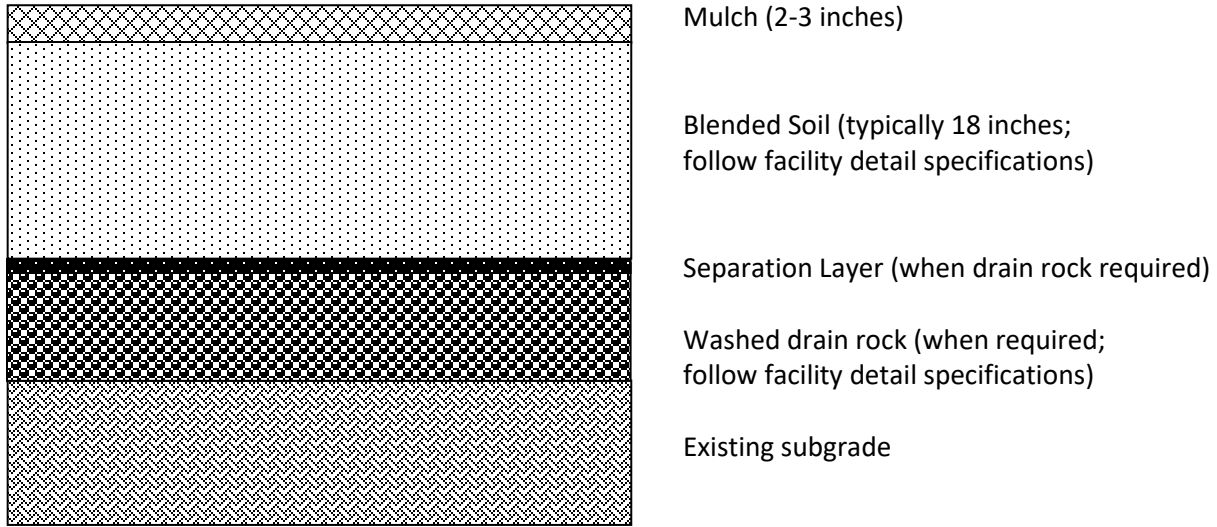


Appendix F: Soil and Mulch Specifications

Public and private stormwater facilities all require a stormwater facility topsoil blend covered by a layer of mulch. Depending upon the type of stormwater facility being constructed, there may also be a layer of drain rock required. This appendix provides specifications about soil, mulch, rock and placement of those materials into stormwater facilities.



F.1 Stormwater Facility Blended Soil

The planting media or blended soil to be used in vegetated stormwater facilities shall be a 3-way blend with equal parts topsoil, sand, and compost (by volume) and meets the other criteria in this specification.

Table F-1. Recommended particle gradation for final planting media to be used in stormwater facilities

U.S. Sieve Size	Percent Passing
1 inch (25.4 mm)	100
# 4 (4.75 mm)	75-100
# 10 (2.0 mm)	40-100
# 40 (0.42 mm)	15-50
# 100 (0.15 mm)	5-25
# 200 (0.075 mm)	5-15

In addition to meeting the meeting the particle gradation, the blended soil/planting media shall also meet the following criteria:

- The pH of the blended material shall be tested. The material shall have a pH of 6 to 8.
- The material shall be loose and easily broken into small pieces.
- It shall be well mixed and homogenous.
- It shall be free of wood pieces, plastic, and other foreign matter.
- It shall have no visible free water.

The best way to ensure the planting media installed meets the blended soil requirements is to import a 3-way mix from a commercial facility. However, it is possible to stockpile the existing topsoil on-site and then amend with one part imported organic compost and one part gravelly sand, such that there are equal parts compost, sand, and topsoil. Existing topsoil shall be topsoil, rather than subgrade soil and meet the requirements specified in the Topsoil section below (F.1.1).

The assumed infiltration rate for the stormwater facility blended soil is 2 inches per hour.

F.1.1 Topsoil

Topsoil shall be a loamy soil that is not subgrade soil with a high clay content. Topsoil shall not contain contaminants or other substances that would be detrimental to the growth of plants. Soil shall be free of plant material or seeds designated by the Oregon Department of Agriculture as Type "A" or Type "B" weeds.

