

DIVISION 31 – EARTHWORK

31 05 13 SOILS FOR EARTHWORK

A. Design Considerations

1. On-Site Fill:

- a. The reuse of on-site fill shall be evaluated by the design team's geotechnical engineer.
- b. Material containing rock, stone or masonry debris greater than 4-inches in its largest dimension is unacceptable as backfill for pavement or building subgrade elevation.
- c. On-site fill shall not be reused if the fill contains organics, timber, steel, brick, refuse, and other debris.
- d. Excavated on-site fill containing deleterious materials, debris, and other materials deemed geotechnically unsuitable for reuse as on-site fill by Geotechnical Engineer shall be segregated from usable material and disposed of offsite in accordance with all applicable regulations.
- e. In some circumstances, asphalt millings generated by milling of existing asphalt pavement can be temporarily stockpiled on-site and reused as sub-base material for new asphalt pavement construction if deemed acceptable by the design team's geotechnical engineer and Rutgers University. Milled asphalt proposed for use as asphalt pavement subbase material shall be broken into pieces having dimensions less than 2 inches in any direction. Stockpile material must be stored on a plastic lined base pad and must be completely covered with a plastic liner if not being utilized.

2. Export of On-Site Fill:

- a. The design team shall prepare a cut/fill plan to estimate the required export volume of fill material (if applicable).
- b. If export of on-site fill material is anticipated, preliminary in-situ testing of the material shall be coordinated with Rutgers University during the design phase, prior to bidding of a project.
- c. All soil must be sampled, in accordance with the NJ DEP Field Sampling Guideline, prior to any offsite shipments/ disposal. All sampling must be

completed by a NJ DEP certified laboratory. Results of laboratory testing must be supplied to Rutgers Environmental Health and Safety (REHS)

3. During the project design phase a soil sampling plan must be prepared and implemented to characterize soils within the limits of the project site. The characterization must determine the extents and quantities of all soils to be excavated within the limits of the project site. The characterization of soils should determine if the soils are clean (NJDEP Residential Direct Contact), impacted, contaminated or hazardous and disposal or re-use requirements for each characterization of soils. All soil must be sampled, in accordance with the NJ DEP Field Sampling Guideline, prior to any offsite shipments/disposal. All sampling must be completed by a NJ DEP certified laboratory. Results of laboratory testing must be supplied to Rutgers representative(s) of REHS.
4. All disposal locations for any soils determined to be above residential standards must be approved by REHS
5. Soils must be sampled and analyzed by an NJDEP accredited laboratory. One 8:1 composite sample must be collected per 800 cubic yards of soil and analyzed for the Target Compound List/Target Analyte List (TCL/TAL) parameters. Analytical results must be provided to Rutgers Environmental Health & Safety (REHS) in Excel format for compliance review. Based upon sampling results, it will be determined if soils can be offered for re-use or require disposal at a regulated facility.
6. Off-Site Imported Fill:
 - a. Off-site fill (when required) shall be clean (meeting NJDEP residential standards), well graded granular soil which is non-expansive and non-collapsible and shall have less than 15% by weight passing the #200 sieve. The portion passing the #200 sieve shall be non-plastic. Off-site fill shall be free of organics and other deleterious materials.
 - b. A sample of any off-site fill material shall be provided to University and the design team along with laboratory testing results and a certificate of clean fill. Approval of off-site fill material shall be obtained from Rutgers University and the design team prior to delivery of any proposed imported fill to the site.
 - c. Imported fill shall be free of all hazardous substances as listed by the New Jersey Department of Environmental Protection in New Jersey Administrative Code, Title 7; Chapter 1E, Appendix A. Certification of compliance and test results substantiating compliance shall be furnished to University and design team by the Contractor not less than two weeks prior to its delivery to the site and intended use.
 - d. Rutgers University reserves the right to test off-site fill material for conformance with these design standards on campus or at the fill site.

