):
 1. 3" (76mm)
 2. 2 1/2" – 3" (63-76mm)
 3. 2" – 2 1/2" (50-63mm)
 4. 1 1/2" – 2" (37-50mm)
 5. 1" (25-37mm)
 6. 3/4" (19-25mm)
 7. Fine gravel – 1/8" – 3/4" (2-19mm)
 8. Sand – 0.05 -2mm
 9. Silt – 0.002-0.05mm
 10. Clay – minus 0.002mm
 - b. Provide manufacturer's analysis of the following:
 1. Loose and rodded unit weight.
 2. Bulk specific gravity and absorbance.
 3. Gravel dimension and surface texture description.

4. Aggregate soundness and L.A. abrasion.
- c. Provide a percent pore space analysis defined as follows:
 1. Rodded Unit Weight divided by the Bulk Specific Gravity x 100.
- d. Sample Collection Procedure:
 1. Collect a minimum of eight samples to make up the composite sample.
 2. Take samples from random locations in the stockpile varying from the top to the bottom and around the stockpile.
 3. Take at least half the samples from the lower third of the stockpile into a clean bucket
 4. Thoroughly mix material after samples are taken.
 5. Remove 2 gallon of material from bucket and fill a zip-lock plastic bag.
 6. Double bag the composite sample and label the bag with a permanent marker indicating the material name and date sample was taken.]
- D. Shoring Design: Where shoring is required by State Law or Contractor shall provide necessary design, provide proposed excavation shoring method for review prior to commencement of excavation requiring shoring. Include the following information:
 1. Basic design assumptions.
 2. Design Calculations.
 3. Describe materials or shoring system to be used.
 4. Indicate whether or not any components will remain after filling or backfilling.
 5. The shop drawings for the proposed shoring system.
 6. Coordinate with the Construction Documents and identify any proposed modifications or deviations.
 7. Certification of the above by a registered professional civil or structural engineer licensed by the State of California.
 8. Submittal will be reviewed for general conformance with project plans, but no review of calculations will be provided.
- E. Dewatering Plan: Based upon site surface and subsurface conditions, including available geotechnical and hydrological data, provide a system to perform the following:
 1. Lower the ground water level below bottom of excavation.
 2. Relieve the hydrostatic pressure below the subgrade to prevent uplift.
 3. Prevent surface drainage from accumulating within work area.

4. Legally discharge and dispose of excess water.
5. Submit description of basic components of proposed dewatering system and its planned method of operation.

F. Samples:

1. 20-lb. samples sealed in air-tight containers, of each proposed fill and backfill soil material from on-site or borrow sources. Provide to District's Representative as requested.
2. 20-lb samples sealed in air tight containers of specialty soils for submission to a plant and soil testing facility for analysis. Include perc test and sieve analysis.

G. Pad Certification

1. Submit a pad certification stamped by a California Licensed Land Surveyor.

H. Storm Water Pollution Prevention / Erosion Control Plans/Water Pollution Control Plans

I. Permit/Notice of Intent (N.O.I.), for discharge of storm run-off from the construction site.

J. Haul Routes.

1.4 ASSURANCE:

A. Requirements of Regulatory Agencies:

1. Comply with State of California Business and Transportation Agency, California Department of Transportation (CDT, Caltrans) "Standard Specifications" (Caltrans Standard Specification).
2. Comply with State of California Code of Regulations (CCR).
3. Comply with State of California Construction Safety Orders, Latest Edition (CAL/OSHA).
4. San Lorenzo Valley Water District, Standards and Specifications and Drawings, latest edition.
5. BCDC, ACOE, Fish and Wildlife, if applicable.

B. Soil Testing:

1. District may elect to engage a geotechnical testing agency, to include testing soil materials proposed for use in the work and for quality control testing during excavation and fill operations.
2. Test results will be distributed in compliance with Section 01 45 23 – TESTING AND INSPECTION SERVICES.

C. Codes and Standards:

1. Perform excavation work in compliance with applicable requirements of authorities

having jurisdiction.

2. Statewide General Permit to Discharge Storm Water associated with construction activity.
 3. The project Storm Water Pollution Prevention and Monitoring Plan.
- D. Comply with the latest editions of the following Standards and Regulations:
1. American Society for Testing and Materials (ASTM):
 - a. Concrete Aggregates.
 - b. C125: Standard Terminology Relating to Concrete and Concrete Aggregates.
 - c. C136: Sieve Analysis of Fine and Coarse Aggregates.
 - d. C566: Total Evaporable Moisture Content of Aggregate by Drying.
 - e. D421: Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
 - f. D422: Particle Size Analysis of Soil.
 - g. D854: Specific Gravity of Soils.
 - h. D1556: Density of Soil by the Sand Cone Method.
 - i. D1557: Laboratory Compaction Characteristics of Soil Using Modified Effort
 - j. D2216: Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
 - k. D2487: Classification of Soils for Engineering Purposes.
 - l. D2922: Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - m. D2937: Density of Soil in Place by Drive Cylinder Method.
 - n. D3017: Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - o. D4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 2. California Code of Regulations, Title 24, Part 2 - Basic Building Regulations, Chapter 24 - Excavations, Foundations, and Retaining Walls.
 3. California Department of Transportation (Caltrans) Standard Specifications:
 - a. Section 10: Watering.
 - b. Section 18: Dust Palliatives.
 - c. Section 19: Earthwork.

4. CAL/OSHA, Title 8.
5. San Lorenzo Valley Water District Standard Plans and Specifications
6. Other authorities having jurisdiction

E. Geotechnical Engineering Services:

1. Geotechnical Engineer may be elected by the District, as the District's Representative to observe grading observations during preparation offsite, excavation, and compaction of fill materials.
2. Make visits to site to familiarize him generally with progress and quality of work.
3. Make field observations and tests to enable him to form opinions regarding adequacy of site preparation, acceptability of fill materials and extent to which earthwork construction and relative compaction comply with specifications requirements.
4. Examine conditions exposed in foundation excavations.

F. Site Information:

1. Geotechnical Investigation Reports are available for examination by Contractor.
2. Additional soil borings and other exploratory operations may be made by Contractor at no cost to the District. Submit proposed boring locations for review prior to performing the work.

G. Contractor Qualifications:

1. Have successfully installed structural soil mixes similar to the quality specified for a period of not less than 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Protect materials of this section before, during and after installation; objects designated to be retained; and the installed work of other trades.
- B. In the event of damage to any of these items, immediately make repairs or replacements necessary to the acceptance of the District's Representative and at no additional cost to the District.
- C. Comply with provisions of Section 01 50 00 – TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during performance of the Work.

1.6 PROJECT CONDITIONS:

- A. Site Information: Review the geotechnical report identified in Section 02 30 00 – SUBSURFACE INVESTIGATION.
 1. The character of the material to be excavated or used for subgrade is not necessarily as indicated.

2. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
- B. Environmental Requirements:
1. Comply with the project SWPPP.
 2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water.
 3. Provide adequate temporary drainage to prevent erosion.
 4. After interruption, reestablish compaction specified in last layer before resuming work.
 5. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
 6. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of straw bale dikes, filter fiber dams, or other methods.
- C. Protections of open excavations.
1. Barricade open excavations and post with warning lights.
 2. Comply with requirements of Section 01 50 00 –TEMPORARY FACILITIES AND CONTROLS.
 3. Operate warning lights as recommended by authorities having jurisdiction.
 4. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout and other hazards.
- D. Protection of Subgrade
1. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
 2. At Contractor's option, and with the Geotechnical Engineer's approval, a working pad of granular material may be laid to protect footing and floor subgrade soils from disruption by traffic during wet conditions.
- E. Transport of soils.
1. Transport all excess soils materials by legally approved methods to disposal areas.
 2. Coordinate with the District's Representative.
 3. Sufficient topsoil and fill material shall be retained from the site to complete project requirements.

4. Any additional topsoil and fill requirements shall be the responsibility of the Contractor.
- F. Blasting and use of explosives will not be permitted.
- G. Dust Control Requirements: At all times during earthwork operations and until final completion and acceptance of the earthwork, the Contractor shall prevent the formation of an airborne dust and dirt nuisance from interfering with the surrounding normal operations. The Contractor shall effectively stabilize the site of work in such a manner that it will confine dust particles to the immediate surface of the work and to obtain a minimum of 40 percent emissions reduction by applying a dust palliative except in areas of active cut and fill. The dust palliative shall be non-petroleum based. Water alone is not considered to be a dust palliative. The dust palliative shall be applied at the rate and method in conformance with Section 18, "Dust Palliatives," of the Caltrans Standard Specifications and as recommended and/or specified by the manufacturer. Contractor shall assume liability for all claims related to dust and dirt nuisances.
- H. All areas to receive Structural Soil shall be inspected by the District's Representative prior to beginning this work.

1.7 EXISTING UTILITIES

- A. The District will contact local utility agencies prior to construction and arrange for the shut-off of all utilities serving the buildings to be demolished. Coordinate work required to abandon active lines with the Program Manager and the District.
- B. Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during excavation operations.
- C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the District's Representative immediately for directions.
 1. Cooperate with the District and public and private utility companies in keeping their respective services and facilities in operation.
 2. Repair damaged utilities to the satisfaction of the District's Representative.
- D. Do not interrupt existing utilities serving facilities occupied and used by the District or others, except when permitted in writing by the District and then only after acceptable temporary utility services have been provided.

1.8 SEQUENCING AND SCHEDULING

- A. The schedule of operations shall be reviewed by the District's Representative prior to commencement of any work.
- B. Coordinate operations with other construction activities, such as relocation of existing utilities.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General:

1. Fill material will be subject to approval of the District's Representative.
 2. For approval of imported fill material, notify the District's Representative at least 7 days in advance of intention to import material, designated proposed borrow area, and permit the Geotechnical Engineer to sample as necessary from borrow area for purpose of making acceptance tests to prove quality of material.
 3. The Geotechnical Engineer's report on acceptability shall be final and binding.
 4. During grading operations, soil types other than those analyzed in the geotechnical report for the project, may be encountered.
 5. Consult the District's Representative to determine the suitability of these soils.
- B. Select Fill Material: Imported soil conforming to requirements for fill material contained in geotechnical report for this project.
- C. Native Fill Requirements:
1. Approved native materials shall have a particle size not exceeding 3 inches as determined by ASTM D422, at least 90 percent by weight passing the 1 inch sieve and less than 3 percent organic content by weight.
 2. Fill to be treated with lime per District's Representative recommendations.
- D. Imported Fill Requirements: Imported fill, where required, shall be non expansive granular soil, free of organic matter and deleterious substances. In general, import fill should be tested and documents to be non-corrosive and free from hazardous material in concentrations above the level of concern. Imported fill material shall conform to the following requirements:
1. Grading:

<u>U. S. Sieve Size</u>	<u>Percentage Passing Sieve</u>
2 ½ inch	85
No. 8	25-45
No. 200	0-35
 2. Be thoroughly compactable without excessive voids.
 3. Fill to be treated with lime per District's Representative's recommendations.
 4. Meeting one of following plasticity requirements:
 - a. Maximum Expansion Index of 50.
 - b. Maximum Plasticity Index of 15, as determined by ASTM D4318.
- E. Imported Fill for Planting Areas: Imported fill for use in planting areas shall be sandy loam weed free soil. Submit analysis from certified Soil and Plant Lab. Coordinate with Landscape Architect.

- F. Topsoil: Friable clay loam surface soil found in a depth of not less than 10 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, and without weeds, roots and other objectionable material.

1. Use topsoil for top 2 feet of fill against exterior walls, except at paving and sidewalks.
2. Topsoil may also be used beyond the area within 5 feet of building, except under paving and sidewalks.
3. Confirm suitability of stockpiled materials.

- G. Sand: Clean, well-graded fine to coarse sand with not more than 2 percent passing the No. 200 sieve based on wet sieve analysis. Provide at locations indicated in the construction documents.

Where coarse sand is required, provide sand no finer than No. 40 sieve.

- H. Bioretention Soil Mixture

1. Follow Appendix L of the NPDES.

- J. Drain Rock:

1. Washed, uniformly graded mineral aggregate ASTM D448 with percentage composition of dry weight conforming to following limits:
 - a. Passing 1-inch Sieve: 100 percent.
 - b. Passing 3/4-inch Sieve: 90-100 percent.
 - c. Passing No. 4 Sieve: 0-10 percent.
2. Base at Slab-on-Grade: As specified in the geotechnical report for this project.
3. Absorption of water to saturated-surface dry condition shall not exceed 3 percent of oven-dry weight of a sample.

- K. Backfill material for use behind retaining walls shall be a granular material consisting of sand, broken rock, or a mixture of sand and gravel containing no size larger than 2 ½ inches and not more than 15 percent passing the No. 200 sieve.

- L. Pea Gravel: 3/8 inch to ½ inch washed, uncrushed gravel. Use at drainage pipe and at other locations indicated.

- M. Filter Fabric: Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D4759 and the referenced standard test method in parentheses.