F.1.2 Compost

Compost material shall be derived from plant material, be provided by a member of the U.S. Composting Council Seal of Testing Assurance program, and have the following properties:

- 100% shall pass a ½-inch screen.
- pH between 6-8.
- Carbon/Nitrogen ratio less than 25:1
- Organic matter content between 30 and 70% (dry weight basis)
- Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0% by weight.
- Soluble salt content less than 6.0 mmhos/cm.
- Maturity Indicator greater than 80% for Germination and Vigor.
- Stability shall be 'Stable' to 'Very Stable'
- Trace metals test result = Pass

F.1.3 Gravelly Sand

Gravelly sand shall be free of organic material, contaminants, and hazardous materials. 100% shall pass a ½-inch screen. Sand may need to be tested for metals to ensure it does not contain high levels of zinc or other RCRA-8 metals.

F.2 Drain Rock

For facilities where drain rock is required, this layer shall consist of ¾" to 1.5" washed rock (open graded aggregate). The depth varies by facility type, but is general a minimum of 9" and might be 18" deep for public facilities in the right of way.

A 2-3" deep lens of finer rock shall be used to provide separation between the underlying drain rock and the blended soil that will be placed on top. This separation or "choker" layer should consist of ¾" - #10 rock (ensure "clean" so no fine smaller than #1- sieve), rather than pea gravel.

F.3 Mulch

After placement of the soil blend and vegetation installation, all stormwater facilities shall be top dressed with medium fine fir or hemlock bark mulch (not bark dust or bark chips). For some facilities

located within the right-of-way where fire prevention may be an issue, the City may recommend use of gravel mulch (pea gravel or ¼"). Mulch shall be placed in a 2 to 3 inch layer over exposed soil between the plantings to completely cover the soil and prevent erosion or weed intrusion.

F.4 Facility Excavation and Subgrade Preparation

Native soil in a stormwater facility is removed to a typical depth of 18 inches below final soil grade (excavation depth needs to also account for ponding depth of water in facility and account for additional depth if rock is to be included below soil) and replaced with a 3-way blend of sand-compost-topsoil. Prior to placement of the blended soil, all construction waste should be removed from the underlying subgrade and the existing soil should be fractured and loosened to prevent the existing subgrade soil from becoming sealed following mechanical excavation.

F.5 Storage of Materials

Store stockpiles of organic soil mix in a manner that prevents them from becoming wet from rain, stormwater runoff, or other sources of water, or contaminated by fine soil or other undesirable materials. All stockpiles of mixed soil material shall be protected and covered.

F.6 Soil Placement

Place amended soil mix in stormwater facilities in lifts not exceeding 8 inches in loose thickness. Each lift shall be compacted with a water-filled landscape roller. After all lifts have been placed, grade soil to finish grades as specified on the plans. Do not overly compact soil mix with mechanical equipment after placement.

F.7 Infiltration Testing

Sites opting to amend existing topsoil using compost and gravelly sand must ensure that the blended soil infiltrates at a rate of at least 2 inches per hour. The following method shall be used to ensure the blended soil has an adequate amount of compost and sand added.

Wet the surface of the rain garden or stormwater planter with a sprinkler or hose until saturated. Small rain gardens and planters (<100 square-feet in surface) area can be tested full-scale, while large rain gardens and planters can utilize isolated falling head tests (minimum 2 per 100 square-feet of area). Fill the testing area to a depth of 4-inches and track the time it takes to completely draw down. Repeat test 3 times. If the water in any of the tests fails to draw down in less than an hour, add compost and gravelly sand to the mix and re-till. Repeat this procedure until favorable test results are achieved.

F.8 Protection of Soil and Facility During Construction

Soil shall be protected from all sources of contamination, including weed seeds, while at the supplier, in conveyance, and at the project site. The facility shall be protected from foot or equipment traffic that is unrelated to the construction of the facility. Temporary fencing or walkways should be installed as needed to keep workers, pedestrians, and equipment out of the facility. Stormwater facilities shall be kept clean. Materials and equipment shall not be stored in the facility, and any sediment or materials collected in the facility during construction shall be removed prior to final acceptance.

F.9 Installation in Wet and Winter Conditions

Avoid soil placement when the ground is frozen, saturated, or when the weather is too wet. Construction during the wet winter months may lead to damage to soil by compaction and sedimentation, higher risk of erosion, and harsher conditions for new plantings.