- e. No construction debris (concrete, bricks, asphalt, millings, wood, etc.) shall be used as “fill” material without the expressed written permission of REHS.
- 7. Any soils, backfill (fill material) must have certification of “clean fill”. No materials shall be allowed to be imported for use without proper certification. All certification forms must be maintained and provided to the Rutgers University representative responsible for overseeing the project.
- 8. Soil sampling analytical results must be provided to Rutgers Environmental Health & Safety (REHS) in Excel format for review prior to soil import. Sampling results must include Target Compound List/Target Analyte List (TCL/TAL) parameters at a minimum frequency of one 8:1 composite sample per 800 cubic yards of soil. Analytical results must meet the most stringent NJDEP Soil Remediation Standards (N.J.A.C. 7:26D) to be accepted for import. No materials shall be imported without proper documentation.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 05 16 AGGREGATES FOR EARTHWORK

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

- 1. Proposed aggregate shall be approved by Rutgers University and shall meet the requirements of the State of New Jersey Department of Transportation Standard Specifications for Roads and Bridges Construction (Sections 200, 300, and 400).

31 05 19 GEOSYNTHETICS FOR EARTHWORK

A. Design Considerations

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B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. Geosynthetics including geotextiles, geomembranes, geogrids, geosynthetic clay liners, geocomposites, and geonets may be proposed by the design team. The University will evaluate the use of geosynthetics on an individual project basis.

31 06 00 SCHEDULES FOR EARTHWORK

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. A schedule of proposed earthwork operations shall be submitted to Rutgers University at least two weeks prior to the start of construction. The schedule shall include but not limited to detail general work areas, work hours, pedestrian safety measures, soil erosion compliance, and compliance with a project's Stormwater Construction General Permit (RFA).

31 08 00 COMMISSIONING OF EARTHWORK

A. Design Considerations

1. The design team (geotechnical engineer) is responsible for providing detailed testing procedures and testing criteria within the project specifications for necessary geotechnical construction items. Geotechnical items may include, but are not limited to

pile load testing, dynamic pile load testing, static pile load testing, compaction, tie-back anchor testing, settlement, adjacent building monitoring, underpinning monitoring, etc.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 09 00 GEOTECHNICAL INSTRUMENTATION AND MONITORING OF EARTHWORK

A. Design Considerations

1. The design team (geotechnical engineer) is responsible for providing instrumentation and monitoring requirements within the project specifications.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 11 00 CLEARING AND GRUBBING

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. Clearing and grubbing shall be performed in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey.

2. Clearing and grubbing shall include the removal of trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps, roots, and organic materials. Depressions caused by clearing and grubbing operations are to be filled to subgrade elevation to avoid ponding of water. Features to remain shall be protected throughout clearing and grubbing work.

31 13 00 SELECTIVE TREE AND SHRUB REMOVAL AND TRIMMING

A. Design Considerations

1. The Contractor, while working the site, is responsible for protecting all existing trees to remain such that they will be free from any damage. If damage is done, the Contractor shall be responsible for replacement of damaged trees. All existing trees to remain affected by construction activities shall be protected with temporary chain link fencing installed at the drip line of the tree, or at the direction of the University Landscape Architect.
2. Tree replacement and protection is as follows, and at the direction of the University Landscape Architect or the Office of Planning and Development:
 - a. Contractor shall take all precautions necessary to protect existing trees scheduled to remain against injury or damage, including cutting, breaking, or skinning of roots, trunks or branches; smothering by stockpiled construction materials, excavated materials or vehicular traffic within branch spread.
 - 1) Interfering branches of trees scheduled to remain may be removed when acceptable to the University Architect and University Landscape Architect. It cannot be assumed that permission will be granted. The Contractor must obtain permission from University Facilities prior to such activities.
 - 2) Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to University Facilities. Repair damaged trees promptly to prevent progressive deterioration caused by damage.
 - b. Should an existing tree be damaged to the extent that it is deemed to be a complete loss by University Facilities, or if, due to the Contractor's negligence, a tree on the construction site exhibits visible signs of decline or dies within one year of project completion, the Contractor shall replace the tree according to the following requirements:

