

Appendix C: Soil Compost Amendment Requirements

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C.1 Introduction

Soil amendment (also called soil restoration) is a technique applied after construction to deeply till compacted soils and restore their porosity by amending them with compost. These soil amendments can be used to enhance the performance of impervious cover disconnections and grass channels.

C.2 Physical Feasibility and Design Applications

Amended soils are suitable for any pervious area where soils have been or will be compacted by the grading and construction process. They are particularly well suited when existing soils have low infiltration rates (HSG C and D) and when the pervious area will be used to filter runoff (downspout disconnections and grass channels). The area or strip of amended soils should be hydraulically connected to the stormwater conveyance system. Soil restoration is recommended for sites that will experience mass grading of more than a foot of cut and fill across the site.

Compost amendments are not recommended where any of the following exists:

- Existing soils have high infiltration rates (e.g., HSG A and B), although compost amendments may be needed at mass-graded B soils in order to maintain infiltration rates.
- The water table or bedrock is located within 1.5 feet of the soil surface.
- Slopes exceed 10% (compost can be used on slopes exceeding 10% as long as proper soil erosion and sediment control measures are included in the plan).
- Existing soils are saturated or seasonally wet.
- They would harm roots of existing trees (keep amendments outside the tree drip line).
- The downhill slope runs toward an existing or proposed building foundation.

- Areas that will be used for snow storage.

C.3 Design Criteria

C.3.1 Performance

When Used in Conjunction with Other Practices. As referenced in several of the Chapter 4 Stormwater Best Management Practices (BMPs) specifications, soil compost amendments can be used to enhance the performance of allied practices by improving runoff infiltration. The specifications for each of these practices contain design criteria for how compost amendments can be incorporated into those designs:

- Impermeable Surface Disconnection – See Section 4.6 Impervious Surface Disconnection.
- Grass Channels – See Section 4.7 Open Channel Systems.

C.3.2 Soil Testing

Soil tests are required during two stages of the compost amendment process. The first testing is done to ascertain preconstruction soil properties at proposed amendment areas. The initial testing is used to determine soil properties to a depth 1 foot below the proposed amendment area, with respect to bulk density, pH, salts, and soil nutrients. These tests should be conducted every 5,000 square feet and are used to characterize potential drainage problems and determine what, if any, further soil amendments are needed.

The second soil test is taken at least 1 week after the compost has been incorporated into the soils. This soil analysis should be conducted by a reputable laboratory to determine whether any further nutritional requirements, pH adjustment, and organic matter adjustments are necessary for plant growth. This soil analysis must be done in conjunction with the final construction inspection to ensure tilling or subsoiling has achieved design depths.

C.3.3 Determining Depth of Compost Incorporation

The depth of compost amendment is based on the relationship of the surface area of the soil amendment to the contributing area of impervious cover that it receives. Table C.1 presents some general guidance derived from soil modeling by Holman-Dodds (2004) that evaluates the required depth to which compost must be incorporated. Some adjustments to the recommended incorporation depth were made to reflect alternative recommendations of Roa Espinosa (2006), Balousek (2003), Chollak and Rosenfeld (1998), and others.

Table 1 indicates the number of test pits or soil borings and subsequent infiltration tests that must be performed per BMP. In cases where multiple BMPs are proposed in 1 area with generally uniform conditions, a circular shape that fully encompasses all of the BMPs may be substituted for the “area of practice” that determines the number of required infiltration tests.

Table 1. Method to Determine Compost and Incorporation Depths.

Ratio of Area of Contributing Impervious Cover to Soil Amendment ^a (IC/SA)	Compost Depth ^b (in.)	Incorporation Depth (in.)	Incorporation Method
0.5	3 ^c	12 ^c	Tiller
0.75	4 ^c	18 ^c	Subsoiler
1.0 ^d	6 ^c	24 ^c	Subsoiler

^a IC = contrib. impervious cover (ft²) and SA = surface area of compost amendment (ft²)

^b Average depth of compost added

^c Lower end for B soils, higher end for C/D soils

^d In general, IC/SA ratios greater than 1 should be avoided

Once the area and depth of the compost amendments are known, the designer can estimate the total amount of compost needed, using an estimator developed by TCC, (1997):

$$C = A \times D \times 0.0031$$

where:

- C = compost needed (yd³)
- A = area of soil amended (ft²)
- D = depth of compost added (in)

C.3.4 Compost Specifications

The basic material specifications for compost amendments are outlined below:

