

Soil De-compaction and Testing Requirements

Soil Compaction Testing Requirements

- Subgrade soils **prior to the application of topsoil** (see permanent seeding and stabilization notes for topsoil requirements) shall be free of excessive compaction to a depth of 6.0 inches to enhance the establishment of permanent vegetative cover.
- Areas of the site which are subject to compaction testing and/or mitigation are **graphically denoted** on the certified soil erosion control plan.
- Compaction testing locations** are denoted on the plan. A copy of the plan or portion of the plan shall be used to mark locations of tests, and attached to the compaction remediation form, available from the local soil conservation district. This form must be filled out and submitted prior to receiving a certificate of compliance from the district.
- In the event that testing indicates compaction in excess of the maximum thresholds indicated for the simplified testing methods (see details below), the contractor/owner shall have the option to perform either (1) compaction mitigation over the entire mitigation area denoted on the plan (excluding exempt areas), or (2) perform additional, more detailed testing to establish the limits of excessive compaction whereupon only the excessively compacted areas would require compaction mitigation. Additional detailed testing shall be performed by a trained, licensed professional.

Compaction Testing Methods

- Probing Wire Test (see detail)
- Hand-held Penetrometer Test (see detail)
- Tube Bulk Density Test (licensed professional engineer required)
- Nuclear Density Test (licensed professional engineer required)

Note: Additional testing methods which conform to ASTM standards and specifications, and which produce a dry weight, soil bulk density measurement may be allowed subject to District approval.

Soil compaction testing is **not required** if/when subsoil compaction remediation (scarification/tillage (6" minimum depth) or similar) is proposed as part of the sequence of construction.

Procedures for Soil Compaction Mitigation

Procedures shall be used to mitigate excessive soil compaction **prior to placement of topsoil** and establishment of permanent vegetative cover.

Restoration of compacted soils shall be through deep scarification/tillage (6" minimum depth) where there is no danger to underground utilities (cables, irrigation systems, etc.). In the alternative, another method as specified by a New Jersey Licensed Professional Engineer may be substituted subject to District Approval.

Simplified Testing Methods

Probing Wire Test- 15.5 ga steel wire (survey flag)

Note: soil should be moist but not saturated. Do not test when soil is excessively dry or subject to freezing temperatures. Slow, steady downward pressure used to advance the wire.

Handheld Soil Penetrometer Test

Note: soil should be moist but not saturated. Do not test when soil is excessively dry or subject to freezing temperatures. Slow, steady downward pressure used to advance the probe. Probe must penetrate at least 6" with less than 300 psi reading on the gage.

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- 4-4 inch stripping depth is common, but may vary depending on the particular soil.
- Stockpiles of topsoil should be situated so as not to obstruct natural drainage or cause off-site environmental damage.
- Stockpiles should be vegetated in accordance with standards previously described herein; see standards for Permanent (pg. 4-4) or Temporary (pg. 7-1) Vegetative Cover for Soil Stabilization. Weeds should not be allowed to grow on stockpiles.

3. Site Preparation

- Grade at the onset of the optimal seeding period so as to minimize the duration and area of exposure of disturbed soil to erosion. Immediately proceed to stabilize vegetative cover in accordance with the specified seed mixture. Time is of the essence.
- Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application and anchoring, and maintenance. See the Standard for Land Grading, pg. 19-1.
- As guidance for ideal conditions, soil should be tested for lime requirement. Limestone, if needed, should be applied to bring soil to a pH of approximately 6.5 and incorporated into the soil as nearly as practical to a depth of 4 inches.
- Prior to topsoiling, the subsoil shall be in compliance with the Standard for Land Grading, pg. 19-1.
- Employ needed erosion control practices such as diversions, grade stabilization structures, channel stabilization measures, sedimentation basins, and waterways. See Standards 11 through 42.

4. Applying Topsoil

- Topsoil should be handled only when it is dry enough to work without damaging soil structure, i.e., less than field capacity (see glossary).
- A uniform application to an average depth of 5.0 inches, minimum of 4 inches, firmed in place is required. Alternative depths may be considered where special regulatory and/or industry design details are approved such as golf courses, sports fields, landfill caprains, etc. Soils with pH of 4.0 or less or containing iron sulfide shall be covered with a minimum depth of 12 inches of soil having a pH of 5.0 or more, in accordance with the Standard for Management of High Acid Producing Soil (pg. 1-1).
- Pursuant to the requirements in Section 7 of the Standard for Permanent Vegetative Stabilization, the contractor is responsible to ensure that permanent vegetative cover becomes established on at least 80% of the soils to be stabilized with vegetation. Failure to achieve the minimum coverage may require additional work to be performed by the contractor to include some or all of the following: supplemental seeding, reapplication of lime and fertilizers, and/or the addition of organic matter (i.e. compost) to a top dressing. Such additional measures shall be based on soil tests such as those offered by Rutgers Cooperative Extension Service or other approved laboratory facilities qualified to test soil samples for agronomic properties.

