

SECTION 31 00 00
EARTHWORK AND GRADING
Construction Specification

PART 1 GENERAL

1.1 PURPOSE:

- 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 Local City or County Public Works Agency, and the State of California Department of Transportation. Earthwork includes, but is not limited to, the following:
1. Grading.
 2. Material.
 3. Excavation.
 4. Filling and backfilling.
 5. Soil Sterilant.
 6. Termiticide.
 7. Provide labor, material and equipment and services necessary to complete the excavations, recompaction and finish grading as specified and indicated on plans.
 8. Obtain permit from local authorities.
 9. Provide surveying for grading operations.
 10. Provide shoring design.
 11. Provide dewatering operations.
 12. Provide Site grading, cut, fill and finish.
 13. Provide excavation and backfill for filling construction, including trenches within building lines.
 14. Preparation for subgrade for building slabs, walks, pavements, and landscaping.
 15. Provide distribution of stockpiled topsoil.
 16. Provide sub-base course for walks and pavements.
 17. Provide sand and gravel for capillary break/moisture barrier under building slabs.
 18. Provide sub-surface drainage backfill for walls and trenches.
 19. Provide Engineered fills for building slabs and foundations.
- B. The work includes removal and legal disposal off the site of debris, rubbish and other materials resulting from clearing and grubbing operations.
- C. Work specified in Related Sections:

1. Section 31 10 00 – SITE PREPARATION.
 2. Section 31 23 33– TRENCHING, BACKFILLING, & COMPACTING.
- D. San Mateo County Community College District is strongly committed to promoting sustainability throughout their campus projects. Section 01 81 13 Sustainability of the Design Standard provides guidelines and recommendations for implementing sustainability strategies. Where relevant, specific sustainability criteria is noted in this section; however, each project team should review and cross reference that front section while developing the specific project and its documentation. Each discipline shall confirm that specific performance and manufacturer information provided in the specification section is in alignment with code requirements, LEED criteria, and any other goals for sustainability.

1.2 DEFINITIONS

- A. Engineered Fill:
1. Soil or soil-rock material approved by Project Manager and transported to the site 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 specification requirement.
- 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, or topsoil materials.
- E. Borrow: 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. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below top soil, rock base course, or drainage fill.

1.3 SYSTEM DESCRIPTION

- A. Requirements:
1. Grades and elevations are to be established with reference to bench marks referenced on Plans.
 2. Maintain Engineering markers such as monuments, bench marks and location stakes. If disturbed or destroyed, replace by a licensed surveyor at the expense of the contractor
- B. Criteria:

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.
 3. Blasting will not be permitted.
 4. Remove material in an approved manner.
- C. Shoring Design: Where shoring is required by State Law or determined by the Contractor to be necessary, 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 plans 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 Project Manager licensed by the State of California.
- D. 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 two feet below the 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.
- E. Safety:
1. The College of San Mateo campus has a history of serpentine rock. The Contractor shall take all necessary precautions to eliminate the exposure of workers, students, staff and the public to asbestos fibers, including but not limited to: dust control measures and measures included in Section 93106 and Section 93105 of California Code of Regulations, Title 17.

1.4 SUBMITTALS

- A. Comply with provisions of Section 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 (CDT Section 26).
 - 3. Storm Water Pollution Prevention / Erosion Control Plans.
 - 4. Permit/Notice of Intent (N.O.I.), for discharge of storm run-off from the construction site.
 - 5. Soil Sterilant.
 - 6. Termiticide.
- C. Test Reports: Submit following reports for import material directly to Project Manager 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. Report of actual unconfined compressive strength and/or results of bearing test of each strata tested.
 - 5. At least one laboratory optimum moisture - maximum dry density curve for each type of soil encountered.
- D. Shoring Design: Submit 4 copies of shoring design and shop plans; none will be returned unless a concern is observed.
- E. Submit description of dewatering methods proposed for use.
- F. Submit description of vibratory compactors proposed for use when requesting placement of backfill and fill materials in layers greater than 6 inches thick.
- G. Samples:
 - 1. 20-lb. Samples, sealed in air-tight containers, of each proposed fill and backfill soil material from on-site or borrow sources.
 - 2. 12-by-12 inch sample of filter fabric.