- 1) **Tree Replacement Formula:** One square inch of caliper lost will equal one square inch of caliper replaced. This formula is based on tree trunk diameter at breast height. Example: loss of one 12" caliper (same as 6" radius) tree would require replacement with nine (9) 4" caliper trees. [Area of Circle = $3.14 \times r^2 = 3.14 \times (6)^2 = 3.14 \times (36) = 113.04$ sq. in. Assuming 4" caliper trees (same as 2" radius) will be planted as replacements, calculate the area of a 4" caliper tree: $3.14 \times (2)^2 = 12.56$ sq. in. Divide the area of the 4" caliper tree into the area of the 12" caliper tree to determine the number of 4" caliper trees required to replace the loss of the 12" caliper tree. $113.04 / 12.56 = 9$ trees.]
3. **Installation:** Contractor will be responsible for planting the replacement tree(s) at a location designated by University Facilities. Installation practices and a one-year guarantee shall hold as per the landscaping section of these design standards.
4. **Materials:** The replacement tree(s) shall be of the same species and variety as the tree(s) lost, or of a species and variety identified by the University Landscape Architect. If the species and variety is not available, a substitute must be proposed in writing to University Facilities and approved by University Facilities. The Contractor will be notified of approval of substitution within seven days. Minimum caliper of replacement tree(s) shall be 2 ½ - 3".
 - a. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at Contractor's expense.
 - b. The contractor shall be responsible for the care and maintenance of the replacement tree(s) for the duration of the guarantee period. The care and maintenance shall include at a minimum – installation and maintenance of stakes and guy wires, installation and maintenance of water bags (TreeGator) or Tree Diaper), watering, pruning, fertilizing, resetting, etc. The trees must be maintained following accepted horticultural and arboricultural practices. See table below for watering requirements:

Gallons per Watering (by Tree Caliper)

Tree Caliper	Gallons per Watering
1.5"	2-3 gal
2.0"	3-4 gal
2.5"	4-5 gal
3.0"	4.5-6 gal
3.5"	5-7 gal
4.0"	6-8 gal

24-Month Growing-Season Watering Frequency Table (NJ)

Year 1 (Planting Year)

Growing Season Period	Frequency
Month 1 (planting → 4 weeks)	2–3× per week
Months 2–3	1–2× per week
Months 4–6 (mid-summer)	1× per week
Months 7–8 (early fall)	Every 10–14 days

Year 2

Growing Season Period	Frequency
Months 13–14 (early spring)	Every 10–14 days
Months 15–18 (late spring–summer)	Every 14–21 days
Months 19–20 (late summer / drought periods)	Every 7–14 days as needed
Months 21–22 (early fall)	Once every 3–4 weeks

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 14 00 EARTH STRIPPING AND STOCKPILING

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. Pending approval from the design team's geotechnical engineer and Rutgers University, stripped topsoil may be reused on-site in landscaped areas. Reusable topsoil shall be segregated from other cleared materials and shall be stocked piled in accordance with the requirements in the Standards for Soil Erosion and Sediment Control in New Jersey.
 2. Topsoil shall consist of organic surficial soil found in depth of not less than 6 to 8 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2-in. in diameter, weeds, roots, and other objectionable material. Topsoil shall be approved by Rutgers University prior to final site placement. Existing topsoil that is proposed to be re-used on site must be tested for agronomic properties – gradation, organic content, micro and macro nutrients, nutrient holding capacity, etc. Recommendations from the testing lab for amending the existing soil must be provided with guidance on appropriate soil blending / amending methods.
 3. The person conducting a construction project must ensure excess, unusable, or unsuitable material/ soils are properly characterized (all soils sampled in accordance with the NJ DEP Field Sampling requirements), transported and disposed of in accordance with applicable Federal, State and local requirements. The person conducting a construction project should employ best management practices to prevent spillage and leakage (e.g., plastic sheeting lining and covering soils within the truck) during transport and must prepare a bill of lading or a manifest for each truckload of contaminated material removed from the project area, as appropriate. If material is determined to be above soil reuse standards (residential standards) then material will be properly disposed of at approved soils recycling facility and/ or an approved landfill. The person conducting a construction project must keep a copy of the bills of lading and supply all copies to Rutgers University representatives.
- ❖ *Soils being reused as fill that were originally excavated from the same excavation do not need to be sampled prior to re-use as fill material. Only non-useable (unsuitable) soils/ materials must be sampled prior to offsite disposal.*