F.10 Structural Soil

Structural soil consists of a mixture of coarse open-graded rock, soil, and a binder. This material provides load bearing capacity for use under sidewalks, streets and parking lots – particularly for providing root space for trees and/or storage and treatment of stormwater.

The City will accept pre-blended proprietary blends, such as Cornell’s CU-Soil, EarthLite Biostructure Soil Mix from Sunmark, a mixture that follows the guidance in this section, or equivalent.

F.10.1. Materials

Structural soil that is not purchased as a proprietary blend shall consist of the following materials:

1. Angular, open-graded, crushed rock, $\frac{3}{4}$ " to 1- $\frac{1}{2}$ ". Gradation of 100% passing 2", with a maximum of 30% passing 0.75", 5% passing $\frac{1}{4}$ " and 0.5% passing No. 40 sieve by weight.
2. High clay content topsoil (minimum 20% clay)
3. Soil binding agent – “Stabilizer®” from Stabilizer Solutions (www.stabilizersolutions.com/products/stabilizer-landscape/)
4. Potable water

Material should be sourced as close to the project site as practicable. The developer must submit material specification information in sufficient detail for the City to determine if the material meets these specifications.

F.10.2. Proportions of Materials

The major components of the structural soil mixture are crushed rock and topsoil. Since some of the topsoil fills in the voids of the crushed rock material during mixing, the sum of the rock and topsoil volumes does not equal the volume of the structural soil material. There is approximately a 10% volume reduction due to mixing the materials together.

Material	Amount for 1 CY of Structural Soil	Amount for 4.6 CY of Structural Soil
Crushed Rock	23.2 cubic feet	4 cubic yards
Topsoil	1 cubic yard	5.9 cubic feet
Soil Binder	13.7 oz	4 pounds
Water	1.6 gallons	46 gallons

The target moisture content is 20% by weight of the topsoil weight. This water content assumes the materials are dry. The actual amount of water that will need to be added depends on the moisture content of the raw materials, which will be determined during mixing.

F.10.3. Mixing Procedure

- A. Mix structural soil in batches of an appropriate size for the equipment being used. The expected result is a material that is uniformly blended together. Do not batch in quantities that will not allow the equipment to completely mix the material. Determine batch size and quantities of each material needed for the batch.
- B. Start with half of the crushed rock material.
- C. Add all of the topsoil material.
- D. Add the soil binder.
- E. Add half of the estimated water.
- F. Add the other half of the crushed rock material.
- G. Mix the material together.
- H. Slowly add water to the mixture and continue to mix. The final amount of water will vary with moisture content of the crushed rock and topsoil. Add water in incremental amounts and mix the material between the additions of water.
- I. Stop adding water and mixing when there is a minute amount of free topsoil remaining. The topsoil will coat the crushed rock and not fall out of the material. All of the crushed rock should be uniformly coated with topsoil. There should be no clumps of topsoil or uncovered crushed rock in the mixture.
- J. If too much water is added to the mixture water will drain out of the material and the topsoil will wash off of the crushed rock. If this occurs this batch of material is to be discarded and shall not be incorporated into the completed work.

F.10.4. Placement

Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content.

All areas to receive structural soil mixture shall be inspected by the City before starting placement of mixture. All defects such as incorrect grading, compaction and inadequate drainage, etc., shall be corrected prior to beginning placement of structural soil.

Confirm that the sub-grade is at the proper elevation and compacted as required. Sub-grade elevations shall slope parallel to the finished grade. Clear the excavation of all construction debris, trash, rubble and foreign material. Fill any over excavation with approved fill and compact to the required sub-grade compaction.

Install structural soil in 6-inch lifts and spread uniformly over the area. Delay placement 24 hours if moisture content exceeds maximum allowable, protect structural soil with plastic or plywood during delay.

Bring structural soils to finished grades as shown in standard detail drawing. Immediately protect the structural soil material from contamination from construction dirt and water by covering with plastic or plywood.

The structural soil should have a geotextile or smaller rock “choker” layer installed over the top of it to prevent migration of fines or concrete from sidewalk from migrating down into the mix. Typical depth of structural soil placed under sidewalks is 24” and under paved parking lots or streets is 36”.