1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Comply with State of California Business and Transportation Agency, Department of Transportation (Caltrans) "Standard Specifications."
 - 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 Mateo Department of Public Works, Standards and Specifications and Plans.
- B. Soil Testing:
1. District will 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 Testing and Inspection.
- C. Codes and Standards:
1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
 2. Storm Water Pollution Prevention and Monitoring Plan to be prepared by others.
 3. Statewide General Permit to Discharge Storm Water associated with construction activity.
- D. Comply with the latest editions of the following Standards and Regulations:
1. American Society for Testing and Materials (ASTM):
 - a. C33: 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 (CDT) Standard Specifications:
 - a. Section 17:
 - b. Section 18:
 - c. Section 19: Earthwork.
 4. CAL/OSHA, Title 8.
 5. Other authorities having jurisdiction
- E. Geotechnical Engineering Services:
1. Geotechnical Engineer will observe grading observations during preparation offsite, excavation, and compaction of fill materials.
 2. Make visits to site to familiarize himself or herself generally with progress and quality of work.
 3. Make field observations and tests to enable him or her 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.
- F. Examine conditions exposed in foundation excavations.

1.6 SITE INFORMATION

- A. Soil borings and other exploratory operations may be made by Contractor at no cost to District. Submit proposed boring locations for review prior to performing the work.

1.7 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 Project Manager and at no additional cost to the District.
- C. Comply with provisions of Section 01500 - Temporary Facilities and Controls where necessary to control dust and noise on and near the work caused by operations during performance of the Work.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements:
1. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water.
 2. Provide adequate temporary drainage to prevent erosion.
 3. After interruption, reestablish compaction specified in last layer before resuming work.

4. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to District.
 5. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of straw bale dikes, filter fiber dams, or other methods as approved by the Project Manager.
- B. Barricade open excavations and post with warning lights:
1. Comply with requirements of Section Temporary Facilities and Controls.
 2. Operate warning lights as recommended by authorities having jurisdiction.
 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. At Contractor's option, 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 all excess soils materials by legally approved methods to disposal areas.
- F. Coordinate with the Project Manager.
- G. Sufficient topsoil and fill material shall be retained from the site to complete project requirements.
- H. Any additional topsoil and fill requirements shall be the responsibility of the Contractor.
- I. Use of explosives will not be permitted.
- J. 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. 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 Palliative," of the CDT Standard Specifications and as recommended and/or specified by the manufacturer. Contractor shall assume liability for all claims related to dust and dirt nuisances.

1.9 EXISTING UTILITIES

- A. The Contractor shall 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 Project 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 utility Project Manager immediately for directions.

- D. Cooperate with the District and public and private utility companies in keeping their respective services and facilities in operation.
- E. 2. Repair damaged utilities to the satisfaction of the utility District for public utilities and the Project manager for private utilities.
- F. Do not interrupt existing utilities serving facilities occupied and used by the District or others, except when permitted in writing by Project Manager and then only after acceptable temporary utility services have been provided.

1.10 SEQUENCING AND SCHEDULING

- A. The sequence of operations shall be reviewed by the Project Manager prior to commencement of any work.
- B. Coordinate operations with relocation of existing utilities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. General:
 - 1. Fill material will be subject to approval of the Geotechnical Engineer.
 - 2. For approval of imported fill material, notify the Project Manager at least 7 days in advance of intention to import material, designate 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 Geotechnical Engineer to determine the suitability of these soils.
- B. Engineered Fill Material: Soil excavated from site or imported conforming to requirements for fill material.
 - 1. Imported materials should have a plasticity index not less than 5 nor greater than 15, as determined by ASTM D4318; and expansion index not exceeding 20, as determined by UBC Specification 29-2; and a particle size not exceeding 3 inches as determined by ASTM D422.
- C. 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, sidewalks, and slabs.
 - 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.

