

SECTION 02300 (31 2000) – EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, filling, and backfilling for structures, pavement, and outparcels.
2. Trenching and backfilling for utilities.
3. Dewatering.
4. Boring under crossings.

B. Related Requirements:

1. Section 02318 - Rock Excavation.
2. Section 02340 - Soil Stabilization.
3. Section 02370 - Erosion Control and Sedimentation. Temporary and permanent erosion control.
4. Section 02375 - Stone Protection. Rip-rap stone for slope protection.
5. Section 02900 - Planting
6. Division 3 - Subbase requirements for granular subbase below building slabs.
7. Appendix B – Testing, Inspection, and Observation by Owner.

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM)

1. ASTM C136 - Particle Size Analysis of Soil.
2. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 Kn.m/m³)).
3. ASTM D2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedures).
5. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
6. ASTM D4829 – Standard Test Method for Expansion of Soils.
7. ASTM D5778 – Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils.
8. ASTM D6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. State of California Department of Transportation (CALTRANS):

1. 2018 Standard Specifications

D. City of Stockton

1. City of Stockton Standard Specifications, latest edition

E. National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code.

F. American Water Works Association (AWWA)

1. AWWA C200 - Standard for Steel Water Pipe - 6 In. (150 mm) and Larger.
2. AWWA C206 - Field Welding Of Steel Water Pipe.

1.3 DEFINITIONS

- A. Satisfactory Materials: ASTM D2487 soil classification groups GW, GP, GM, SW, SP, SM, ML, CL, [CH,] [MH,] [SC,][GC,] or a combination of these group symbols.
 - 1. Fill material shall further conform to the plasticity index and liquid limits (PI and LL) specified in Paragraph FILLING hereinafter.
 - 2. Satisfactory materials shall be free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings.
 - 3. Satisfactory materials shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.
 - 4. Unless specifically stated otherwise in "Foundation Subsurface Preparation" on the Drawings, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of satisfactory materials to be used as fill in specified areas:

<u>Location</u>	<u>PI</u>	<u>LL</u>
Building area (below upper four feet)	10	30
Building area (upper four feet)	10	30
Areas outside the building pad including outparcels	10	30

- B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
 - 1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory materials which contains root and other organic matter or frozen material. The CTL shall be notified of any contaminated materials.
 - 2. Unsatisfactory materials also include satisfactory materials not maintained within optimum and 3 percent above optimum moisture content at time of compaction.
- C. Rock: Rock shall be as defined in Section 02318.

1.4 SUBMITTALS

- A. Submit 30-pound sample of each type of off-site fill material that is to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.
- B. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Owner.
- C. Submit Dewatering Plans upon request by Owner.
- D. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.
- E. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.
- F. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.

PART 2 - PRODUCTS

2.1 SOIL AND ROCK MATERIALS

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- A. Fill and Backfill. Satisfactory materials excavated from the site. The following supersedes Caltrans Section 19-3.03I in total: CDF will be accepted in lieu of the standard backfill specifications. It shall be mandatory in all situations where the prevention of subsequent settlement after placement of backfill is required and in trenches eight (8) inches wide or less.
- B. Imported Fill Material: Satisfactory material provided from offsite borrow areas when sufficient satisfactory materials are not available from required excavations.
- C. Trench Backfill: ASTM D2321 unless otherwise specified or shown on the drawings.
- D. Building Subbase Material: Subbase for building and appurtenances slabs on ground is specified in Section 03300 or 03312 as applicable.
- E. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No.200 sieve.
- F. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No.8 sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No.4 sieve.
- H. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial. Topsoil shall be as further defined in Section 02900 – Planting.

2.2 APPURTENANT MATERIALS

- A. Stabilization fabrics and geogrids: As specified in Section 02340.
- B. Filter and drainage fabrics: As specified in Section 02340.
- C. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on The Drawings.
- D. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet, whichever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:
 - 1. Natural Gas or Propane – Yellow.
 - 2. Electric – Red.
 - 3. Telephone – Orange.
 - 4. Water – Blue.
 - 5. Sanitary Sewer – Green.

2.3 EQUIPMENT

- A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.4 SOURCE QUALITY CONTROL

- A. Laboratory testing of materials proposed for use in the project shall be by the Wal-Mart Construction Testing Laboratory at no cost to Contractor. The Contractor shall provide samples of material obtained off-site.