4. Grab Tensile Strength (ASTM D4632): 120 lb.
5. Apparent Opening Size (ASTM D4751): #70 U.S. Standard sieve.
6. Permeability (ASTM D4491): 135 gallons per minute per square foot.

- N. Drainage Pipe:
 - 1. Perforated corrugated plastic drainage tubing meeting ASTM F667, with continuous integral nylon filter screen.
 - 2. Acceptable Manufacturers and Products: Advanced Drainage Systems "DrainGuard," Hancor "Agri-Flow."
 - 3. Provide couplings, elbows and other fittings as recommended by pipe manufacturer.
- O. Water: Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.

2.2 SOIL STERILANT

- A. Soil Sterilant shall be Treflan E.C. or approved equivalent.

2.3 TERMITICIDE

- A. Termiticide shall be Permethrin, Denon, or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Prior to commencement of earthwork, become thoroughly familiar with site conditions.
- B. If event discrepancies are found, immediately notify the District's Representative in writing, indicating the nature and extent of differing conditions.
- C. Requirements:
 - 1. Grades and elevations are to be established with reference to benchmarks referenced on Drawings.
 - 2. Maintain engineering markers such as monuments, benchmarks and location stakes. If disturbed or destroyed, replace.
- D. No earthwork shall be performed without physical presence or acceptance of the District's Representative.
- E. Compacting:
 - 1. Compact by power tamping, rolling or combinations thereof as accepted by the Geotechnical Engineer.
 - 2. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping.
 - 3. Scarify and re-compact any layer not attaining compaction until required density is obtained.
 - 4. Compaction by flooding, ponding or jetting will not be permitted, unless specifically accepted by the District's Representative.

F. Hazardous Materials

1. If any materials are encountered that may be hazardous (as defined in Section 25117 of the California Health and Safety Code), inform the District's Representative verbally within 24 hours and in writing within 2 business days. Upon discovery, material is to remain undisturbed until investigation by State's representative is complete. The removal and disposal of hazardous materials, if discovered, is not part of the scope of work of this Division for this project.

3.2 SITE PREPARATION:

- A. Protect structures, utilities, sidewalks, pavements, and other facilities which are to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Set up tree protection measures prior to commencing grading or demolition operations.

B. Clearing and Grubbing:

1. Remove from area of designated project earthwork all improvements and obstructions, including designated concrete curbs or slabs, asphaltic concrete, all tree and shrub roots, any abandoned buried utility, any irrigation lines, and other matter determined by the District's Representative to be deleterious.
 - a. In all new planting areas, remove existing base material.
 - b. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.
 - c. Vegetation should be removed to such a depth that organic material is generally not present.
2. Remove from the site all trees and shrubs, unless otherwise indicated on the drawings as existing trees to be left standing.
3. Active utilities with the project limit should be rerouted or protected from damage by construction activities.
4. Rubble and excavated materials that do not meet the criteria of fill should be disposed of in an appropriate landfill.
5. Excavations resulting from the removal of buried utilities, tree stumps, or obstructions should be backfilled with compacted fill in accordance with the recommendations of the geotechnical report.
6. Existing Trees to remain:
 - a. Verify the locations of existing trees to be preserved.
 - b. Replace existing trees to remain that are damaged during construction at no additional cost to the District.
 - c. Carefully make clean cuts at roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction. Paint cuts over ½ inch in size with tree pruning compound.

C. Topsoil:

1. Strip topsoil to whatever depths encountered in manner to prevent intermingling with the underlying subsoil or other objectionable material.
2. Remove heavy growths of grass from areas before stripping. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.
3. Stockpile topsoil in storage piles to freely drain surface water.
4. Cover storage piles if required to prevent windblown dust.

3.3 EXISTING UTILITIES:

- A. Protect existing utilities that are to remain in operation as specified.
- B. Demolish and completely remove from the site existing underground utilities indicated to be removed. See Section 31 10 00 – SITE PREPARATION AND DEMOLITION.
- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at contractor's risk.
- D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
 1. Use hand or light equipment for excavating immediately adjacent to or for excavations exposing a utility or buried structure.
 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
 4. Report damage of utility line or subsurface structures immediately to the District's Representative.

3.4 PREPARATION OF SUBGRADE:

A. Fill Areas:

1. All final subgrades that will receive engineered fills should be scarified to a depth of 8 inches, moisture conditioned and compacted in strict accordance with requirements in Haro, Kasunich and Associates Geotechnical Investigation Report dated August 2021. All final subgrades must be inspected and certified by the District's Representative. If final subgrade cannot be prepared through scarification and moisture conditioning, stabilization measures may be required. These

stabilization measures may include, but no limited to, over-excavation, geosynthetic (geogrid or fabric) placement and crushed rock placement. The most appropriate stabilization measure will be selected by the Districts Representative on a case-by-case basis during earthworks activities.

2. Bring subgrades to not less than 3 percentage points above optimum moisture content (not less than 2 percentage points above optimum upper 6 inches of pavement subgrade) and compact to 90 percent of the maximum laboratory dry density, in accordance with ASTM D1557.

B. Building Pad, exterior flatwork and pavement areas:

1. Scarify building pad, exterior flatwork and pavement subgrade to a depth of at least 6 inches and work until uniform and free from large clods.
2. Bring expansive subgrades to not less than 3 percentage points above optimum moisture content (not less than 2 percentage points above optimum upper 6 inches of pavement subgrade) and compact to 95 percent of the maximum laboratory dry density, in accordance with ASTM D1557.
3. Bring non-expansive subgrades to or slightly above the optimum moisture content and compact to 90 percent of the maximum laboratory dry density in accordance with ASTM D1557.
4. Increase compaction of the upper 6 inches of pavement subgrades to 95 percent of the maximum laboratory dry density and at least 2 percent over the optimum moisture content per ASTM D1557 for non-expansive subgrades.

3.5 DEWATERING:

- A. Do not allow water from surface drainage or underground sources to accumulate in excavations, unfinished fills, or other low areas.
- B. Provide and maintain ample means and devices to remove water promptly and dispose properly of water entering excavations or other parts of the work to prevent softening of exposed surfaces.
- C. Dewater by methods which will ensure dry excavation and preservation of finish lines and grades of excavation bottoms.
- D. Prior to excavating below ground water level, place dewatering system in operation.
 1. Lower the ground water level a minimum of 1 foot below the bottom of the excavation.
 2. Relieve the hydrostatic pressure in pervious zones below the subgrade elevation to prevent uplift.
 3. Use screens and gravel packs as necessary to prevent removal of fines from the soil.

- E. Operate the dewatering system continuously, 24 hours a day, 7 days a week until construction work below existing ground water level is completed.
 - 1. Measure and record the performance of the dewatering system.
 - 2. After placement of initial slabs and backfill, the ground water level may be allowed to rise.
 - 3. At no time allow ground water to rise higher than 1 foot below the prevailing level of excavation or backfill.
 - 4. Have a back-up pump and system available for immediate use.
- F. Dispose of water away from the work in suitable manner without damage to adjacent property or menace to public health.
- G. Do not drain water into work being built or under construction without prior acceptance of the District's Representative.
- H. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.

3.6 SITE EXCAVATION:

- A. General
 - 1. All supports, shoring, and sheet piling required for the sides of excavations or for protection of adjacent existing improvements shall be provided and maintained by the Contractor. The adequacy of such systems shall be the complete responsibility of the Contractor.
 - 2. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on drawings and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of side forms, except at slab perimeters.
 - 3. Large rocks, pieces of concrete or other obstructions, if encountered during the excavation/scarifying operations, shall be removed and disposed of by the Contractor off the site in a legal manner.
 - 4. Where footing excavation is too deep, backfill shall be concrete. Where footings are over dug laterally, side forms shall be employed for backfill with rock fill or concrete backfill shall be used (Contractor's option).
 - 5. Where forming is required, only that excavation necessary to permit placing and removal of forms shall be done.
 - 6. Bottoms of all footings and foundations trenches shall be subject to testing by the District's Representative. Corrective measures as directed by the State's representative shall be executed promptly.
- B. Excavate subgrade as required to allow for finish grades shown on drawings, as required for structural fill or otherwise required for proper completion of the work.

- C. Remove and replace subgrade materials designated by the District's Representative as unsuitable.

3.7 FILL AND COMPACTING:

- A. General Requirements:
 - 1. Backfill excavations as promptly as work permits.
 - 2. Do not place select fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the District's Representative.
 - 3. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
 - 4. In excavations, use satisfactory excavated or borrow material.
 - 5. Under grassed areas, use satisfactory excavated or borrow material.
- B. After subgrade compaction has been approved by the District's Representative, spread the engineered fill materials in lifts not exceeding 8 inches and uniformly mixed during the spreading operation.
 - 1. Bring non-expansive fill materials to or slightly above the optimum moisture content and compacted to at least 90 percent of the maximum laboratory dry density, per ASTM D1557.
 - 2. Bring non-expansive aggregate fill materials to or slightly above the optimum moisture content and compacted to at least 95 percent of the maximum laboratory dry density, per ASTM D1557.
 - 3. Do not compact the top 12 inches of soil in the planting areas.
 - 4. Fill sections greater than 5 feet in depth shall be compacted to at least 95 percent.
- C. Repeat compaction procedure until proper grade is attained.
- D. Rocks generated during site earthwork may be used in fill when conforming to material specifications.

3.8 MOISTURE CONTROL:

- A. Do not place, spread or roll fill material during unfavorable weather conditions or when fill material is excessively wet.
- B. Do not resume operations until moisture content and fill density are satisfactory to the District's Representative.
- C. Provide berms or channels to prevent surface water from flooding excavations. Promptly remove water collecting in depressions.
- D. Where soil has been softened or eroded by flooding or by placement during unfavorable weather, remove damaged areas and re-compact as described for fill and compaction.

- E. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material.
 - 1. Prevent free water appearing on surface during or subsequent to compaction operation.
 - 2. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
 - 3. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.9 GRADING:

- A. General: Uniformly grade areas of work including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
 - 1. All areas covered by the project, including excavated and filled areas and adjacent transition areas, shall be uniformly graded so that finished surfaces are at the elevations established by the plans. Planter areas to receive future topsoil shall be graded below finished grade to allow for such material.
 - 2. Finished surfaces and surfaces to receive paving and aggregate base shall be smooth, compacted, and free from irregular surface drainage.
 - 3. Ditches, gutters, and swales shall be finished to permit proper surface drainage.
 - 4. All surface areas, except paved and sloped embankments exceeding 8:1, shall be hydroseeded in accordance with specifications in Landscaping Sections.
- B. Grading Tolerances:
 - 1. Excavations shall not exceed 0.10-foot variation from dimensions and elevations shown or noted, unless otherwise approved by the District's Representative.
 - 2. Fill and backfill shall be placed with tolerance of plus or minus 0.10 foot if placed in layers.
 - 3. Grading shall be done within plus or minus 0.10 foot typically; areas under slabs, walks or pavements shall be graded within tolerance of 0 to 0.10 foot.
 - 4. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 - 5. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
 - 6. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than ½ inch above or below required subgrade elevation.

- C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.10 SOIL STERILIZATION:

- A. General: Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base as recommended by the manufacturer. Sterilant shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath asphalt concrete pavement, brick pavement, concrete pavement, or on-grade concrete slabs including sidewalks, curbs, and gutters and areas between the inner and outer security fences. In addition to ground areas treated, sterilant shall be applied below expansion or control joints, and at all areas where pipe, ducts, or other features penetrate slabs.

3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS:

- A. Removal of Excess Excavated Material: Excess material shall be removed by the Contractor off the site in a legal manner.

3.12 FIELD QUALITY CONTROL:

- A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
 - 1. Perform field in-place density tests according to ASTM D1556 (sand cone method), ASTM D2167 (Rubber Balloon Method), or ASTM D2937 (Drive Cylinder Method), as applicable.
 - a. Field in-place density tests may also be performed by the nuclear method according to ASTM D6938 , provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D1556. With each density calibration check, check the calibration curves furnished with the moisture gauges according to ASTM D6938
 - b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work on each different type of material encountered, and at intervals as directed by the Architect.
 - 2. Footing Subgrade: At footing subgrades, use a hand probe and consult with the District's Representative.
 - 3. Paved and Building Slab Areas; At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 square feet or less of paved area or building slab, but in no case fewer than three tests.
 - 4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
 - 5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but not fewer than two tests.

- B. Number and location of test shall be at option of the District's Representative.
- C. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.
- D. After grading is completed and the testing agency has completed observation of the work, permit no further excavation or filling, except as approved by the District's Representative.

3.13 PROTECTION:

- A. Protect newly graded areas from traffic and erosion. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer's recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completion of construction. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

3.14 CLEAN-UP:

- A. Comply with requirements of Section 01 74 00 – CLEANING.

3.15 TERMITICIDE:

- A. Termiticide shall be applied to soils as recommended by the manufacturer. Termiticide shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath and around wood frame structures.