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STANDARD FOR TOPSOILING

Definition
Topsoiling entails the distribution of suitable quality soil on areas to be vegetated.

Purpose
To improve the soil medium for plant establishment and maintenance.

Water Quality Enhancement
Growth and establishment of a vigorous vegetative cover is facilitated by topsoiling, preventing soil loss by wind and rain runoff and into streams and other downstream conveyances.

When Applicable
Topsoil shall be used where soils are to be disturbed and will be revegetated.

Methods and Materials

- Materials
 - Topsoil should be friable, loamy, free of debris, objectionable weeds and stones, and contain no toxic substance or adverse chemical or physical condition that may be harmful to plant growth. Suitable soils should not be excessive (conductivity less than 0.5 millimhos per centimeter. More than 0.5 millimhos may indicate acidities and adversely impact growth). Imported topsoil shall have a minimum organic matter content of 2.75 percent. Organic matter content may be raised by additives.
 - Topsoil substitute is a soil material which may have been amended with sand, silt, clay, organic matter, fertilizer or lime and has the appearance of topsoil. Topsoil substitute may be utilized on sites with insufficient topsoil for establishing permanent vegetation. All topsoil substitute materials shall meet the requirements of topsoil noted above. Soil tests shall be performed to determine the composition of sand, silt, clay, organic matter, soluble salts and pH level.
- Stripping and Stockpiling
 - Field exploration should be made to determine whether quantity and/or quality of surface soil justifies stripping.
 - Stripping shall be confined to the immediate construction area.
 - Where feasible, lime may be applied before stripping at a rate determined by soil tests to bring the soil pH to approximately 6.5.

*Fratric means early colonists in the flag, as defined in most soils texts.
*Fratric means coarse grains consisting of coarse heavy sands, sandy loam, fine and very fine sandy loam, loam, silty loam, silty clay loam and silty clay loam textures and having less than 35% passing No. 20 sieve (as defined in the Glossary of Soil Science Terms, 1996, Soil Science Society of America.)

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STANDARD FOR LAND GRADING

Definition
Reshaping the ground surface by grading to planned elevations which are determined by topographic survey and layout.

Purpose
The practice is for one or more of the following: Provide more suitable sites for land development; improve surface drainage and control erosion.

Conditions Where Practice Applies
This practice is applicable where grading to planned elevations is practical and is determined that grading is needed. Grading that involves the disturbance of vegetation over large areas shall be avoided. It may be necessary to provide for temporary stabilization of large areas.

Water Quality Enhancement
Proper grading of disturbed sites will protect against soil loss from erosion, enhance establishment of permanent vegetative cover and help to properly manage stormwater runoff of which will reduce off site discharge of pollutants.

Planting Criteria
The grading plan and installation shall be based upon adequate topographic surveys and investigations. The plan is to show the location, slope, cut, fill and finish elevation of the surface to be graded. The plan should also include auxiliary practices for such disposal of runoff water, slope stabilization, erosion control and drainage. Facilities such as waterways, ditches, diversions, grade stabilization structures, retaining walls and subsurface drains should be installed when necessary.

Erosion control measures shall be designed and installed in accordance with the applicable standard contained herein.

The development and establishment of the plan shall include the following:

- The cut face of earth excavations and fills shall be no steeper than the safe angle of repose for the materials encountered and flat enough for proper maintenance.
- The permanently exposed face of earth cuts and fills shall be vegetated or otherwise protected from erosion.
- Provisions shall be made to safely conduct surface water to storm drains or suitable water courses and to prevent surface runoff from disturbing cut faces and fill slopes.
- Surface drainage is to be provided in areas having a high water table, to intercept seepage that would adversely affect slope stability, building foundations or create undesirable wetness. See Standard for Subsurface Drainage, pg. 32-1.
- Adjoining property shall be protected from excavation and filling operations.
- Fill shall not be placed adjacent to the bank of a stream or channel, unless provisions are made to protect the

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hydraulic, biological, aesthetic and other environmental functions of the stream.