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- B. Perform California Bearing Ratio (CBR) tests in outparcels and areas to receive pavement for each type of material that is imported from off-site. CBR value shall be equal to or above pavement design subgrade CBR value indicated on Construction Drawings.
- C. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:
 1. Moisture and Density Relationship: ASTM D1557.
 2. Mechanical Analysis: AASHTO T88 or ASTM D422.
 3. Plasticity Index: ASTM D4318.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.
- B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.
- C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.
- D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- E. Remove from site, material encountered in grading operations that is unsatisfactory material or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in manner satisfactory to Owner and local governing agencies. Backfill areas with layers of satisfactory material and compact as specified herein.
- F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
 1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
 2. After drainage of low area is complete, remove muck, mud, debris, and other unsatisfactory material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
 3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation. Material shall be inspected and, if found to be satisfactory for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building subgrade or within 5'-0" of perimeter of building subgrade, paving or outparcel subgrade. If, after observation, material is found to be unsatisfactory, it shall be removed from site.
- G. Locate and identify utilities that have previously been installed and protect from damage.
- H. Locate and identify existing utilities that are to remain and protect from damage.
- I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on the Drawings.
- J. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on the Drawings.
- K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted as specified in Section 02340.

3.2 DEWATERING

A. General:

1. Dewatering activities shall conform to applicable provisions in 02370.
2. Provide dewatering systems as required for excavations.
3. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability.
4. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.
5. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.
6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
9. Install wells or wellpoints, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples by the Owner. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.
10. Control grading around excavations to prevent surface water from flowing into excavation areas.
11. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

B. Design:

1. Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:

1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
2. Remove subgrade materials rendered unsatisfactory by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:

1. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.
3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails.

If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.

4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components and any other work required to maintain excavation in dewatered condition.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.3 TOPSOIL EXCAVATION

A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

B. Strip topsoil from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed by Owner. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Remove excess topsoil from site unless specifically noted otherwise on the Drawings.

3.4 GENERAL EXCAVATION

A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building subgrades.

E. Place satisfactory excavated material into project fill areas.

F. Unsatisfactory excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.

G. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.5 ROCK EXCAVATION

A. Rock excavation is specified in Section 02318.

3.6 TRENCHING EXCAVATION FOR UTILITIES

A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to

avoid point-bearing. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace over-excavation with satisfactory material and dispose of unsatisfactory material.

- B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.
- C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.
- D. Remove excavated materials not required or not satisfactory as backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 02220.
- E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.
- F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.
- G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- H. Trench width below top of pipe shall not be less than 12 inches nor more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.
- I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
 - 1. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
 - 2. Sanitary Sewer: Elevations and grades as indicated on the drawings and as specified in Section 02535.
 - 3. Storm Sewer: Elevations and grades as indicated on the Drawings.
 - 4. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
 - 5. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
 - 6. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
 - 7. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

3.7 SUBGRADE PREPARATION

- A. Scarification and Compaction: The exposed subgrade soil should be scarified, moisture conditioned, and compacted. The depth of scarification of subgrade soils and moisture conditioning of the subgrade is highly dependent upon the time of year of construction and the site conditions that exist immediately prior to construction. If construction occurs during the winter or spring, when the subgrade soils are typically already in a moist condition, scarification and compaction may only be 8 inches. If construction occurs during the summer or fall when the subgrade soils have been allowed to dry out deeper, the depth of scarification and moisture conditioning may be as much as 18 inches or more. The geotechnical engineer should be present to observe the

exposed subgrade and specify the depth of scarification and moisture conditioning required subsequent to grading cuts and prior to placing fill.

Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified, moisture conditioned and compacted to at least 95% Maximum Dry Density as obtained by the Standard Proctor Method (ASTM 1557), moisture conditioned within optimum and 3% above the optimum moisture content.

- B. Proofrolling: Subgrades shall be proofrolled to detect areas of insufficient compaction and soft pocket, or areas of excess yielding. Proofrolling shall be accomplished by making minimum of two complete passes with fully-loaded tandem-axle dump truck with a minimum weight of 20 tons, or approved equal, in each of two perpendicular directions. Limit vehicle speed to three mph. Areas of failure such as soft spots, unsatisfactory soils, and areas of excessive pumping or rutting shall be excavated and re-compacted as specified herein. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner. Subgrade exposed longer than 48 hours or on which precipitation has occurred shall be re-proofrolled. Document proofrolling procedure, specific locations, deficiencies, and corrective measures for review by Owner or Owner's CTL upon request.

3.8 FILLING

- A. Fill areas to contours and elevations shown on the Drawings with materials deemed satisfactory.
- B. Place fills in continuous lifts specified herein.
- C. Fill within proposed building subgrade, paving subgrade, and outparcel subgrades shall not contain rock or stone greater than 6 inches in any dimension.
- D. Unless otherwise specified for rock fill, rock or stone less than 6-inches in largest dimension may be used in fill below structures, paving, outparcels, and graded areas, up to 24 inches below surface of proposed subgrade or finish grade of graded areas when mixed with satisfactory material. Rock or stone less than 2 inches in largest dimension may be used in fill within the upper 24 inches of proposed subgrade or finish grade of graded areas when mixed with satisfactory material.
- E. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 10 inches loose measure and compacted as specified hereinafter.
- F. Material imported from off-site shall have CBR or LBR value equal to or above pavement design subgrade CBR or LBR value indicated on The Drawings.
- G. Building area subgrade pad shall be that portion of site directly beneath and 5 feet beyond building and appurtenances, including limits of future building expansion areas as shown on the Drawings.
- H. Prepare building area subgrade pad in strict accordance with "Foundation Subsurface Preparation" as shown on the Drawings. The Foundation Subsurface Preparation provisions shall take precedence over the provisions of this section whenever duplication or conflict occurs.

3.9 ROCK FILL

- A. Rock fill shall include on-site excavated material classified as rock excavation as specified in Section 02318. Rock fill may be utilized in fill up to 48 inches below top of subgrade or finish grade of graded areas outside the proposed building, paving, and outparcel areas. Rock fill shall consist of rock having a maximum dimension not greater than 12 inches in any dimension. Rock fill shall be placed in successive horizontal layers of loose material having a thickness of approximately the maximum size of the larger rock in the lift, but not greater than 12 inches. Each layer of material shall be spread uniformly, completely saturated, and compacted. Shot rock shall not be dumped into place, but shall be distributed in horizontal lifts by blading and dozing in such a manner as to ensure proper placement into final position in the embankment. Voids shall be filled with finer material including shot rock fines and limited soil fines during the spreading operation. Successive layers shall not be placed until all

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voids of the current lift are filled and the lift is compacted. Each successive layer of material shall adequately bond to the material on which it is placed. Compaction shall be accomplished with vibratory compactors, heavy rubber-tired rollers, or steel-wheeled rollers. Compaction shall be by uniform passes of compaction equipment in sufficient number of passes, but not less than two passes, such that no further consolidation is evident.

3.10 PIPE BEDDING

- A. Excavate trenches for pipe or conduit to 4 inches below bottom of pipe and to the width as specified herein. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel.
- B. Place geotextile fabric as specified on the Drawings and in accordance with Section 02340.

3.11 TRENCH BACKFILLING

- A. Materials used for trench backfill shall comply with requirements as specified herein.
- B. Backfill and compact in accordance with fill and compaction requirements in ASTM D2321 unless otherwise shown on the drawings.
- C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.
- D. Backfill trenches to contours and elevations shown on the Drawings.
- E. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.12 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

- A. When indicated by the Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.
- B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density in accordance with ASTM D1557 obtained at optimum moisture as determined by AASHTO T180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.
- C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.
- D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area.
- E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt coating in accordance with and governing authorities.
- F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206.
- G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.13 COMPACTION

- A. Compact as follows:

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<u>Location</u>	Percent of Maximum Laboratory Density <u>ASTM D1557</u>
Subgrade & Fill below Structures, Pavement and Outparcels	95
Subgrade & Fill in All other Areas	92

- B. Maintain moisture content between optimum and 3% above the optimum moisture content of fill materials to attain required compaction density.
- C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.
- D. Corrective Measures for Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner.

3.14 MAINTENANCE OF SUBGRADE

- A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.
- C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR or LBR equal to or better than that specified on the drawings. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.
- D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.15 BORROW AND SPOIL SITES

- A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.16 FINISH GRADING

- A. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.
- B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas, outparcels, and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sodding, and seeding requirements refer to Section 02900.
- C. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation.

3.17 FIELD QUALITY CONTROL

- A. Field quality control shall be the responsibility of the Contractor in accordance with Section 01452. Except for specified mandatory testing, field quality control testing and inspection shall be at the discretion of the Contractor

as necessary to assure compliance with Contract requirements. Owner T&I specified below shall not be considered a substitute for the Contractor's responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

3.18 OWNER TESTING AND INSPECTION (T&I) AND OBSERVATION

- A. The Owner will perform testing and inspection (T & I) as specified in Appendix B (Section 02300).
- B. Civil Engineering Consultant Observation: The Owner's Civil Engineering Consultant (CEC) will perform special observations as specified in Appendix B (Section 01456).

END OF SECTION