END OF SECTION

SECTION 31 23 33

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 – GENERAL

1.1 SUMMARY:

- A. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
 - 1. Initial Backfill Material.
 - 2. Subsequent Backfill.
 - 3. Detectable Tape.
 - 4. Trench Excavation.
 - 5. Pipe Bedding.
 - 6. Trench Backfill.
 - 7. Trench Surfacing.
- B. Work specified in Related Sections include:
 - 1. Section 31 22 00 – EARTHWORK AND GRADING.
 - 2. Section 33 10 00 – WATER SYSTEMS.
 - 3. Section 33 30 00 – SANITARY SEWER.

1.2 DEFINITIONS:

- A. Select Fill:
 - 1. Soil or soil-rock material approved by the District Representative and transported to the site by the Contractor in order to raise grades or to backfill excavations.
 - 2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.
- B. Excavation: Consists of the removal of material encountered to subgrade elevations.
- C. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.
- D. Base: The layer placed between the subgrade and surface pavement in a paving system.

- E. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure American Society for Testing and Materials (ASTM) D1557.

1.3 SYSTEM DESCRIPTION:

- A. Requirements:
 - 1. Comply with the recommendations of the District Representative.
 - 2. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.
 - 3. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.
 - 4. Unless otherwise indicated in the Drawings, all excavation for pipelines shall be open cut.

1.4 SUBMITTALS:

- A. Comply with provisions of Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Test Reports: Submit the following report for import material directly to the District's Representative from the Contractor's testing services:
 - 1. Compaction test reports for import materials.
- C. Submit description of compactors proposed for use when requesting placement of base material.

1.5 QUALITY ASSURANCE:

- A. Requirements of Regulatory Agencies:
 - 1. Comply with State of California Business and Transportation Agency, Department of Transportation (Caltrans) latest edition of "Standard Specifications." (Caltrans Standard Specification).
 - 2. Comply with State of California Code of Regulations (CCR).
 - 3. Comply with State of California Construction Safety Orders, Latest Edition (CAL/OSHA).
- B. Soil Testing:
 - 1. District may elect to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
 - 2. Test results will be submitted to the District's Representative.
- C. Codes and Standards:

1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
2. NPDES Construction General Permit.
3. Project Storm Water Pollution Prevention Plan (SWPPP)
4. California Department of Transportation Standard Specifications (Caltrans Standard Specification):
 - a. Section 19: Earthwork.
 - b. Standard Test Methods: No. 202.
5. American Society for Testing and Materials (ASTM):
 - a. D1556: Density of Soil by the Sand Cone Method.
 - b. D1557: Moisture Density Relations of Soils and Soil-Aggregate Mixtures.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Protect materials before, during and after installation.
- B. Comply with provisions of Section 01 57 00 – TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during construction activities.

1.7 PROJECT CONDITIONS:

- A. Environmental Requirements:
 1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
 2. Protect existing streams, ditches and storm drain inlets during work on this project.
- B. Barricade open excavations and post with warning lights.
 1. Comply with requirements of Section 01 57 00 – TEMPORARY FACILITIES AND CONTROLS.
 2. Operate warning lights and barricades as required.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
- C. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.

- D. Transport all excess soils materials by legally approved methods to disposal areas.
 - 1. Coordinate with the District's Representative.
 - 2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES:

- A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility agency immediately for directions.
 - 1. Cooperate with the District's Representative and public and private utility companies in keeping their respective services and facilities in operation.
 - 2. Repair damaged utilities to the satisfaction of the utility owner.
- C. Do not interrupt existing utilities serving facilities occupied and used by the District or others, except when permitted in writing by the District's Representative and then only after acceptable temporary utility services have been provided.

1.9 SEQUENCING AND SCHEDULING:

- A. The sequence of operations shall be reviewed by the District's Representative prior to commencement of any work.

PART 2 – PRODUCTS**2.1 MATERIALS:**

- A. General:
 - 1. Backfill materials will be subject to approval of the Engineer.
 - 2. For approval of backfill fill material, notify the District's Representative at least 7 days in advance of intention to import material.
 - 3. Consideration shall also be given to the environmental characteristics as well as the corrosion potential of backfill materials. Laboratory testing, including pH, soluble sulfates, chlorides, and resistivity shall be reviewed. Backfill materials shall not be more corrosive than the native materials.
- B. Trench Sand:
 - 1. Material free from clay, organic materials, and other deleterious substances and conforming to Caltrans Standard Specification Section 19-3.02F(2).
- C. Trench Gravel:

1. Granular material free from clay, organic materials, and other deleterious substances and conforming to Class 1 Type A Permeable Material, per Caltrans Standard Specification Section 68-2.02F(2).
- D. Approved Native Fill:
1. See Section 31 22 00 – EARTHWORK AND GRADING.
- E. Imported Fill:
1. See Section 31 22 00 – EARTHWORK AND GRADING.
- F. Class II Aggregate Base: $\frac{3}{4}$ " maximum, Class II AB, free from organic matter and other deleterious substances and conforming to Caltrans Standard Specification Section 26-1.02A.
- G. Controlled Low Strength Material (CLSM):
1. Low strength structural backfill with a compressive strength between 50 and 100 psi, conforming to Caltrans Standard Specifications Section 19-3.02G.
- H. Water: Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes.

Red: Electric.

Yellow: Gas, Oil; Dangerous Materials.

Orange: Telephone and Other Communications.

Blue: Water Systems.

Green: Sewer Systems.

White: Steam Systems.

Gray: Compressed Air.
 2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum

strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

- A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Prior to commencement of work, become thoroughly familiar with site conditions.
- B. In the event discrepancies are found, immediately notify the District's Representative in writing, indicating the nature and extent of differing conditions.
- C. Backfill excavations as promptly as work permits.
- D. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the District's Representative.
- E. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- F. In excavations, use satisfactory excavated or borrow material.
- G. Under grassed areas, use satisfactory excavated or borrow material.

3.2 COMPACTING:

- A. Compact by power tamping, rolling or combinations thereof.
 1. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping.
 2. Scarify and re-compact any layer not attaining compaction until required density is obtained.

3.3 SITE PREPARATION:

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.

3.4 EXISTING UTILITIES:

- A. Identify the location of existing utilities.
 - 1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Drawings, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
 - 2. The Contractor shall contact Underground Service Alert (USA) at 811 for assistance in locating existing utilities.
 - 3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Engineer of Record to clear the utility.
- B. Protect all existing utilities to remain in operation.
- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.
- D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
 - 1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
 - 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
 - 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
 - 4. Report damage of utility line or subsurface structures immediately to the District's Representative.
- E. Backfill trenches resulting from utility removal in accordance with this section.

3.5 TRENCH EXCAVATION

- A. General:
 - 1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.

2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.

B. Existing Paving and Concrete:

1. Existing pavement over trench shall be saw cut, removed, and hauled away from the job. Existing pavement shall be neatly saw cut a minimum of 6-inches beyond the limits of excavations.
2. Existing concrete over the trench shall be saw cut to a full depth in straight lines either parallel to the curb or right angles to the alignment of the sidewalk.
3. Boards or other suitable material shall be placed under equipment out rigging to prevent damage to paved surfaces.

C. Trench Width:

1. The maximum allowable trench widths at the top of the pipe shall be as follows:

<u>Pipe Type</u>	<u>Trench Width (Maximum)</u>
Copper	Outside diameter of barrel plus 18 inches
Plastic	"
Vitrified Clay	"
Cast-Iron	Outside diameter of barrel plus 24 inches
Ductile-Iron	"
Reinforced Concrete	

- a. The maximum trench width shall be inclusive of all shoring.
- b. If the maximum trench width is exceeded, the District's Representative or Inspector of Record may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.

D. Open Trench:

1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.

E. Excavation Bracing:

1. The excavation shall be supported and excavation operations shall be conducted in accordance with the California Industrial Accident Commission and CAL/OSHA.
2. The Contractor shall, at his/her own expense, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below the pipe grade), and to prevent any movement which could in any way diminish the required trench section or otherwise injure or delay the work. The sheeting and bracing shall be withdrawn in a manner such as to prevent any earth movement that might overload the pipe.

F. Excavated Material:

1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.6 PIPE BEDDING

- A. Bedding Excavation: The trench shall be excavated below the grade of the pipe bottom to the following minimum depths:

<u>Pipe Type</u>	<u>Depth</u>
Copper	3 inch
Reinforced Concrete	3 inch
Plastic: 2 inch diameter and smaller	3 inch
Cast/Ductile Iron	6 inch
Plastic: over 2 inch diameter	6 inch

1. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed

rock. The Inspector of Record will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.

2. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing pipe bedding material. Pipe bedding shall be trench sand or trench gravel, as defined in these specifications. Sufficient pipe bedding material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe, plus 1/8th of the pipe diameter. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.7 TRENCH BACKFILL

A. Initial Backfill:

1. Prior to trench backfill, the condition of the trench and lying of pipe must be inspected and approved by the Inspector of Record.
2. Trench Sand and Trench Gravel shall be used for initial backfill. After the pipe has been properly laid and inspected, initial backfill material shall be placed on both sides of the pipe and compacted to final depth as follows:

<u>Pipe Type</u>	<u>Depth</u>
Copper	6 inches above top of pipe
Cast Iron	6 inches above top of pipe
Plastic: less than 3 inches diameter	6 inches above top of pipe
Plastic: 3 inches diameter and larger	12 inches above top of pipe
Ductile Iron	12 inches above top of pipe
Reinforced Concrete	½ outside diameter of pipe (pipe spring line)

3. Compaction: Initial backfill compaction shall be by mechanical means. The initial backfill material shall be hand tamped in layers not exceeding 4 inches in un-compacted depth and shall be brought up uniformly on both sides of the pipe to avoid bending or distortional stress. After hand tamping, the relative compaction of the initial backfill material shall be not less than 90 percent.
4. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.
5. For natural gas piping see also Section 33 50 00 – NATURAL GAS DISTRIBUTION PIPING Section 3.02.C.

B. Subsequent Backfill:

1. Subsequent backfill material shall consist of approved native material, imported fill, or Class II AB conforming to these specifications.
 2. Structure and utility trench backfill should be moisture conditioned, placed in lifts eight inches or less in loose thickness, and mechanically compacted to at least 90 percent relative compaction except the relative compaction shall not be less than 95 percent within 2-1/2 feet of finished permanent surface grade or 1-1/2 feet below the finished subgrade, whichever is greater; jetting will not be permitted. The moderately expansive clay soils exposed in trenches should not be allowed to dry out prior to placement of trench backfill materials.
 3. It must be the contractor's responsibility to select equipment and procedures that will accomplish the grading as described above. He/she must organize his/her work in such a manner that the Soil Engineer can test and/or observe each element of grading.
- C. Controlled Low Strength Material (CLSM):
1. CLSM is permitted at Engineer of Records discretion or where indicated on the contract documents.
- D. Jetting and Ponding:
1. Jetting of trench backfill is not permitted.
- E. Compaction Testing:
1. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.8 TRENCH SURFACING

- A. Unpaved Areas:
1. In unimproved areas, the trench surface shall be restored to its original condition. No mounds of earth shall be left along the trench. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
 2. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.
- B. Temporary Surfacing:
1. Temporary surfacing shall be a minimum of 2 inches of cutback asphalt on 10 inches of Class 2 aggregate base and shall be placed at all trench locations subject to vehicular or pedestrian traffic.
 2. Temporary surfacing shall be laid within one day after backfilling (except where the Contractor elects to place permanent surfacing within this time period).

3. Before the trenching area is opened for traffic, all excess dirt, rock, and debris shall be removed, the street surface shall be swept clean and the pavement shall be washed down with a water truck and pressure nozzle.
4. Temporary surfacing shall be maintained to prevent the occurrence of mud holes and prevent the surface from settling below 1 inch or rising more than 1 inch from the existing pavement grade.

3.9 MOISTURE CONTROL:

- A. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS:

- A. Testing Services: Allow testing agency to test each backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
- B. When testing agency reports that backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

3.11 PROTECTION:

- A. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

3.12 CLEAN-UP:

- A. Remove all debris, equipment, tools and materials upon completion prior to final inspections to the satisfactions of the engineer.
- B. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer's recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completions of construction.

END OF SECTION

SECTION 32 12 33
PAVING AND SURFACING

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes (but is not necessarily limited to):
 - 1. Asphalt Concrete Paving.
 - 2. Portland Cement Concrete Paving.
 - 3. Liquid Asphalt and Asphalt Emulsion.
 - 4. Aggregate Base.
 - 5. Concrete Pavers.
 - 6. Decomposed Granite.
 - 7. Sealants
- B. Related work furnished under other sections but conforming to the provisions of this section:
 - 1. Subgrade preparation.
 - 2. Aggregate Base installation.
- C. Related Sections:
 - 1. Section 31 10 00 – SITE PREPARATION AND DEMOLITION.
 - 2. Section 31 22 00 – EARTHWORK AND GRADING.
 - 3. Section 32 17 23 – PAVEMENT MARKING.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 2. C150: Portland Cement.
 - 3. D1557: Moisture Unit Weight Relations of Soils and Aggregate Mixtures Using a 10 lb (4.5 kg) Rammer and 18 in. (457 mm) Drop.
 - 4. D1682: Breaking Loads and Elongation of Textile Fabrics.
- B. California Code of Regulations (CCR): Title 24, Chapter 2-71, Site Development Requirements for ADA Accessibility.