Soil Management and Preparation

Subgrade soils prior to the application of topsoil shall be free of excessive compaction to a depth of 6.0 inches to enhance the establishment of permanent vegetative cover.

This section of this Standard addresses the potential for excessive soil compaction in light of the intended land use, testing for excessive soil compaction where permanent vegetation is to be established and mitigation of excessive soil compaction when appropriate.

Dug in size or setting, certain disturbed areas will not require compaction remediation including, but not limited to the following:

- Within 20 feet of building foundations with basements, 12 feet from shaft or aerial space construction
- Where soils or gravel surfaces will be required to support post-construction vehicular traffic loads such as roads, parking lots and driveways (including gravel surfaces), bicycle paths or pedestrian walkways (sidewalks, etc.)
- Airports, runways or other transportation facilities
- Areas requiring industry or government specified soil designs, including golf courses, landfills, wetland restoration, septic disposal fields, wetland ponds, etc.
- Areas governed or regulated by other local, state or federal regulations which dictate soil conditions
- Brownfields (capped sites), urban redevelopment areas, in-fill areas, recycling yards, junk yards, quarries and
- Slopes determined to be inappropriate for safe operation of equipment
- Portions of a site where no heavy equipment travel or other disturbance has taken place
- Areas receiving temporary vegetative stabilization in accordance with the Standard.
- Where the area available for remediation practices is 500 square feet or less in size
- Locations containing shallow (close to the surface) bedrock conditions.

Areas of the site which are subject to compaction testing and/or mitigation shall be graphically denoted on the certified soil erosion control plan.

Soil compaction remediation or testing to prove remediation is not necessary will be required in areas where permanent vegetation is to be established that are not otherwise recognized above. Testing method shall be selected, and soil compaction testing shall be performed by the contractor or other project owner's representative (e.g. engineer). A minimum of two (2) tests shall be performed for projects with an overall limit of disturbance of up to one (1) acre and at a rate of two (2) tests per acre of the overall limit of disturbance for larger areas which shall be evenly distributed over the area of disturbance subject to testing. Tests shall be performed in areas representative of the construction activity prevailing in the area. In the event this testing indicates compaction in excess of the maximum threshold indicated for the testing method, the contractor/owner shall have the option to perform compaction mitigation over the entire disturbed area (excluding exempt areas) or to perform additional testing to establish the limits of excessive compaction whereupon only the excessively compacted areas would require compaction mitigation.

Soil compaction testing is not required if/when subsoil compaction remediation (scarification/tillage (6" minimum depth) or similar) is proposed as part of the sequence of construction.

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Soil Test Method Options

- Probing Wire Test Method**
This test shall be conducted with a firm wire (15-12 gauge steel wire - e.g. survey marker flag, straight wire stock, etc.), 18 to 21 inches in length, with 6" inches from one end visibly marked on the wire. Conduct wire flag test by holding the wire one the flag end and push it vertically into the soil at several different locations in the field to the lesser of a 6 inch depth or the depth at which it bends due to resistance in the soil. Record the depth at which it bends due to resistance in the soil. The wire should penetrate without bending or deforming at least 6" into the ground by hand, without the use of tools. If penetration fails and an obstruction is suspected (rocks, root debris, etc.) the test can be repeated in the same general area. If the test is successful the soil is not excessively compacted. If the wire is difficult to insert (wire bends or deforms prior to reaching 6 inches in depth) the soil may be excessively compacted and compaction mitigation or further testing via method 3 or 4 below is required, the choice of which is at the contractor/owner's discretion.
- Handheld Soil Penetrometer Test Method**
This test shall be conducted based on the Standard Operation Procedure (SOP) #RCED010-001, prepared by the Rutgers Cooperative Extension, implemented June 1, 2010, last revised February 28, 2011. A result of less than or equal to 300 psi shall be considered passing. If the result is greater than 300 psi the soil may be excessively compacted and compaction mitigation or further testing via method 3 or 4 below is required, the choice of which is at the contractor/owner's discretion.
- Tube Bulk Density Test Method**
This test shall be certified by a New Jersey Licensed Professional Engineer utilizing only undisturbed samples (reconstruction of the sample not permitted) collected utilizing the procedure for Soil Bulk Density Tests as described in the USDA NRCS Soil Quality Test Kit Guide, Section 1-4, July 2001. When the texture of the soil to be tested is a sand or loamy sand and lack of soil cohesion or the presence of large amounts of coarse fragments, roots or worm channels prevent the taking of undisturbed samples, this test shall not be used.
Where the results of replicate tests differ by more than ten percent (10%), the samples shall be examined for the following defects:
i. Cracks, worm channels, large root channels or poor soil tube contact within the samples;
ii. Large pieces of gravel, roots or other foreign objects;
iii. Sintering or compaction of the soil on the upper or lower surface of the samples.
If any of the defects described in 3 i-iii) above are found, the defective core(s) shall be discarded and the test repeated using a new replicate sample for each defective replicate sample. The bulk density (defined as the weight of dry soil per volume) results shall be compared with the Maximum Dry Bulk Density in Table 19-1. A result of less than or equal to the applicable maximum bulk density shall be considered passing. If the result is greater than the maximum bulk density the soil shall be considered excessively compacted and compaction mitigation is required.
- Nuclear Density Test Method**
This test shall be certified by a New Jersey Licensed Professional Engineer and conducted by a nuclear gauge certified inspector pursuant to ASTM D6938. The bulk density measurement results shall be compared with the Maximum Dry Bulk Densities in Table 19-1. A result of less than or equal to the applicable maximum bulk density shall be considered passing. If the result is greater than the maximum bulk density the soil shall be considered excessively compacted and compaction mitigation is required.

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Table 19-1 - Maximum Dry Bulk Density (grammatic/cm³) by soil type

Soil Type/Texture	Bulk Density (g/cc)
Coarse, Medium and Fine Sandy and Loamy Sands	1.80
Very Fine Sand and Loamy Very Fine Sand	1.77
Sandy Loam	1.73
Loam, Sandy Clay Loam	1.70
Clay Loam	1.65
Sandy Clay	1.60
Silt, Silt Loam	1.55
Silt, Clay Loam	1.50
Silt, Clay	1.45
Clay	1.40

Source: USDA Natural Resource Conservation Service, Soil Quality Information Sheet, Soil Quality Resource Concerns, Corvallis, April 1996

- Additional testing methods which conform to ASTM standards and specifications, and which produce a dry weight, soil bulk density measurement may be allowed subject to District approval.

Procedures for Soil Compaction Mitigation

If subgrade soils are determined to be excessively compacted by testing, as identified above, procedures shall be used to mitigate excessive soil compaction prior to placement of topsoil and establishment of permanent vegetative cover. Remediation of compacted soils shall be through deep scarification/tillage (6" minimum depth) where there is no danger to underground utilities (cables, irrigation systems, etc.) or in the alternative, another method as specified by a New Jersey Licensed Professional Engineer.

Installation Requirements

Timber, logs, brush, rubbish, rocks, stumps and vegetative matter which will interfere with the grading operation or affect the planned stability or fill areas shall be removed and disposed of according to the plan.

Topsoil is to be stripped and stockpiled in amounts necessary to complete final grading of all exposed areas requiring topsoil. See Standard for Topsoiling, pg. 4-1.

Fill material is to be free of brush, rubbish, timber, logs, vegetative matter and stumps in amounts that will be detrimental to constructing suitable fills.

All structural fills shall be compacted as determined by structural engineering requirements for their intended purpose and as required to reduce slippage, erosion or excessive saturation.

All disturbed areas shall be left with a neat and finished appearance and shall be protected from erosion. See Standards for Permanent Vegetative Cover for Soil Stabilization, pg. 4-1.

Trees to be retained shall be protected if necessary in accordance with the Standard for Tree Protection During Construction, pg. 9-1.

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REV.	DATE	DESCRIPTION

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■ Civil Engineers
 ■ Forensic Experts
 ■ Environmental Consultants

PROJECT NO.: 18130
 DATE: FEBRUARY 13, 2020
 DRAWING NO.: 18130-11
 DRAWN BY: AJG
 CLIENT: CNCC
 SCALE: 1"=30'

PRELIMINARY AND FINAL MAJOR SITE PLAN

SOIL MITIGATION COMPACTION NOTES

BLOCK 33 LOT 21

TAX MAP SHEET NO. 7
TOWNSHIP OF COLTS NECK
MONMOUTH COUNTY
NEW JERSEY

A.J. GARFIO, JR.
DATE: 02-13-2020
N.J. Professional Engineer
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SHEET NO. 11 OF 15

PB