31 14 13.16 SOIL STOCKPILING

A. Design Considerations

1. Due to New Jersey Department of Environmental Protection (NJ DEP) requirements governing soil reuse the following shall be required when excavating and managing any asphalt, millings and/ or soils at Rutgers University.
2. All asphalt, millings and soils shall be managed accordingly:
 - a. Asphalt and millings shall be removed and stored separately from any soils
 - b. All overburdened/ fill soils shall be excavated and stored separately
 - c. All weathered shale/ rock shall be excavated and stored separately
 - d. No mixing of stockpiled materials shall be permitted. Stockpiled materials that are mixed shall be considered unsuitable and must be removed at the expense of the contractor.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. Stockpiles: The person (vendor/ contractor) conducting a construction project should include a materials management plan for stockpiling and temporary storage of excavated material that will be reused during the project or will be stockpiled for disposal. The goal is to prevent contamination in order to protect human health and the environment and, to prevent contaminated material from migrating beyond temporary stockpiles. Locations for temporary stockpiles are selected by the person conducting a construction project based on field conditions, but when feasible stockpiles should be located within the boundaries of the construction project. Stockpiles should be placed on an impervious surface, underlain by plastic sheeting and securely covered with plastic sheeting to prevent wind dispersion and contact with rainfall and other weather. The piles should be contained with hay bales or silt fence to prevent migration of contaminants into adjacent soil, surface water, and ground water. Stockpiles must be covered and secured at the end of each day or whenever there is potential for the migration of contaminated material from the stockpile. Alternatively, contaminated material may be stored in containers, preferably with a liner. Containers shall be covered to prevent wind dispersion and contact with rainfall or other weather. Stockpiled contaminated material intended for off-site disposal should be removed from the site as soon as possible, but not longer than 180 days pursuant to applicable solid waste requirements and/ or no longer than 90 days for material that is characterized as hazardous waste pursuant to applicable hazardous waste requirements.

31 22 00 GRADING

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. For setting and establishing finish elevations and lines, contractor shall secure the services of a licensed land surveyor acceptable to Rutgers University and the design team.
2. Contractor shall provide elevation grade stakes and any other surveying necessary for the layout of the work. The work shall be conducted in such a manner that the survey stakes will be protected as long as their need exists. Grade stakes which are damaged or stolen, shall be replaced by contractor's surveyor at contractor's expense.
3. Graded areas shall be uniform, hard and smooth, free from rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10 feet above or below the design finished subgrade elevation; any deviation shall not result in changes in drainage areas or ponding. All ground surfaces shall vary uniformly between indicated elevations. Graded areas shall also be protected from compaction unless the site is specifically called upon for a designed compaction level.
4. Areas having drainage slopes of one-quarter inch per foot or more shall have grade stakes, set with an instrument, at grid intervals of fifty (50) feet.
5. Areas having drainage slopes of one-quarter inch per foot or less shall have grade stakes, set with an instrument, at grid intervals of twenty-five (25) feet.
6. Graded areas shall be temporarily and permanently stabilized in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, Chapter 251 unless otherwise requested and/or approved by University Facilities.