- C. California Department of Transportation (Caltrans):
 - 1. Standard Specifications:
 - a. Section 20-10: Decomposed Granite.
 - b. Section 24: Stabilized Soils.
 - c. Section 26: Aggregate Bases.
 - d. Section 37: Bituminous Seals.
 - e. Section 39: Asphalt Concrete.
 - f. Section 40: Concrete Pavement.
 - g. Section 41: Concrete Pavement Repair.
 - h. Section 51: Concrete Structures.
 - i. Section 52: Reinforcement.
 - j. Section 73: Concrete Curbs and Sidewalks.
 - k. Section 88: Geosynthetics.
 - l. Section 90: Portland Cement Concrete.
 - m. Section 92: Asphalts.
 - n. Section 93: Liquid Asphalts.
 - o. Section 94: Asphaltic Emulsions.
 - p. Section 95: Epoxy
 - 2. Traffic Manual.
 - 3. Highway Design.
- D. Institute of Transportation Engineers: Transportation and Traffic Engineering Handbook.
- E. American Concrete Institute Manual of Practice.
- F. Interlocking Concrete Pavement Institute (ICPI).

1.3 SUBMITTALS

- A. Requirements: Refer to Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Asphalt Concrete Paving:
 - 1. Provide copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with or exceeds specified requirements.

2. The Contractor shall furnish a certified weight or load slip for each load of material used in the construction of the asphalt concrete pavement.
- C. Concrete Paving: The Contractor shall furnish mill test reports on the cement, reinforcement bars, and aggregates, showing compliance with the respective specifications. The Testing Engineer may make concrete test cylinders and slump tests as deemed necessary to determine compliance with the Specifications.
- D. Liquid Asphalt.
- E. Pavement Reinforcement Fabric.
- F. Tack Coat.
- G. Pavement Reinforcement Mesh.
- H. Structural Geotextile Fabric.
- I. Concrete Pavers.
- J. Slurry Seal.
- K. Joint Sealants.
- L. Backer Rod.
- M. Joint Filler.
- N. Epoxy Crack Filler.
- O. Bonding Epoxy.
- P. Concrete Quality Control Plan. Inclusive of the following:
 - Placing and timing of joints including a location plan for all joints
 - Bar placement, alignment
 - Concrete placement methods
 - Finishing and curing methods and timing.
 - Joint sealants and timing of placement

1.4 PROJECT CONDITIONS

- A. Liquid Asphalt and Asphalt Emulsion:
 1. Seal coat and paint binder shall be applied only when the ambient temperature is above 50° Fahrenheit and when temperature has not been below 35° Fahrenheit for 12 hours immediately prior to application.
 2. Fog coat, seal coat, and paint binder shall not be applied when base or surfaces are wet or contain excess moisture.

- B. Asphalt Concrete Paving: Asphalt concrete surfaces shall be constructed only when ambient temperature is above 50° Fahrenheit and when base is dry.
- C. Portland Cement Concrete: Concrete shall be placed when the conditions will yield satisfactory results and when the ambient temperature will be above 40°F for 72 hours after placement with no threat of precipitation.
- D. Joint Sealants: Sealants shall be placed per the manufacturers recommendations and when temperature is above 40°F for 2 days after and no threat of precipitation.

PART 2 - PRODUCTS

2.1 PAVING MATERIALS

- A. Aggregate Base: Aggregate base shall conform to Caltrans Class 2 (R value 78 min) aggregate base, 3/4" maximum size, as specified in Section 26 of the Caltrans Standard Specifications.

- B. Asphalt Concrete Paving:

1. Shall be Type A HMA, conforming to Section 39-2.02B of the Caltrans Standard Specifications.
2. Asphalt binder to be mixed with aggregate shall be performance-graded asphalt, PG64-10, conforming to Section 92 of the Caltrans Standard Specifications.

3. Aggregate size shall be as follows:

Total AC Thickness	Min # of AC lifts	Aggregate Grading
3/4 inch – 1-1/2 inch	1	1/2" max
2 inch – 2-1/2 inch	1	1/2" max
3 inch or greater	2	1/2" max for top lift and 3/4" max for initial lifts

4. If multiple lifts, apply a tack coat before placing a subsequent lift.
5. Asphaltic emulsion for paint binder, fog coat, and seal coat shall be emulsified asphalt, Type SS-1h, conforming to Section 94 of the Caltrans Standard Specifications.

- C. Portland Cement Concrete:

1. Concrete shall be minor concrete conforming to Section 90-2 of the Caltrans Standard Specifications, except as modified by these specifications.
2. Concrete Pavement shall contain a minimum of 505 lbs/yard of cementitious material.

3. Cement shall be a combination of Type II or Type V Portland cement and supplemental cementitious materials conforming to Section 90-1.02B of the Caltrans Standard Specifications.
 4. For minor concrete, the maximum aggregate size must not be larger than 1-1/2 inches or smaller than 3/4 inch, per Section 90-2.02C of the Caltrans Standard Specifications.
 5. Water shall be potable and free of organic matter and injurious amounts of oil, acid, alkali, or other deleterious substances.
 6. Unless otherwise noted on the plans the concrete mix design shall provide a minimum compressive strength of 3,000 psi at 28 days.
 7. Supplementary Cementitious Materials (SCM) shall comply with Section 90-1.02B(3) of the Caltrans Standard Specifications including chemical properties, physical properties, and proportioning.
 8. Reinforcing bars shall be deformed and shall conform to ASTM A615.
 9. Filled joints, unless noted otherwise on the Drawings, shall be 1/4-inch wide, the full depth of the concrete section and conforming to Section 51 of the Caltrans Standard Specifications.
 10. Joint filler shall conform to Section 51 of the Caltrans Standard Specifications for pre-molded expansion joint filler and expanded polystyrene joint filler.
 11. No admixtures will be allowed without prior approval of the Engineer of Record.
- D. Epoxy shall meet the requirements of Section 95 of the Caltrans standard specifications.
1. Epoxy used to bond dowels to hardened concrete shall be Type 1, Grade 1, Class B or C per ASTM C881.
 2. For high strength applications epoxy shall be Type IV.
- E. Pavement Reinforcement Fabric: Pavement reinforcement fabric shall meet Caltrans Section 96-1.02J. BP Petromat, or approved equivalent.
- F. Crack Sealant:
1. Crack sealant shall be rubberized hot-pour type and shall meet ASTM D 3405. Husky 1611, or approved equivalent.
 2. Blotting Agent shall be one of: Screened sand, cement, or fly ash.
- G. Tack coat: Tack coat shall meet Caltrans Section 39-2.01B(10).
- H. Pavement reinforcement mesh: Pavement reinforcement mesh for use in overlays shall be Glasgrid Model 8501, or approved equivalent.
- I. Structural geotextile fabric: Structural geotextile fabric shall be Mirafi 500X, or approved equivalent.

- J. Joint Sealant:
 - 1. Dow Corning 890-SL or approved silicone sealant conforming to ASTM D5893, C639, C1183, C679, C792, C66 and C792.
 - 2. Conform to Caltrans Section 41-5.02B.
- K. Backer Rod
 - 1. Backer Rod shall be expanded, cross linked, crossed-cell polyethylene foam compiling to ASTM D5249, Type I.
 - 2. Rod diameter shall be 25% greater than the saw cut joint width.

2.2 BITUMINOUS SEALS

- A. Fog Seal: Fog Seal asphaltic emulsion shall conform to Caltrans Section 37-4.02.
- B. Flush Coat: Flush Coat asphaltic emulsion shall conform to Caltrans Section 37-4.03. Sand for the flush coat shall comply with the fine aggregate grading in Caltrans Section 90-1.02C(3), sand must be free of organic material or clays.
- C. Slurry Seal: Slurry seal shall conform to Caltrans Section 37-3.02B, and be Type II unless otherwise specified.
- D. Chip Seal: Chip seal shall conform to Caltrans Section 37-2 for polymer modified asphaltic emulsion seal coat and included screenings per Caltrans Section 37-2.01B.
- E. Crack Sealant: Crack Sealant shall conform to Caltrans Section 37-6.02, Type 2, unless otherwise specified.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade and Aggregate Base:
 - 1. Prepare subgrade and over excavate per Section 31 22 00 – EARTHWORK AND GRADING.
 - 2. Aggregate base shall be compacted to 95 percent ASTM D1557 per the Geotechnical report. Section 26-1.03E of the Caltrans Standard Specifications shall apply.
 - 3. Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.
- B. Crack Sealing:
 - 1. Before sealing, cracks shall be cleared of dirt, dust, and all other deleterious materials to a depth of 1/4-inch to 1/2-inch.
 - 2. Cracks 1/8-inch in width and greater shall be sealed.

3. Application of crack sealer shall be in accordance with the manufacturer's recommendations unless otherwise directed.

3.2 ASPHALT CONCRETE PAVING

A. General:

1. Asphalt concrete shall be proportioned, mixed, placed, spread, and compacted in conformance with Section 39 of the Caltrans Standard Specifications.
2. Before placing asphalt concrete, an asphalt emulsion tack coat shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints, and all existing pavement to be surfaced, in conformance with Section 39 of the Caltrans Standard Specifications.
3. Spreading and compacting asphalt concrete shall be performed in accordance with Section 39 of the Caltrans Standard Specifications.
4. Fog seal shall be applied to all finished surfaces of asphalt concrete pavement at a rate of 0.05 gallons per square yard, in accordance with Section 37 of the Caltrans Standard Specifications.
5. After fog seal has been applied, ample time shall be allowed for drying before traffic is allowed on the pavement or paint striping is applied.

3.3 CONCRETE CONSTRUCTION

A. General:

1. All concrete shall be mixed in accordance with applicable provisions of Section 90 of the Caltrans Standard Specifications.
2. Construction of concrete substructures shall conform to applicable provisions of Section 51 of the Caltrans Standard Specifications. Unless noted otherwise in the Specifications, all exposed surfaces of structure shall have Class 1 surface finish. Finish shall match adjacent existing concrete paving.
3. Schedule of Locations for Concrete Finish Types, unless otherwise specified:
 - a. Slabs or Stairs to receive toppings and fills: Scratched.
 - b. Exposed Stairs Fills: Nonslip.
 - c. Exterior Paved Areas: Light Broomed.
 - d. Formed Surface to receive paint: Smooth Formed.
 - e. Concealed Concrete Surfaces: Rough Formed.
4. Curing shall conform to provision of Caltrans Section 90-1.03B. No pigment shall be used in curing compounds for construction of concrete curbs, gutters, and structures.

5. All work shall be subject to field inspection. No concrete shall be placed until the Program Manager has approved the forms and reinforcement.
6. Expansion joints on curbs and gutters shall be placed 20 feet on centers, adjacent to structures, and at all returns, and shall be filled with joint filler. Control joints shall be formed 10 feet on centers.
7. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than 6 feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.4 CONCRETE PAVER CONSTRUCTION

A. Installation - General

1. Concrete pavers to be clean and free of foreign materials before installation.
2. Paving work to be plumb, level and true to line and grade as shown.
3. Install pavers in pattern and layout as shown on Plans. Use string lines to hold pattern lines true.
4. Use a masonry saw to cut pavers.
5. Protection: Protect the installed concrete paver system work from damage, including sediment deposition due to subsequent construction activity on the site.
6. During the landscape maintenance period, promptly remove any pavers that settle or deviate from the grades as shown on plans.

B. Sand Bedding (Non Permeable) – Install dry sand to uniform depth required for flush finish after pavers are installed. The maximum designed depth shall be one inch thick with no sand thickness less than $\frac{3}{4}$ " or more than $1\frac{1}{2}$ " except where required otherwise by Drawings. Sand is to remain undisturbed prior to the installation of unit pavers. Moisture content of sand to remain constant.

C. Open-graded Subbase and Base (Permeable)

1. Moisten, spread and compact the No. 2 subbase in 4-inch to 6-inch lifts without wrinkling or folding the geotextile.
2. For each lift, make at least two passes in the vibratory mode, then at least two in the static mode, with a minimum 10-ton vibratory roller, until there is no visible movement of the No. 2 stone. Do not crush aggregate with the roller.
3. The surface tolerance of the compacted No. 2 subbase shall be $\pm 2\frac{1}{2}$ in. over a 10 ft straightedge.
4. Moisten, spread and compact the No. 57 base in 4-inch lift over the compacted No. 2 subbase with a minimum 10-ton vibratory roller, until there is no visible movement of the No. 57 stone. Do not crush aggregate with the roller.
5. The surface tolerance the compacted No. 57 base should not deviate more than ± 1 in. over a 10 ft straightedge.
6. Compacted density of base and subbase, per ASTM D4254, to be 95% of the

laboratory index density established for the subbase and base stone.