- Compost shall be derived from plant material and provided by a member of the U.S. Composting Seal of Testing Assurance (STA) program. See <https://compostingcouncil.org/> for a list of local providers.
- Alternative specifications and/or certifications, such as Clemson University or the US Department of Agriculture, may be substituted, as authorized by <local jurisdiction>. In all cases, compost material must meet standards for chemical contamination and pathogen limits pertaining to source materials, as well as reasonable limits on phosphorus and nitrogen content to avoid excessive leaching of nutrients.
- The compost shall be the result of the biological degradation and transformation of plant-derived materials under conditions that promote anaerobic decomposition. The material shall be well composted, free of viable weed seeds, and stable with regard to oxygen consumption and carbon dioxide generation. The compost shall have a moisture content that has no visible free water or dust produced when handling the material. It shall meet the following criteria, as reported by the U.S. Composting Council STA Compost Technical Data Sheet provided by the vendor:
 - a. 100% of the material must pass through a half-inch screen
 - b. The pH of the material shall be between 6 and 8
 - c. Manufactured inlet material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0% by weight
 - d. The organic matter shall be between 35%–65%
 - e. Soluble salt content shall be less than 6.0 mmhos/cm
 - f. Maturity must be greater than 80%
 - g. Stability shall be 7 or less
 - h. Carbon/nitrogen ratio shall be less than 25:1
 - i. Trace metal test result must equal “pass”
 - j. The compost must have a dry bulk density ranging from 40–50 lb/ft³

C.4 Construction Sequence

The construction sequence for compost amendments differs depending whether the practice will be applied to a large area or a narrow filter strip, such as in a rooftop disconnection or grass channel. For larger areas, a typical construction sequence is as follows:

- 1) **Soil Erosion and Sediment Control.** When areas of compost amendments exceed 2,500 square feet install soil erosion and sediment control measures, such as silt fences, are required to secure the area until the surface is stabilized by vegetation.
- 2) **Deep Till.** Deep till to a depth of 12 to 18 inches after the final building lots have been graded prior to the addition of compost.
- 3) **Dry Conditions.** Wait for dry conditions at the site prior to incorporating compost.
- 4) **Compost.** Incorporate the required compost depth (as indicated in Table 1) into the tilled soil using the appropriate equipment. Level the site. Seeds or sod are required to establish a vigorous grass cover. To help the grass grow quickly, lime or irrigation is recommended.
- 5) **Vegetation.** Ensure surface area is stabilized with vegetation.
- 6) **Construction Inspection.** Construction inspection by a qualified professional involves digging a test pit to verify the depth of amended soil and scarification. A rod penetrometer should be used to establish the depth of uncompacted soil at a minimum of 1 location per 10,000 square feet.

C.5 Maintenance

C.5.1 First-Year Maintenance Operations

In order to ensure the success of soil compost amendments, the following tasks must be undertaken in the first year following soil restoration:

- **Initial inspections.** For the first 6 months following the incorporation of soil amendments, the site should be inspected by a qualified professional at least once after each storm event that exceeds 1/2-inch of rainfall.
- **Spot Reseeding.** Inspectors should look for bare or eroding areas in the contributing drainage area (CDA) or around the soil restoration area and make sure they are immediately stabilized with grass cover.
- **Fertilization.** Depending on the amended soils test, a one-time, spot fertilization may be needed in the fall after the first growing season to increase plant vigor.
- **Watering.** Water once every 3 days for the first month, and then weekly during the first year (April through October), depending on rainfall.

C.5.2 Ongoing Maintenance

There are no major ongoing maintenance needs associated with soil compost amendments, although the owners may want to de-thatch the turf every few years to increase permeability. The owner should also be aware that there are maintenance tasks needed for filter strips, grass channels, and reforestation areas. The maintenance inspection checklist for an area of Soil Compost Amendments can be accessed in Appendix F Maintenance Inspection Forms.

C.5.3 Declaration of Covenants

A declaration of covenants that includes all maintenance responsibilities to ensure the continued stormwater performance for the BMP is required. The Declaration of Covenants specifies the property owner's primary maintenance responsibilities and authorizes the <local jurisdiction> staff to access the property for inspection or corrective action in the event the proper maintenance is not performed. The Declaration of Covenants is attached to the deed of the property. The covenant is attached to the land and is to be recorded in the Register of Deeds in the County office. All SWMPs have a maintenance agreement stamp that must be signed for a building permit to proceed. A maintenance schedule must appear on the SWMP. Additionally, a maintenance schedule is required in Exhibit C of the Declaration of Covenants.

Covenants are not required on government properties, but maintenance responsibilities must be defined through a partnership agreement or a memorandum of understanding.

C.6 References

- Balusek. 2003. Quantifying decreases in stormwater runoff from deep-tilling, chisel-planting and compost amendments. Dane County Land Conservation Department. Madison, Wisconsin.
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- The Composting Council (TCC). 1997. Development of a Landscape Architect Specification for Compost Utilization. Alexandria, VA. <http://infohouse.p2ric.org/ref/13/12551.pdf>
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- Low Impact Development Center. 2003. Guideline for Soil Amendments.
- Roa-Espinosa. 2006. An Introduction to Soil Compaction and the Subsoiling Practice. Technical Note. Dane County Land Conservation Department. Madison, Wisconsin