- D. Sand: Clean, well-graded fine to coarse sand with not more than 2 percent passing the #200 sieve based on wet sieve analysis.
1. Provide 2-inch layer under building slabs on grade.
 2. Provide layer at least two feet wide (thick) against embedded walls.
 3. Provide at other locations indicated.
 4. Where coarse sand is required, provide sand no finer than No. 40 sieve.
- E. Graded Rock Base:
1. Bedding for utility piping: Washed, uniformly graded mineral aggregate ASTM D448 with percentage composition of dry weight conforming with following limits:
 2. Passing 1-inch Sieve: 100 percent.
 3. Passing 3/4-inch Sieve: 90-100 percent.
 4. Passing No. 4 Sieve: 0-10 percent.
- F. Base at Slab-on-Grade: As specified in the geotechnical report for this project.
1. Absorption of water to saturated-surface dry condition shall not exceed 3 percent of oven-dry weight of a sample.
- G. 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.
- H. Imported Fill Requirements: Imported fill, where required, shall be non expansive granular soil, free of organic matter and deleterious substances. Imported fill material shall conform to the following requirements:
1. Grading:

U. S. Sieve Size	Percentage Passing Sieve
2 ½ inch	100
No. 8	25-45
No. 200	0-10
 2. Be thoroughly compactable without excessive voids.
 3. Meet the following plasticity requirements:
 - a. Maximum Plasticity Index of 12, as determined by ASTM D4318.
 - b. Maximum Liquid Limit of 35, as determined by ASTM D4318
- I. 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 Engineer.
- J. Pea Gravel: 3/8 inch to ½ inch washed, uncrushed gravel. Use at drainage pipe and at other locations indicated.

- K. 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.
 - 1. Grab Tensile Strength (ASTM D4632): 100 lb.
 - 2. Apparent Opening Size (ASTM D4751): #100 U.S. Standard sieve.
 - 3. Permeability (ASTM D4491): 150 gallons per minute per square foot.
- L. Drainage Pipe:
 - 1. Perforated corrugated plastic drainage tubing meeting ASTM F405, with continuous integral nylon filter screen.
 - 2. Acceptable Manufacturers and Products: JM Eagle "SDR 35 PVC Perforated Pipe," PWPipe "PVC Perforated Pipe"
 - 3. Provide couplings, elbows and other fittings as recommended by pipe manufacturer.
- M. 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. In the event discrepancies are found, immediately notify the Project Manager in writing, indicating the nature and extent of differing conditions.
- C. No earthwork shall be performed without physical presence or acceptance of the Geotechnical Engineer.
 - 1. The Geotechnical Engineer's acceptance is required by these specifications; notify the Project Manager at least 48 hours prior to commencing any phase of earthwork.
 - 2. No phase of work shall proceed until prior phase has been accepted by the Geotechnical Engineer.
 - 3. Work shall not be covered up or continued until acceptance of the Geotechnical Engineer shall give written notice of conformance with the specifications upon completion of grading.

3.2 COMPACTING

- A. Compact by power tamping, rolling or combinations thereof as accepted by the Geotechnical Engineer.
- B. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping.

- C. Scarify and recompact any layer not attaining compaction until required density is obtained.
- D. Compaction by flooding, ponding or jetting will not be permitted, unless specifically accepted by the Geotechnical Engineer.

3.3 HAZARDOUS MATERIALS

- A. If any materials are encountered that may be hazardous (as defined in Section 25117 of the California Health and Safety Code), inform the Project Manager verbally within 24 hours and in writing within 2 business days. Upon discovery, material is to remain undisturbed until investigation by Project Manager 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.

3.4 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 buried utility and irrigation lines, and other matter determined by the Geotechnical Engineer 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. Retain on the site all trees and shrubs, unless otherwise indicated on the plans as existing trees to be removed.
 - d. Remove or fill existing basements left from removed structures as appropriate to areas. Compact in accordance with requirements of these specifications.
 - e. Removed material shall become property of the Contractor and shall be removed from site, unless otherwise indicated on the plans or specified herein.
 - f. Holes resulting from removal of underground obstructions that extend below finish grades shall be cleared and backfilled with Engineered fill.
- C. Existing Trees to remain:
 - 1. Verify the locations of existing trees to be preserved.
 - 2. Replace existing trees to remain that are damaged during construction at no additional cost to the District and provide replacement specimens of same species per coordination with the Project Manager.
 - 3. 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.
 - 4. Contact District Arborist 48 hours prior to cutting any trees

- D. 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.