D. No. 8 Stone Bedding (Permeable)

1. Moisten, spread and screed the No. 8 stone bedding material.
2. Fill voids left by removed screed rails with No. 8 stone.
3. The surface tolerance of the screeded No. 8 bedding layer shall be $\pm 3/8$ inches over a 10-foot straightedge.
4. Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.

E. Non-Permeable Paver Installation

1. Install pavers hand-tight on the undisturbed sand laying course as indicated on Plans, with tolerance from given dimensions not to exceed $3/8$ -inch in 100 feet.
2. Use a roller or plate vibrator with a rubber shoe to compact the pavers and to vibrate the sand into the joints between the pavers.
3. Spread joint filler sand over the installed pavers and vibrate into the joints between the pavers.
4. Sweep excess sand into the joints. Remove remaining excess sand from installed pavers and dispose of off-site.

F. Quality Control

1. The final surface elevation of pavers shall not deviate more than $3/8$ in. under a 10 ft long straightedge.
2. The surface elevation of pavers shall be $1/8$ to $1/4$ inch above adjacent drainage inlets, concrete collars or channels.
3. No greater than $1/8$ inch difference in height between adjacent pavers.
4. Prior to applying Water-based Paver Sealer, remove any stains and efflorescence using cleaners. Apply Water-based Paver Sealer, per ICPI Tech Spec 5 and label Instructions, after final cleanup and wash down of paving stone surface. During application, protect surrounding areas from overspray. All traffic, pedestrian or vehicular, shall be kept off of sealed pavers until initial cure time has been achieved.

3.5 BITUMINOUS SEALS

A. General:

1. Mixing, spreading and placing shall be in accordance with applicable provisions of Section 37 of the Caltrans Standard Specifications.

3.6 SEALANTS AND BACKER ROD

A. General: Where indicated on the plans and/or specifications, Contractor shall seal joints with a sealant and backer rod.

1. Width and depth of joints shall meet project requirements and accommodate sealant and backer rod in conformance with Manufacturer's requirements.

2. Placements and shall conform to Manufactures requirements.

3.7 FIELD QUALITY CONTROL

A. Asphalt Concrete Paving:

1. Contractor shall perform a flood test in the presence of the engineer and/or Las Positas College's Representative. Location of ponding greater than 1/8" in depth may impact proper drainage and shall be marked and remedied by the contractor.
2. The specified thickness of the finished pavement shown on the plans and specifications shall be the minimum acceptable.
3. Conforms shall form a smooth, pond-free transition between existing and new pavement.
4. Depressions in paving between high spots are not to exceed 1/8-inch when measured below a 10-foot long straight edged placed anywhere on surface in any direction.
5. The finished asphalt pavement shall have positive drainage without ponding.

3.8 CLEANUP

A. General:

1. Surplus material remaining upon completion of paving operations shall become the property of the Contractor, to be removed from the work site and disposed of in a lawful manner.
2. Surfaces shall be left in a clean, neat, and workmanlike condition, and all construction waste, rubbish, and debris shall be removed from the work site and disposed of in a lawful manner.

END OF SECTION

SECTION 32 17 23**PAVEMENT MARKING****PART 1 – GENERAL****1.1 SUMMARY:**

- A. Provide requirements for materials, fabrications, and installation of traffic control and pavement markings.

1.2 SUBMITTALS:

- A. Submit manufacturer's product data describing application of products and compliance with VOC requirements.
- B. Shop Drawings: Show complete layout and location of pavement markings prior to demolition or obliteration of the existing markings.
- C. Submit samples as follows:
 - 1. Traffic paint.
 - 2. Pavement markers and adhesives.
 - 3. Reflectorized markers and posts.

1.3 DELIVERY, STORAGE AND HANDLING:

- A. Comply with Division 1 requirements and specifications.
- B. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of installation.
- C. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

PART 2 – PRODUCTS**2.1 MATERIALS:**

- A. Traffic Marking and Symbol Paint:
 - 1. Traffic Marking and Symbol Paint shall conform to the applicable requirements of Caltrans Standard Specification Section 84-2.02C.
 - 2. Physical Characteristics shall conform to the following:

Volatile Organic Compounds	100 g/l max
Pigment (White) Content, by Weight	58-62%
Pigment (Yellow) Content, by Weight	56-60%

Total Nonvolatile Content, by Weight

75-79%

3. EF Series, Fast Dry, Waterborne Traffic Paint distributed by Ennis Flint (Product Code PTWB01WH, Color Fed 595 White 37925); (Product Code PTWB01YLF, Color Lead Free Yellow 33538); or approved equivalent.
- B. Accessible Symbol Background Paint: Blue Color. Glidden Co. "Glid-Guard Lifemaster Finish No. 5200 /series, Color 1/M 79", or approved equivalent.
- C. Thermoplastic Stripes and Markings:
 1. Thermoplastic stripes and makings shall be hot applied conforming to Caltrans Standard Specification Section 84 and shall be Cataphote-Catatherm brand, Pavemark thermoplastic brand, or approved equivalent.
 2. Thermoplastic stripes and markings shall include glass beads to meet retroreflective requirements of Caltrans Section 84-2.02A and 84-2.02B
- D. Glass beads shall be per Caltrans Section 84-2.02D.
- E. Pavement Markers and Adhesives:
 1. Pavement markers shall be two-way retroreflective markers and shall conform to the applicable requirements of Caltrans Standard Specification Section 81.3.02C.
 - a. Pavement Marker: For fire hydrants shall be blue.
 - b. Pavement Marker: For lane delineation shall be per plan.
 2. Adhesive for pavement markers shall be standard set epoxy adhesive conforming to the requirements of Caltrans Standard Specification Section 95-1.02F.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine receiving surfaces and verify that surfaces are clean and proper for installation.
- B. Do not start work until unsatisfactory conditions have been corrected.

3.2 APPLICATION:

- A. Preparation:
 1. Clean and prepare surfaces to receive traffic paint in accordance with Caltrans Standard Specification Section 84-2.03B and these special provisions. Where required, remove existing striping and markings by wet blasting or equivalent method. Do not use dry sandblasting or other dust producing methods.
- B. Traffic Paint:

1. Traffic paint shall be machine applied in accordance with Caltrans Standard Specification Section 84-2.03C.
 2. No paint shall be applied until the surface has been approved by the Engineer and until at least 10 days after the slurry seal on asphalt concrete has been placed. Place markers in accordance with Caltrans Standard Specification Section 81-3.03.
- C. Striping Layout:
1. Layout striping locations via “cat tracking” or chalk line for District approval prior to application of any markings or paint.
 2. Traffic stripe shall be single and double, solid and broken, and of the color to match existing conditions.
 3. Traffic striping shall be placed in patterns to match existing conditions, contractor shall document.
- D. Thermoplastic Stripes and Markings:
1. Thermoplastic stripes and markings shall be applied hot in conformance with manufacturer’s recommended instructions and the applicable requirements of Caltrans Standard Specification Sections 84-2.03B and 2.03C.
- E. Pavement Markers:
1. Pavement markers shall be installed to delineate the location of fire hydrants along off-site and on-site roadways. No markers shall be installed until the surface has been approved by the Engineer and until at least 10 days after the slurry seal on asphalt concrete has been placed. Place markers in accordance with Caltrans Standard Specification Section 81-3.03
- F. Apply marking paint in accordance with approved manufacturer’s recommendations.
- G. Density of paint coverage shall hide color and texture of substate.
- H. Parking Stripes: Paint four inches wide unless otherwise noted.
- I. Symbol Marking: Paint to match existing conditions.

3.3 CLEANING AND PROTECTION:

- A. Comply with requirements of Section 01 74 00 – CLEANING.
- B. Upon completion of work, remove surplus materials and rubbish and clean off spilled or splattered paint resulting from this work.
- C. Permit no surface traffic until pavement and symbol marking has dried thoroughly.

END OF SECTION

SECTION 33 10 00**WATER SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to on-site domestic water and fire water systems serving all buildings and appurtenances. Unless otherwise noted, this section does not apply to irrigation water systems and water systems inside and within 5 feet of buildings. This section applies to:
 - 1. Domestic water distribution and services.
 - 2. Fire water distribution and services.
 - 3. Water storage tanks.
- B. Contractor shall provide all labor, equipment, materials, and testing services unless otherwise noted.
- C. Related Sections:
 - 1. Section 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING.

1.2 SUBMITTALS

- A. Comply with requirements of Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following:
 - 1. Piping and fittings.
 - 2. Gaskets, couplings, sleeves, and assembly bolts and nuts.
 - 3. Gate valves and ball valves.
 - 4. Blow-off valves, air release and vacuum valves, and combination air valves.
 - 5. Check valves.
 - 6. Pressure reducing valves.
 - 7. Backflow preventers.
 - 8. Valve boxes, frames and covers.
 - 9. Water meter boxes, frames and covers.

10. Post indicators.
11. Fire department connections and wet stand pipes.
12. Fire hydrants.
13. Thrust block concrete mix and/or restrained joints and fittings.
14. Tapping sleeves and tapping valves.
15. Service saddles and corporation stops.
16. Identification materials and devices.
17. Corrosion protection.
18. Water sampling stations.
19. Water storage tanks

C. Test Reports:

1. Bacteriologic Testing: Provide copies of the test results indicating water sample meets California Drinking Water Standards.

D. Samples: None specified. Provide as necessary.

1.3 QUALITY ASSURANCE

A. Comply with the latest edition of the following Standards and Regulations:

1. American Water Works Association (AWWA) and American National Standards Institute (ANSI):
 - a. C104/A21.4 ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - b. C105/A21.5 ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - c. C110/A21.10 ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 inch - 48 inch for Water.
 - d. C111/A21.11 ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - e. C115/A21.15 ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - f. C116/A21.16 ANSI Standard for Protective Fusion-Bonded Epoxy Coatings Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings.
 - g. C150/A21.50 ANSI Standard for Thickness Design of Ductile-Iron Pipe.

- h. C151/A21.51 ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
- i. C153/A21.53 ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
- j. C500 Metal-Seated Gate Valves for Water Supply Service.
- k. C502 Dry-Barrel Fire Hydrants.
- l. C503 Wet-Barrel Fire Hydrants.
- m. C504 Rubber-Seated Butterfly Valves.
- n. C507 Ball Valves, 6 inches - 48 inches.
- o. C508 Swing-Check Valves for Waterworks Service, 2 inches - 24 inches NPS.
- p. C509 Resilient-Seated Gate Valves for Water Supply Service.
- q. C510 Double Check Valve Backflow Prevention Assembly.
- r. C511 Reduced-Pressure Principle Backflow Prevention Assembly.
- s. C512 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
- t. C550 Protective Epoxy Interior Coating for valves and Hydrants.
- u. C600 Installation of Ductile-Iron Water Mains and their Appurtenances.
- v. C602 Cement- Mortar Lining of water Pipelines in place- 4 inches and larger.
- w. C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
- x. C651 Disinfecting Water Mains
- y. C652 Disinfection of Water-Storage Facilities
- z. C800 Underground Service Line Valves and Fittings for 1/2 inches - 2 inches.
- aa. C900 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 inches - 12 inches, for Water Distribution.
- bb. C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inches through 3 inches, for Water Service.
- cc. C905 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inches - 48 inches.

- dd. C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 inches - 63 inches, for Water Distribution and Transmission.
 - ee. C907 Polyvinyl Chloride (PVC) Pressure Fittings for Water, 4 inches - 8 inches.
 - ff. C908 PVC Self-Tapping Saddle Tees for Use on PVC Pipe.
 - gg. D103 Factory-Coated Bolted steel Tanks for water Storage.
2. National Fire Protection Association (NFPA):
- a. NFPA 13 Standard for the Installation of Sprinkler Systems.
 - b. NFPA 14 Standard for the Installation of Standpipe, Private Hydrants, and Hose Systems.
 - c. NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection.
 - d. NFPA 22 Standard for Water Tanks for Private Fire Protection.
 - e. NFPA 24 Private Service Mains and their Appurtenances.
 - f. NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
3. Uni-Bell Plastic Pipe Association (UNI).
- a. PUB 3 PVC Pipe – Technology Serving the Water Industry.
 - b. PUB 7 External Corrosion of Underground Water Distribution Piping Systems.
 - c. PUB 8 Tapping Guide for AWWA C900 Pressure Pipe.
 - d. PUB 9 Installation Guide for PVC Pressure Pipe.
 - e. B-8 Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 6-12 inch).
4. American Society of Testing and Materials (ASTM).
- a. ASTM A536 Standard Specification for Ductile Iron Castings.
 - b. ASTM A674 Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
 - c. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - d. ASTM D2241 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe.