31 23 13 SUBGRADE PREPARATION

A. Design Considerations

1. Based on the results of the design team's geotechnical investigation, the team shall provide project specific specifications for the items listed below. At a minimum, the following requirements shall be included:
 - a. Finished subgrades shall be protected from excessive construction traffic and wheel loading including concrete and dump trucks.
 - b. Areas of finished subgrade deemed unacceptable by the project's geotechnical engineer or University Facilities shall be removed and replaced.
 - c. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and at the proper elevation.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 23 16 EXCAVATION

A. Design Considerations

1. Where existing grades are above proposed subgrade elevation, excavate materials to the lines and grades shown on the Construction Drawings. Excavation work shall be in accordance with all local, state, and federal safety requirements.
2. When excavating for footings, footing bottoms shall be level and shall be kept clean and free of debris and deleterious materials. Exposed building footing subgrades shall be proof rolled/compacted using, at a minimum, a double drum walk-behind vibratory roller or other compactor approved by the Geotechnical Engineer. Deleterious materials present at footing subgrade level and any soft areas identified by proof rolling shall be removed and replaced with approved compacted fill as directed by the Geotechnical Engineer. All footing subgrades shall be subject to inspection and approval by the

Geotechnical Engineer prior to footing construction by the Contractor. No footings shall be placed in areas of standing water, in areas of frozen or thawing ground, or in areas that have not been approved by the Geotechnical Engineer. Footing excavations shall be of sufficient width to allow for forming the footing and for compacting the backfill adjacent to the footing.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 23 19 DEWATERING

A. Design Considerations

RESERVED

B. Special Documentation Requirements

1. The design team shall prepare a project specific dewatering specification based on field investigations and local, state, and federal regulations. The dewatering specification shall be submitted to Rutgers University for approval during the design process.

C. Materials and Methods of Construction

RESERVED

31 23 23 FILL

A. Design Considerations

RESERVED

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. No fill materials shall be placed during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until all saturated surficial soils are returned to a satisfactory moisture content as determined by Geotechnical Engineer.
2. Place and compact approved fill materials in 12 inch maximum loose lifts using a minimum of 6 passes with the a 6-ton compactor and achieve the minimum in-place density specified above. Smaller compaction equipment, together with thinner lifts, may be necessary at areas of limited maneuverability and shall be as directed by Geotechnical Engineer.
3. Visual confirmation of fill quality, lift thickness and compaction procedures, together with density testing, shall determine the acceptability of fill. Any unsatisfactory material or soft areas exhibiting excessive weaving shall be immediately removed, replaced and re-compacted as stated above to the satisfaction of Geotechnical Engineer.
4. No fill material shall be placed in areas of standing water, in areas of frozen or thawing ground, or in areas that have not been approved by Geotechnical Engineer.

31 25 00 EROSION AND SEDIMENTATION CONTROLS

A. Design Considerations

1. Drawings and specifications produced by the design team shall comply with the Standards for Soil Erosion and Sediment Control in New Jersey.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

1. Contractor shall install all soil erosion and sediment control measures as indicated on the approved Soil Erosion and Sediment Control Plans prior to the start of construction.
2. The Contractor shall fill out daily soil erosion and sediment control checklists and when applicable NJDEP Stormwater General Construction Permit (RFA) checklists.
3. The Contractor shall follow all applicable SESC Permit and Stormwater General Construction Permit requirements.

31 30 00 EARTHWORK METHODS

A. Design Considerations

1. When applicable, project specific earthwork methods shall be detailed by the design team on the project drawings and specifications.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 41 00 SHORING AND UNDERPINNING

A. Design Considerations

1. Shoring and underpinning methods shall be detailed by the design team on the project drawings and specifications.
2. Shoring and underpinning shall be designed by a Professional Engineer licensed in the state of New Jersey.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

31 50 00 EXCAVATION SUPPORT AND PROTECTION

A. Design Considerations

1. Excavation support shall be designed by a Professional Engineer licensed in the state of New Jersey.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED