

# Post-construction soil quality

As soil types vary widely, general construction activities may have a serious impact on soil structure and its ability to infiltrate and store water. Amendments can be added to a soil to improve its physical properties, such as water retention, permeability, infiltration, drainage, aeration and structure. Soil amendments increase the spacing between soil particles so that the soil can absorb and hold more moisture. This in turn reduces runoff.

The amendment of soils changes physical, chemical and biological characteristics so the soils become more effective in maintaining water quality. Compared to compacted, un-amended soils, amended soils provide greater infiltration and subsurface storage and thereby help to reduce a site's overall runoff volume, helping to maintain the predevelopment peak discharge rate and timing. The volume of runoff that needs to be controlled to replicate natural watershed conditions changes with each site based on the development's impact on the site's curve number (CN).

## Limitations

- Establishing a minimum soil quality and depth is not the same as preservation of naturally occurring soil and vegetation. However, establishing a minimum soil quality and depth will provide improved onsite management of stormwater flow and water quality.
- Soil organic matter can be attained through numerous materials such as compost, composted yard waste, industrial by-products; wood residuals. It is important that the materials used to improve post-construction soil quality be appropriate and beneficial to the plant cover to be established. Likewise, it is important that imported topsoil improve soil conditions and do not have an excessive percent of clay fines.

## Recommended V<sub>Q</sub> Credit

Amended Area (ft<sup>2</sup>) x 0.50 inch x 1/12 = Volume (cf) at 5% soil organic matter content.

Amended Area (ft<sup>2</sup>) x 1 inch x 1/12 = Volume (cf) at 10% soil organic matter content.

## Sizing Guideline

To achieve targeted soil organic matter content:

$$CR = D (X) \frac{SBD (SOM\% - FOM\%)}{SBD (SOM\% - FOM\%) - CBD (COM\% - FOM\%)}$$

Where:

CR = Compost application rate (inches)

D = Depth of incorporation (inches)

SBD = Soil bulk density (lb/cubic yard dry weight) \*

SOM% = Initial soil organic matter (%)

FOM% = Final target soil organic matter (%)

CBD = Compost bulk density (lb/cubic yard dry weight) #

COM% = Compost organic matter (%)

\*To convert soil bulk density in g/cm<sup>3</sup> units to lb/yard, multiply by 1697

# To convert compost bulk density from lbs/ yard “as is” to lbs./yard dry weight, multiply by solids content

## Recommended Guideline

### 1. Design Considerations

- 1.1. Post-construction turf areas should strive for a 5% soil organic matter content.
- 1.2. Post-construction planting bed / landscape areas should strive for a 10% soil organic matter content.
- 1.3. Soil quality restoration should be established toward the end of construction and once established, should be protected from compaction, such as from large machinery, and from erosion.

### 2. Construction Considerations

#### 2.1. Soil organic matter content

##### 2.1.1. Existing topsoil

- 2.1.1.1. Stockpile on-site topsoil from cleared and graded areas to replace prior to planting.
- 2.1.1.2. On-site topsoil should be stockpiled and protected from heavy traffic and / or compaction.

2.1.1.3. Stockpiled topsoil should be tested and amended with organic matter to achieve recommended organic matter.

2.1.1.4. Uniformly distribute stockpiled topsoil to a minimum 8-inch depth before planting.

2.1.2. Amend existing soil

2.1.2.1. Place composted organic matter, to achieve recommended organic matter content over the surface area and incorporate to an 8-inch depth.

2.1.2.2. A rule of thumb to achieve a 5% soil organic matter content is to incorporate 2 inches of compost to a 8 inch depth.

2.1.2.3. A rule of thumb to achieve a 10% soil organic matter content is to incorporate 4 inches of compost to a 6 inch depth.

2.1.3. Import topsoil

2.1.3.1. Imported topsoil should be tested and amended with organic matter to achieve recommended organic matter.

2.1.3.2. Uniformly distribute imported topsoil to a minimum 8-inch depth before planting.

3. Soil compaction

3.1.1. Care should be taken to prevent or mitigate soil compaction before final stabilization of the site is complete.

3.1.2. To alleviate soil compaction, subsoiling, ripping, spading or tilling of the soil is recommended wherever the subsoil has been compacted by equipment operation.

3.1.3. Amending existing soil mitigates sub-soil compaction when compost is incorporated to an 8-inch depth.

4. Composted organic matter

4.1. Composted organic matter should have the following characteristics:

4.1.1. Organic matter between 35 and 65 percent, as determined by loss of ignition test method (ASTM D 2974)

4.1.2. pH between 5.5 and 7.0

4.1.3. Carbon to nitrogen (CN) ratio between 10:1 and 35:1 (a CN ratio of 35:1 is preferred for native plantings)

4.1.4. Maximum electrical conductivity of 3 ohms/cm

4.1.5. Moisture content range between 35 and 50 percent

4.1.6. No viable weed seeds

- 4.1.7. Manufactured inert material (plastic, etc.) should be less than 1 percent on a dry weight or volume basis
  - 4.2. Specifying the use of compost products that are certified by the U.S. Composting Council's Seal of Testing Assurance (STA) Program will allow for the acquisition of products that are analyzed on a routine basis, using specified test methods. STA participants are also required to provide a standard product label to all customers, allowing easy comparison to other products.
5. Final stabilization
  - 5.1. Soils should be planted and mulched after recommended soil organic matter content has been achieved.
6. *Maintenance Considerations*
  - 6.1. When possible, turf should be mulch mowed and clippings left on the soil surface to replenish soil organic matter.
  - 6.2. If area has heavy foot traffic, an annual soil core aeration followed by a ¼" topdressing of composted organic matter is recommended.

#### **Post-construction Soil Quality Resources**

- Western Washington Stormwater Guidelines for Implementing Soil Depth & Quality (BMP T.5.13)
- Draft Pennsylvania Stormwater Management Manual, April 2006, BMP 6.19: Soil Amendment and Restoration
- LID Technical Guidance Manual for Puget Sound, January 2005, BMP 6.2: Amending Construction Site Soils