- e. ASTM D2466 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - f. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 - g. ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
 - h. ASTM D3139 Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - i. ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - j. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - k. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - l. ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
 - m. ASTM F1056 Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
 - n. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - o. ASTM A795 Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
 - p. ASTM A865 Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.
 - q. ASTM B88 Standard Specification for Seamless Copper Water Tube.
5. American Society of Mechanical Engineers (ASME).
- a. ASME B16 series for valves, fittings, flanges, and gaskets applicable for use in water systems.
 - b. ASME B1.20.1 American Standard Tapered Pipe Threads for factory-threaded pipe and pipe fittings.
6. National Sanitation Foundation (NSF).

- a. NSF/ANSI 14 Plastics Piping System Components and Related Materials.
 - b. NSF/ANSI 61 Standard for Drinking Water Systems Components – Health Effects.
7. Underwriters Laboratories, Inc. (UL).
- a. UL 157 Standard for Safety for Gaskets and Seals.
 - b. UL 194 Standard for Safety for Gasketed Joints for Ductile-Iron Pipe and Fittings for Fire Protection Service.
 - c. UL 213 Rubber Gasketed Fittings for Fire-Protection Service.
 - d. UL 246 Standard for Safety for Hydrants for Fire-Protection Service.
 - e. UL 262 Standard for Safety for Gate Valves for Fire-Protection Service.
 - f. UL 312 Standard for Safety for Check Valves for Fire-Protection Service.
 - g. UL 405 Standard for Safety for Fire Department Connections.
 - h. UL 448 Standard for Safety for Pumps for Fire-Protection Service.
 - i. UL 789 Standard for Safety for Indicator Posts for Fire-Protection Service.
 - j. UL 860 Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service.
 - k. UL 1091 Standard for Safety for Butterfly Valves for Fire-Protection Service.
 - l. UL 1285 Pipe and Couplings, Polyvinyl Chloride (PVC), for Underground Fire Service.
 - m. UL 1468 Direct Acting Pressure Reducing and Pressure Restricting Valves.
 - n. UL 1478 Standard for Safety for Fire Pump Relief Valves.
8. FM Global (FM).
- a. FM 1020 Automatic Water Control Valves.
 - b. FM 1045 Waterflow Detector Check Valves.
 - c. FM 1110 Indicator Posts.
 - d. FM 1111 Post-Indicator-Valve-Assembly.
 - e. FM 1112 Indicating Butterfly Valves.

- f. FM 1120 and FM 1130 Fire Service Water Control Valves (OS&Y and NRS Type Gate Valves).
 - g. FM 1210 Swing Check Valves.
 - h. FM 1221 Backflow Preventers (Reduced Pressure Principle and Double Check Valve Types).
 - i. FM 1311 Centrifugal Fire Pumps (Horizontal, Split-Case Type).
 - j. FM 1312 Centrifugal Fire Pumps (Vertical-Shaft, Turbine Type).
 - k. FM 1319 Centrifugal Fire Pumps (Horizontal, End Suction Type).
 - l. FM 1361 Water Pressure Relief Valve.
 - m. FM 1362 Pressure Reducing Valves.
 - n. FM 1371 Centrifugal Fire Pumps (In-Line Type).
 - o. FM 1510 Fire Hydrants (Dry Barrel Type) for Private Fire Service.
 - p. FM 1511 Fire Hydrants (Wet Barrel Type) for Private Fire Service.
 - q. FM 1530 Fire Department Connections.
 - r. FM 1610 Plastic Pipe & Fittings for Underground Fire Protection Service.
 - s. FM 1620 Pipe Joints & Anchor Fittings for Underground Fire Service Mains.
- 9. Plastics Pipe Institute (PPI).
 - a. Underground Installation of Polyethylene Pipe.
 - b. Polyethylene Joining Procedures.
 - c. Inspections, Test and Safety Considerations.
- 10. American Association of State Highway and Transportation Officials (AASHTO) for H2O Loading.
- 11. American Concrete Institute (ACI).
 - a. ACI 348 - Meter Pit Construction.
- 12. San Lorenzo Valley Water District Standard Specifications and Details.
- 13. Boulder Creek Fire Protection District
- 14. Other authorities having jurisdiction.
- B. System Description: Grades and elevations are to be established with benchmarks referenced on Plans.

- C. Comply with San Lorenzo Valley Water District Standards and authorities having jurisdiction for the installation and testing of potable water piping and fire protection systems.
- D. Comply with San Lorenzo Valley Water District Standards and authorities having jurisdiction for the installation, testing and separation requirements of recycled/reclaimed water piping and fire protection systems.
- E. All testing of systems specified in this section shall be witnessed by representatives of the local water department or local authority. Provide at least 7 days notice.

PART 2 - PRODUCTS

2.1 PIPING

- A. Water Distribution Main (pipe size 4 inches and larger).
 - 1. Ductile Iron Pipe (DIP): Pressure Class 350 pipe conforming to AWWA/ANSI C151/A21.5, cement-mortar lining conforming to AWWA/ANSI C104/A21.4, with standard thickness per AWWA/ANSI C150/A21.50. U.S. Pipe, American Cast Iron Pipe Company (ACIPCO), or approved equivalent.
 - a. Flanged ends shall conform to AWWA/ANSI C115/A21.15.
 - b. Rubber-gasket joints shall conform to AWWA/ANSI C111/A21.11.
 - 2. Polyvinyl Chloride Pipe (PVC): Pressure Class 235, DR 18, spigot and gasket bell end, conforming to AWWA C900 or AWWA C905, with equivalent cast-iron pipe outer diameter (O.D.). J-M Manufacturing, PW Pipe, North American Pipe Company, or approved equivalent.
 - 3. Polyethylene Pipe (PE): PE 4710, ASTM F714, Pressure Class 200, DR 9, conforming to AWWA C906, or approved equivalent.
- B. Water Service Line (pipe size 3 inches and smaller)
 - 1. ~~Copper (Cu): Provide Type K soft or hard copper pipe conforming to ASTM B88.~~
 - 2. High Density Polyethylene Pipe (HDPE): PE4710, Pressure Class 200, DR 9 conforming to AWWA C901. J-M Manufacturing PIPE or approved equivalent.
- C. Recycled/Reclaimed Water piping shall be purple.

2.2 FITTINGS, GASKETS, COUPLINGS, SLEEVES, AND ASSEMBLY BOLTS AND NUTS

- A. For DIP: Provide fittings with pressure rating greater than or equal to that of the pipe. Provide flanged joints, mechanical joints, push-on joints, and insulating joints where indicated. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends. Provide mechanically

coupled type joints using a sleeve-type mechanical coupling where indicated. Provide ends of pipe and fittings suitable for the specified joints. Fittings shall have cement-mortar lining conforming to AWWA/ANSI C104/A21.4.

1. Flanged Joints: Provide bolts, nuts, and gaskets in conformance with AWWA/ANSI C115/A21.15. Flanged fittings shall conform to AWWA/ANSI C110/A21.10 or C153/A21.53.
 - a. Provide flange for set screwed flanges of ductile iron, ASTM A536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250.
 - b. Provide setscrews for set screwed flanges of 190,000 psi tensile strength, heat treated and zinc-coated steel.
 - c. Gaskets for set screwed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA/ANSI C111/A21.11.
 - d. Design of set screwed gaskets shall provide for confinement and compression of gasket when joint to adjoining flange is made.
 - e. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot-pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.
2. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA/ANSI C111/A21.11.
3. Push-on Joints: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA/ANSI C111/A21.11. Modify bell design fittings, as approved.
4. Insulating Joints: Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
 - a. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
 - b. Provide gasket of the dielectric type, full face, as recommended in AWWA/ANSI C115/A21.15.
 - c. Provide bolts and nuts as recommended in AWWA/ANSI C115/A21.15.
 - d. Fittings shall be epoxy lined and coated with a thickness not less than 6-mils.

~~B. For PVC: Fittings shall be DIP or PVC.~~

1. DIP fittings: Provide gray-iron or ductile-iron conforming to AWWA/ANSI C110/A21.10, with cement-mortar lining conforming to AWWA/ANSI C104/A21.4, and standard thickness, with equivalent cast-iron pipe O.D.
 - a. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except the bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe.
 - b. Provide push-on joints, compression joints and mechanical joints where indicated between pipe and fittings, valves, and other accessories.
 - c. Mechanical joints, glands, bolts and nuts, and gaskets shall conform to AWWA/ANSI C111/A21.11.
 - d. Fittings shall be epoxy lined and coated with a thickness not less than 6-mils.
2. PVC fittings: Provide fabricated PVC fittings for pressure pipe conforming to AWWA C900, C905, or C907.
 - a. PVC fittings shall conform to ASTM D2466.
 - b. Push-on joints shall conform to ASTM D3139.
 - c. Compression joints shall conform to ASTM D3139.
 - d. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets shall conform to ASTM F477.
- C. For PE: Fittings shall conform to AWWA C901 or AWWA C906. Driscopipe, or approved equivalent.
 1. Socket type fittings shall conform to ASTM D2683.
 2. Butt fusion fittings shall conform to ASTM D3261.
 3. Electrofusion fittings shall comply with ASTM F1055.
- ~~D. For Cu:~~
 - ~~1. Cast copper alloy solder joint pressure fittings shall conform to ASME B16.18.~~
 - ~~2. Wrought copper solder joint pressure fittings or wrought copper alloy unions shall conform to ASME B16.22~~
 - ~~3. Cast copper alloy flare fittings shall conform to ASME B16.26.~~
 - ~~4. Wrought copper alloy body, hexagonal stock, metal-to-metal seating surfaces, and solder joint threaded ends shall conform to ASME B1.20.1.~~
 - ~~5. Compression connections shall be Mueller 110, Ford or approved equivalent.~~

- E. For HDPE:
 - 1. Cast Copper Fittings shall conform to ASME B16.18.
 - 2. Cast Copper Compression Fittings and connections shall be Mueller 110 Ford or approved equivalent.
 - 3. HDPE Fittings shall conform to PE4710, Pressure Class 200, DR 9 conforming to AWWA C901. Wolseley Industrial Group or approved equivalent.

2.3 GATE VALVES AND BALL VALVES

- A. Gate Valves: Valves shall open by counterclockwise rotation of the valve stem. Provide valves with ends as appropriate for the adjoining pipe.
 - 1. Stuffing boxes shall have O-ring stem seals. Provide stuffing boxes bolted and constructed so as to permit easy removal of parts for repair.
 - 2. Valves (2-1/2 inches and larger):
 - a. Provide valves conforming to AWWA C500 or AWWA C509 and of one manufacturer. Valves shall have a non-rising stem, a 2-inch square nut, and double-disc gates. Valves shall be rated for 250 psi maximum working pressure. Mueller 2360 series, ACIPCO, or approved equivalent.
 - b. For the domestic water system, valves shall also conform to ANSI/NSF 61.
 - c. For the fire water system, valves 2 inches through 16 inches in size shall also conform to UL 262 and FM 1120 or FM 1130 to a working pressure of 200 psi.
 - 3. Where a post indicator is shown, provide valve with an indicator post flange.
- B. Ball Valves: Valves shall open by counterclockwise rotation of the valve stem. Provide valves with ends as appropriate for the adjoining pipe.
 - 1. Valves (2-inches and smaller):
 - a. Provide valves conforming to AWWA C800 and of one manufacturer. Mueller 300 Series, Ford, or approved equivalent.
 - 2. Provide valve with operating nut or handle as shown on the Construction Documents.

2.4 BLOW-OFF VALVES, AIR RELEASE AND VACUUM VALVES, AND COMBINATION AIR VALVES

- A. Blow-off valves: Provide valve and service size as shown in the Contract Documents. Provide 2-inch valves at low points of the piping system, and 4-inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.

1. 2-inch blow-off shall have a 2-inch vertical female iron pipe (FIP) inlet and a 2-inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equivalent.
 2. 4-inch blow-off shall have a 4-inch vertical FIP inlet and a 4-inch male iron pipe (MIP) outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF800, or approved equivalent.
- B. Air release and vacuum valves: Provide valve and service size as shown on the Contract Documents, and where there is an increase in the downward slope or a decrease in the upward slope of the piping system. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin Model UL, Apco, or approved equivalent.
- C. Combination air valves: Provide valve and service size as shown on the Contract Documents, and at high points and sharp changes in gradient of the pipe system. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300psi. Provide a protective cap for the outlet of the valve. Crispin Model C, Apco, or approved equivalent.

2.5 CHECK VALVES

- A. Valves: Valves shall have clear port opening and a cast-iron body. Provide spring-loaded or weight-loaded valves where indicated on the Construction Documents.
1. For the domestic water system, provide swing-check type valves conforming to AWWA C508. Provide valves of one manufacturer. Mueller, Apco, or approved equivalent.
 2. For the fire water system, provide swing-check type valves conforming to FM 1210 and UL 312. Mueller, Watts, or approved equivalent.

2.6 PRESSURE REDUCING VALVES

- A. Pressure Reducing Valves: Valves shall have a cast-iron body, conforming to ASTM A536, with epoxy interior coating conforming to AWWA, and rated to Pressure Class 300. Cla-Val Model 90-01, Singer, or approved equivalent.
1. Valves shall have flanged ends.
 2. Valves sized 3-inches or smaller may have screwed ends.