3.5 EXISTING UTILITIES

- A. Protect existing utilities that are to remain in operation as specified.
- B. Abandon or completely remove from the site existing underground utilities as indicated on the plans in order to complete the work. See Section 02200 – SITE PREPARATION.
- 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.
- E. Use hand or light equipment for excavating immediately adjacent to or for excavations exposing a utility or buried structure.
- F. 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.
- G. Preserve and irrigate removed sections of existing turf for salvage and/or replacement and restoration.
- H. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
- I. Report damage of utility line or subsurface structures immediately to Project Manager

3.6 PREPARATION OF SUBGRADE

- A. Expansive soils are anticipated to basement depth.
 - 1. Review the necessity for overexcavation of expansive soils. Coordinate with project Geotech Engineer.
- B. Scarify building pad, exterior flatwork and pavement subgrade to a depth of at least 8 inches and work until uniform and free from large clods.
- C. Bring expansive subgrades to 2 to 5 percentage points above the optimum moisture content and compact to 90 percent of the maximum laboratory dry density, in accordance with ASTM D1557.
- D. Bring nonexpansive 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.

- E. Increase compaction of the upper 12 - 18 inches of pavement subgrades to 95 percent of the maximum laboratory dry density per ASTM D1557 for nonexpansive subgrades.

3.7 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 2 feet 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.
 - 4. Operate the dewatering system continuously, 24 hours a day, 7 days a week until construction work below existing ground water level is completed.
 - 5. Measure and record the performance of the dewatering system.
 - 6. Perform at the same time each day.
 - 7. Use piezometers and observation wells.
 - 8. After placement of initial slabs and backfill, the ground water level may be allowed to rise.
 - 9. At no time allow ground water to rise higher than 1 foot below the prevailing level of excavation or backfill.
- E. 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 Project Manager.
- 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.

3.8 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 plans 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 overdug 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 Geotechnical Engineer. Corrective measures as directed by the Project Manager shall be executed promptly.
- B. Excavate subgrade as required to allow for finish grades shown on plans, as required for structural fill or otherwise required for proper completion of the work.
- C. Remove and replace subgrade materials designated by Geotechnical Engineer as unsuitable.

3.9 FILL AND COMPACTING

- A. See Section 31 23 33 – TRENCHING, BACKFILLING, & COMPACTING for fill and compacting requirements.

3.10 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 Geotechnical Engineer.
- 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 recompact 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.
- F. Prevent free water appearing on surface during or subsequent to compaction operation.
- G. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
- H. 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.

3.11 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 graded areas not receiving hardscape or landscape improvements, shall be hydroseeded.
- B. Grading Tolerances:
1. Excavations shall not exceed 0.10-foot variation from dimensions and elevations shown or noted, unless otherwise approved by Project Manager.
 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.

3.12 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.
- B. Termiticide:
1. 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.

- C. Disposal of Excess and Waste Materials:
1. Removal of Excess Excavated Material: Excess material shall be removed by the Contractor off the site in a legal manner.
 2. 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.
 3. 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 D2922, 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 D3017.
 - 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 Project Manager.
- D. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verifications and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Project Manager.
- E. 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.
- F. 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.
- G. 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.
- H. Number and location of test shall be at option of the Geotechnical Engineer.
- I. 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, recompact and retest until required density is obtained.
- J. After grading is completed and the testing agency has completed observation of the work, permit no further excavation or filling, except as approved by Project Manager.

3.13 PROTECTION

- A. Protect newly graded areas from traffic and erosion. Install erosion control mat and straw wattles as directed by the Project Manager. 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 Cleaning.

END OF SECTION