2.7 POST INDICATORS

- A. Posts Indicators shall withstand up to 900 ft-lbs of operating torque, be free-standing, and tamper-proof.
- B. Post Indicators shall conform to UL 789 and FM 1110. Mueller, ACIPCO, or approved equivalent.
- C. Post indicators on recycled/reclaimed systems shall be painted purple.

2.8 VALVE BOXES, METER BOXES, FRAMES AND COVERS

- A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked "WATER." Christy Model G5 with G5C cover or approved equivalent.
- B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Contract Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H20 loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equivalent.
- C. Valve boxes, meter boxes, frames and covers on recycled/reclaimed systems shall be purple.

2.9 BACKFLOW PREVENTERS

- A. Provide backflow preventers as shown on the Contract Documents. Subject to local water department approval. Backflow preventers on the fire water system shall be subject to approval by the local office of the Fire Marshal.
- B. Reduced Pressure Principle Assemblies (RPPA): Provide a cast-iron body RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Febco 860, Watts, or approved equivalent.
- C. Double Check Detector Assemblies (DCDA): Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. Febco 806, Watts, or approved equivalent.
- D. Backflow preventers on recycled/reclaimed systems shall be painted purple.

2.10 FIRE DEPARTMENT CONNECTIONS AND WET STAND PIPES

- A. Fire Department Connections (FDC): Provide FDC's with 2-1/2 inch female hose connections, sidewalk or free-standing type. Number of inlets shall be as shown on the Contract Documents. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm, and be furnished with Knox FDC plug. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded "AUTO SPKR".
 - 1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equivalent.

2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equivalent.
 3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equivalent.
 4. 6-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Croker, Potter-Roemer or approved equivalent.
- B. Wet Stand Pipes (WSP): Provide 2-Way WSP's with valves and two (2) 2-1/2 inch male hose connections free-standing type, with a 4" inlet. Each outlet shall each have a minimum capacity of 250 gpm, and be furnished with a Knox cap. Water to the WSP shall be controlled with a remote valve. Connection shall be branded "HYDRANT." Subject to approval by the local water department or fire marshal. Croker, Elkhart, Potter-Roemer or approved equivalent.
- C. Fire department connections and wet stand pipes on recycled/reclaimed systems shall be painted purple.

2.11 FDC AND WET STAND PIPE CAPS AND PLUGS

- A. Provide Knox caps or plugs for all new FDC and wet-stand pipes included in the project. Coordinate the number of Knox keys as well as the key signage location with the local Fire Marshal.

2.12 FIRE HYDRANTS

- A. Provide two 2-1/2 inch and one 4-1/2 inch outlets with a 6-inch nominal inside diameter inlet and break-away type bolts. Hydrant shall have a working pressure of 250 psi and shall conform to AWWA C502 or C503, and be UL listed and FM approved. Provide hydrants of one manufacturer. Clow 800 series, Mueller, ACIPCO, or approved equivalent, subject to approval by the local water department and Fire Marshal. Hydrants on recycled/reclaimed systems shall be painted purple.

2.13 THRUST BLOCKS AND PIPE RESTRAINTS

- A. Blocks: Provide thrust blocks in accordance with NFPA 24 Standards. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
- B. Pipe Restraints: Provide thrust restraint systems for fittings and joints as required or as indicated on the Plans.
1. For mechanical joint fittings and joints: Pipe restraints shall be "Mega-Lug" pipe restraint system by EBBA Iron, Inc., or approved equivalent.
 2. For push-on joint fittings and joints: Pipe restraints shall be "Field-Lok" gaskets by U.S. Pipe, or approved equivalent.

- C. Thrust blocks, gravity blocks, or mechanical pipe restraints may be used at Contractor's option, unless otherwise indicated on the Plans.
- D. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.
- E. Where depth or location of water piping, existing utilities, or other structures prohibit the use of standard thrust blocks, gravity blocks or mechanical pipe restraints may be used. Conform to NFPA 24 Standards.

2.14 TAPPING SLEEVES AND TAPPING VALVES

- A. Sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equivalent.
- B. Tapping valves shall have flanged inlet, Class 125, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equivalent.

2.15 SERVICE SADDLES AND CORPORATION STOPS

- A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
 - 1. For DIP: Provide bronze or stainless steel body, double strap type with a 200 psi maximum working pressure. Mueller BR2 Series, Ford, or approved equivalent.
 - 2. ~~For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equivalent.~~
 - 3. For PE: Provide stainless steel body, double strap style with a 250 psi maximum working pressure. Ford FSP-323, or approved equivalent.
- B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi. and suitable for the working pressure of the system.
 - 1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
 - 2. Threaded ends shall conform to AWWA C800.
 - 3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
 - 4. Mueller H-15000 Series with "CC" threads and a copper flare straight connection outlet, Ford, or approved equivalent.

2.16 IDENTIFICATION MATERIALS AND DEVICES

- A. Marker Tape: Provide marker tape consisting of metallic foil bonded to plastic film not less than 2-inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1-mil. thick. The tape shall be identified with lettering,

not less than 3/4-inch high, "CAUTION: WATER MAIN BELOW," repeated at approximately 24-inch intervals.

- B. Tracer Wire for Nonmetallic Piping: Provide 12 gage, coated copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

2.17 SETTLEMENT JOINTS

- A. Flexible joints shall be used if a differential settlement of greater than 2-inches is anticipated. Flexible joints shall be ductile iron rated, rated for 350 psi working pressure and FM approved. Megalug Flextend or approved equivalent.
- B. Provide pipe restraint on either side of flexible joint to resist thrust forces.

2.18 CORROSION PROTECTION

- A. In soils with low resistivity, high sulfides, high/low ph, redox potential and/or poor surrounding drainage conditions, or as indicated in the Contract Documents, encase underground pipe and appurtenances in 4-mil, high-density cross-laminated (HDCL) polyethylene film or 10-mil linear low-density (LLD) polyethylene film in accordance with AWWA/ANSI C105/A21.5. U.S. Pipe, ACIPCO, or approved equivalent.

2.19 WATER STORAGE TANKS

- A. Provide bolted steel storage tank, size as specified or shown in the Plans, in conformance with AWWA D103. Superior Tank, or approved equivalent.
 - 1. Steel sheets shall conform to ASTM A570 Grade 33 with minimum yield strength of 33,000 psi.
 - 2. Steel plates shall conform to ASTM A36 with minimum yield strength of 36,000 psi.
 - 3. Rolled structural shapes shall conform to ASTM A36.
 - 4. Galvanized bolts, nuts, washers, and gaskets will be per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where water service is being installed.
- B. Do not begin installation until unsatisfactory conditions have been corrected.

3.2 LOCATION OF WATER LINES

- A. Where the location of the water line is not clearly defined by dimensions on the Plans, do not lay water line closer than 10 feet horizontally from any sewer line.

- B. Where water lines cross under gravity sewer lines, encase sewer line in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing.
- C. Where water lines cross sewer force mains and inverted siphons, install water line at least 2 feet above these sewer lines.
- D. When joints in the sewer line are closer than 3 feet horizontally from the water line, encase sewer line joints in concrete.
- E. Do not lay water lines in the same trench with other utilities.
- F. Install water lines at 3'-0" minimum depth or as detailed on Plans.

3.3 INSTALLATION OF PIPING

- A. Inspection:
 - 1. Before placing in position, inspect pipe for noticeable defects. Clean the pipe, fittings, valves, and accessories, and maintain in a clean condition.
 - 2. Remove fins and burrs from pipe and fittings.
- B. Pipe laying and jointing:
 - 1. Provide proper facilities for lowering sections of pipe into trenches.
 - 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
 - 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 - 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of lying.
 - 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
 - 6. Support pipe at proper elevation and grade.
 - 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
 - 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 - 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
 - 10. Make proper provision for expansion and contraction of pipelines.
 - 11. Keep trenches free of water until joints have been properly made.

12. Do not lay pipe when conditions of trench or weather prevent proper installation.
 13. All fittings shall be blocked with appropriately sized thrust blocks as shown in the Contract Documents.
- C. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
- D. Connections to Existing Lines:
1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
 2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.
- E. The end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads to keep out debris and contamination.

3.4 INSTALLATION OF DUCTILE-IRON PIPING

- A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.
- B. Jointing:
1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
 3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
 - a. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
 - b. Align bolt holes for each flanged joint.
 - c. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.

- d. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
 - e. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
 - f. Use set screwed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the set screwed flange manufacturer.
- 4. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
- 5. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
- C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 10-mil linear low-density polyethylene (LLD) film or 4-mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.
- D. Pipe Anchorage:
 - 1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Construction Documents.
 - 2. Pipe anchorage shall be in accordance with NFPA 24 Standards.

3.5 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Install pipe and fittings in accordance with the requirements of UNI B-3 for the following:
 - 1. The laying of pipe, joining PVC pipe to fittings and accessories.
 - 2. The setting of hydrants, valves, and fittings.
- B. Comply with the recommendations for pipe joint assembly and appurtenance installation in AWWA Manual M23, Chapter 7, "Installation."
- C. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.
- D. Jointing:
 - 1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.

2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
 5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UNI B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly.
 6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
 7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- E. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Construction Documents.
 2. Anchorage shall be in accordance with the requirements of UNI B-3 and in accordance with NFPA 24 Standards for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated on the Construction Documents.

3.6 INSTALLATION OF POLYETHYLENE PIPING

- A. Install pipe, fittings, and appurtenances in accordance with PPI and Manufacturer's Recommendations.
- B. Jointing:
1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
 2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
 3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
 4. Butt fusion:
 - a. Pipe ends shall be faced to establish clean, parallel mating surfaces.

- b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
- c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
- d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
- e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the Manufacturer's recommendations for temperature, pressure, holding, and cooling times.
- f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.

5. Socket fusion:

- a. Mixing manufacturers' heating tools and depth gages will not be allowed unless the tools conform to ASTM F1056.
- b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
- c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
- d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
- e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
- f. Simultaneously remove the pipe and fitting from the tool.
- g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
- h. Hold or block the pipe in place during cooling.

6. Electrofusion:

- a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
- b. Clamp the pipe and fitting at the proper position in the fixture.
- c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
- d. Allow the joint to cool before removing the clamping fixtures.

3.7 INSTALLATION OF VALVES

- A. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
- B. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
- C. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23, Chapter 7, "Installation."
- D. Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.
- E. Provide and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

3.8 INSTALLATION OF VALVE AND METER BOXES

- A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown in the Construction Documents. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxes shall be excavated, plumbed, and backfilled at no additional cost to the [District/Owner].

3.9 INSTALLATION OF HYDRANTS

- A. Install hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.
- B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replaced if needed.
- C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.10 SERVICE LINE CONNECTIONS TO WATER MAINS

- A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.
- B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.
- C. Connect service lines to PVC plastic water mains in accordance with UNI-B-8 and the recommendations of AWWA Manual M231, Chapter 9, "Service Connections."

3.11 INSTALLATION OF BACKFLOW PREVENTERS

- A. Devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.
- B. Bottom of backflow device shall be 12-24" above grade.

3.12 WATER TANKS

- A. Install water tanks per Manufacturer's recommendations in conformance with AWWA D103.

3.13 HYDROSTATIC PIPELINE TESTING

- A. Requirements:
 - 1. After the pipe has been laid and backfilled, perform hydrostatic pressure tests.
 - 2. Do not conduct tests until at least 12 hours have elapsed since pipe lying and at least 5 days have elapsed since placing of concrete thrust blocks.
 - 3. Fill the pipe with water which shall remain without external application of pressure for 24 hours before tests are conducted.
 - 4. Prior to hydrostatic testing, flush pipe system with fresh water until piping is free of dirt and foreign matter.
 - 5. Apply pressure by a pump and measured by a test gage. All necessary apparatus and labor for conducting the pressure and leakage tests shall be furnished by the Contractor.
 - 6. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
 - 7. For pressure test, use a hydrostatic pressure not less than 200 psi for fire water or combined water systems and 1 ½ times operating pressure for domestic water systems. The duration of the test shall not be less than 4 hours with the variation in pressure of not more than 5 psi for the duration of the test.
- B. Leakage Tests:

1. At Contractor's option, leakage tests can be performed at the same time as hydrostatic pressure tests.
2. Leakage rate shall be measured for at least 4 hours with a certified water meter, or other approved method. If requested, meter certification shall be submitted to the District for approval prior to testing.
3. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
4. Leakage at mechanical couplings and joints, tapping sleeves, saddles, flanged joints, and copper piping will not be accepted. Correct any visible leaks.
5. Push-on joints: Test ductile iron pipe for leakage in accordance with AWWA C600 as shown in the following table:

TABLE 1

Allowable Leakage per 1000 feet of DIP Pipeline (Gal/Hr)

Average Test Pressure	Nominal Pipe Diameter - Inches									
(psi)	3	4	6	8	10	12	14	16	18	20
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12

6. When the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
7. Test polyvinyl chloride pipe for leakage in accordance with the recommendations of the Uni-Bell Plastic Pipe Association (UNI) as shown in the following table:

TABLE 2

Allowable Leakage per 1000 feet or 50 joints of PVC Pipeline (Gal/Hr)

Nominal Pipe Size (inches)	Average Test Pressure in Line (psi.)	
	200	250
4	0.38	0.43
6	0.57	0.64
8	0.76	0.85

Nominal Pipe Size (inches)	Average Test Pressure in Line (psi.)	
10	0.96	1.07
12	1.15	1.28
14	1.34	1.50
16	1.53	1.71
18	1.72	1.92
20	1.91	2.14

8. Should any section of new pipe fail to pass either test, locate and repair the defective pipe and repeat the test.

3.14 STERILIZATION AND FLUSHING

A. General:

1. Domestic water lines, mains, and branches by chlorination in accordance with AWWA C601 and as herein specified.

B. Sterilization Methods:

1. Liquid Chlorine Solution Method:

- a. Flush all foreign matter from mains, branch runs, hydrant runs, and installed services.
- b. Introduce liquid chlorine solution at appropriate locations to assure uniform distribution through the facilities at the proper concentration.
- c. Do not use installed copper service lines to convey the concentrated chlorine solution to the mains.
- d. The sanitizing solution shall be retained in the facilities for a period of 24 hours after which each service, hydrant run, branch run and dead end shall be flushed until:
 - i. Residual chlorine is less than 1 part per million.
 - ii. Residual chlorine is no greater than the concentration of chlorine in the water supplied for flushing.
- e. Chlorine shall be a 1 percent solution (containing 10,000 parts per million available chlorine) or shall be obtained by use of dry chlorine in tablet form firmly attached to inside tope of the pipe.
- f. The required concentration of chlorine in the pipe is 50 parts per million. This concentration may be attained by adding 5 gallons of the chlorine solution to 1,000 gallons of water.
- g. The weight of chlorine or chlorine compound required to make a 1 percent chlorine solution is as follows:

TABLE 3

One-Percent Chlorine Solution Mix

AMOUNT OF PRODUCT COMPOUND		QUANTITY OF WATER (in gallons)
High-Test Calcium Hypochlorite (65-70% Cl)	1 pound	7.50
Chlorinated Lime (32-35% Cl)	2 pounds	7.50
Liquid Laundry Bleach (5.25% Cl)	1 gallon	4.25
Liquid Chlorine (100% available chlorine)	0.62 pounds	7.50

2. HTH Tablet Method:

- a. The required concentration of chlorine in the mains may be obtained by the use of HTH tablets as produced by Olin Mathieson in the following quantities or approved equivalent:

TABLE 4

HTH Tablet (70%) Dosage

Number of Tablets Per Length of Pipe

Length of Section	DIAMETER OF PIPE				
	4 inches	6 inches	8 inches	10 inches	12 inches
13 feet	1	2	3	4	6
18 feet	1	2	3	5	6
20 feet	1	2	3	5	7
30 feet	2	3	5	7	10
36 feet	2	3	5	8	12
40 feet	2	4	6	9	14
100 feet	4	9	15	23	30

- b. Tablets are to be fastened to the inside top surface of each length of pipe using "Permatex No. 1" no earlier than the day pipe is laid.
- c. Tablets shall not be installed in the pipe and left overnight before laying and shall not be accessible at any time for casual pilferage by the general public or by children. Tablets shall be stored in a hermetically sealed container.

- d. The new water lines are to be slowly filled with water. Air is to be exhausted from each dead end, branch run, hydrant run, and installed service.
 - e. Water shall be retained for a period of 24 hours, after which each service, hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until:
 - i. Residual chlorine concentration is less than 1 part per million
 - ii. Residual chlorine is no greater than the concentration of chlorine in the water supplied for flushing.
- C. Bacteriological Testing:
- 1. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory certified by the California Department of Health Services as an Environmental Testing Laboratory (ELAP).
 - 2. Samples are to be taken at representative points as required by the District and authorities having jurisdiction.
 - 3. The new water lines shall remain isolated and out of service until satisfactory test results have been obtained that:
 - a. Meet the requirements of the California Department of Health Services, Drinking Water Standards.
 - b. District has accepted the results as indicative of the bacteriological condition of the facilities.
 - c. If unsatisfactory or doubtful results are obtained from the initial sampling, repeat the chlorination process until acceptable test results are reported.

3.15 HYDRANT FLOW TESTING

- A. After completion of the pipe and hydrant installation and service connections, the new hydrants shall be flow tested and results provided to the District's Representative and Engineer. The Contract shall provide the following information:
- 1. Who performed the test.
 - 2. Testing date.
 - 3. Hydrant location.
 - 4. Static pressure (psig).
 - 5. Residual pressure (psig).
 - 6. Flow (gpm).

7. Orifice size (in).

END OF SECTION

SECTION 33 40 00**STORM DRAINAGE****PART 1 – GENERAL****1.1 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to on-site storm drainage excluding portions within five feet of buildings unless otherwise noted. All drainage works shall be constructed to the San Lorenzo Valley Water District standards
- B. Contractor shall provide all labor, equipment, and materials, unless otherwise noted.
- C. Related Sections:
 - 1. Section 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING.

1.2 SUBMITTALS

- A. Comply with the requirements of Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Product Data: Manufacturer's literature and data, including, where applicable, pressure rating, capacity, labels, or other markings on equipment made to the specified standards for materials, for the following:
 - 1. Piping and fittings.
 - 2. Jointing material.
 - 3. Gaskets, couplings, and sleeves.
 - 4. Precast concrete structures, including manholes and drainage inlets.
 - 5. Concrete mix design for precast and cast-in-place structures.
 - 6. Manhole lids and frames.
 - 7. Manhole steps.
 - 8. Pipe to Structure Connection Seal.
 - 9. Drainage inlet grates and frames.

1.3 QUALITY ASSURANCE

- A. Comply with the latest editions of the following Standards and Regulations:
 - 1. American Society for Testing and Materials (ASTM).
 - a. A74: Cast Iron Soil Pipe and Fittings.

- b. A615: Deformed and Plain Billet-Steel Bars for Reinforcement.
 - c. B32: Solder Metal.
 - d. C76: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - e. C150: Portland Cement.
 - f. C478: Precast Reinforced Concrete Manhole Sections.
 - g. C494: Chemical Admixtures for Concrete.
 - h. C920-02: Elastomeric Joint Sealants.
 - i. D2241-00: Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - j. D2680-01 Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
 - k. D2729: Perforated PVC Drain Pipe.
 - l. D3034-00: Type PSM Polyvinyl Chloride (PVC) Sewer pipe and Fittings.
 - m. F1336-02: Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
2. California Department of Transportation (Caltrans): Standard Specifications:
- a. Section 51: Concrete Structures.
 - b. Section 52: Reinforcement.
 - c. Section 55: Steel Structures.
 - d. Section 66: Corrugated Metal Pipe.
 - e. Section 70: Miscellaneous Facilities.
 - f. Section 72: Slope Protection.
 - g. Section 75: Miscellaneous Metal.
 - h. Section 90: Portland Cement Concrete.
3. American Association of State Highway and Transportation Officials (AASHTO) for H20 Loading.
4. American Concrete Institute (ACI).
5. Other authorities having jurisdiction.
- B. System Description: Grades and elevations are to be established with reference to the benchmarks referenced on the Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

C. Delivery and Storage

6. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
7. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
8. Cement, Aggregate, and Reinforcement: As specified in Section 03 30 00 – CAST-IN-PLACE CONCRETE.

D. Handling

9. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

PART 2 – PRODUCTS

2.1 PIPING

- A. Polyvinyl Chloride (PVC) Pipe: PVC pipe conforming to ASTM D3034, SDR 26 with bell-and-spigot type of rubber gasket joints. Bells shall be integral with pipe. Spigot end pipe with separate double hub couplings is not acceptable.
- B. Reinforced Concrete Pipe (RCP): RCP shall conform to ASTM C76 with tongue-and-groove or bell-and-spigot joints. Unless indicated otherwise on the plans, all reinforced concrete pipe shall be Class III, 1350-D pipe.
- C. High-Density Polyethylene (HDPE) Pipe: HDPE Pipe shall conform to AASHTO M294 Type S. Acceptable for use in non-vehicular areas ONLY.
- D. Polyethylene Pipe (PE): PE 4710, Pressure Class 160, DR 13.5, conforming to AWWA C906. Driscoplex 4000/4100, or approved equivalent.
- E. Perforated Pipe: PVC conforming to ASTM D2729 or HDPE SDR 17 conforming to AWWA C906

2.2 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Drawings and shall conform to Sections 70-4.02 of the Caltrans Standard Specifications and to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Type II cement.
- B. Frames and covers shall be cast iron conforming to Section 75-2.02B of the Caltrans Standard Specifications. Manhole covers shall have the words "STORM

DRAIN” in letters not less than 2-inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

- C. All interior concrete surfaces shall be coated with Xypex Concentrate or approved equivalent. Use of a water-resistant admix such as “Xypex Crystalline” is acceptable, at Contractor’s option.
- D. Frames and grates for manholes and catch basins shall be match-marked in pairs before delivery to the job site. Grates shall be ductile iron conforming to Section 75-2.02B of the Caltrans Standard Specifications. The grates shall fit into their frames without rocking. Grates shall have a maximum opening of one-half inch between bars, unless otherwise noted in the Drawings. All drainage inlets shall be marked with a stencil or permanent label reading “NO DUMPING FLOWS TO CREEK.”
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Drawings. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.
- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Section 90 and as herein specified. The concrete shall be minor concrete. The grading of the combined aggregate shall conform with the Caltrans requirements of the 1/2-inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by Test Method No. Calif. 520. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.

2.3 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations and/or cast-in-place concrete structures.
 - 1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
 - 2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C-923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C-923.
 - 3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.

4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.4 CLEAN-OUTS

- A. A box shall be provided for each clean-out. Boxes shall be pre-cast concrete with cast iron frame and cover marked "STORM DRAIN"; Christy G05 or approved equivalent.

2.5 CULVERT AND OUTFALL HEADWALLS

- A. All headwalls shall be constructed in conformance with Caltrans Standard Plans as indicated.

PART 3 – EXECUTION

3.1 PIPE INSTALLATION

- A. Pipe shall be installed in conformance with Section 31 23 33 – TRENCHING, BACKFILLING AND COMPACTING, and manufacturer's recommendations. HDPE pipe shall be installed in conformance with ASTM D2321 and as recommended by the pipe manufacturer. HDPE pipe is acceptable for use in non-vehicular areas ONLY.
- B. Pipe laying:
 1. No pipe shall be laid until the Geotechnical Engineer inspects and approves the conditions of the bottom of the trench.
 2. Pipe laying shall proceed "up grade" with the spigot section of the bell-and-spigot pipe pointing in the direction of the flow.
 3. Each section of pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line.
 4. Pipe shall not be laid when the condition of the trench or the weather is unsuitable.
- C. Debris Control:
 1. The interior of the sewer pipe shall be kept clean of dirt and debris at all times. When work is not in progress, open ends of pipe and fittings shall be plugged.
 2. Where clearing after laying is difficult because of small pipe size, a suitable swab or squeegee shall be kept in the pipe and pulled forward past every joint immediately after joining has been completed.

3.2 POURED-IN-PLACE CONCRETE

- A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of the Caltrans Standard Specifications.

- B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Drawings, exposed surfaces of structures shall be Class 1 surface finish.
- C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the District Representative has approved the forms and reinforcement.
- D. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.3 PIPELINE FLUSHING

- A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning. Reclaimed water shall be used where available.

3.4 DEFLECTION TESTING

- A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.
- B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.
- C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.
- D. Pull-Through Device:
 - 1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
 - a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
 - b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
 - 2. Ball, cylinder, or circular sections shall conform to the following:
 - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

- b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
 - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
- 3. Pull-Through Device:
 - a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 - b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- E. Deflection measuring Device:
 - 1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
 - 2. Obtain approval of deflection measuring device prior to use.
- F. Deflection Measuring Device Procedure:
 - 1. Measure deflections through each run of installed pipe.
 - 2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
 - 3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.
- G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.5 CLEANING

- A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.6 VIDEO INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the storm drainage line shall be

televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original DVD and log sheets shall be provided to the District.

1. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
 - a. Low spot (1 inch or greater - mainlines only).
 - b. Joint separations (3/4 inch or greater opening between pipe sections).
 - c. Cocked joints present in straight runs or on the wrong side of pipe curves.
 - d. Chips in pipe ends.
 - e. Cracked or damaged pipe.
 - f. Dropped joints.
 - g. Infiltration.
 - h. Debris or other foreign objects.
 - i. Other obvious deficiencies.
 - j. Irregular condition without logical explanation.

END OF SECTION