Soil Evaluation Guidance

A soil evaluation is required for all proposed stormwater infiltration systems to confirm critical soil characteristics and subsurface conditions at the location of the proposed system including soil types, depth to the seasonal high groundwater table, depth to bedrock, and soil infiltration rates (or hydraulic conductivity). This information is used to determine if stormwater infiltration is appropriate for use at the site and to support the design of the infiltration system.

The soil evaluation should be conducted by a Qualified Professional, which is an individual with demonstrated expertise in soil science, including, **but not limited to**:

- a Connecticut Registered Professional Engineer,
- a Connecticut Registered Landscape Architect
- a Qualified Professional Engineer as defined in the CT DEEP MS4 General Permit,
- a qualified soil erosion and sediment control professional as defined in the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities,
- a Certified Soil Scientist,
- or a Professional Geologist.

Initial Screening

Initial screening of the site is recommended early in the design process to rule out sites or portions of sites that are likely unsuitable for stormwater infiltration systems. Initial feasibility screening could involve the use various information sources including but not limited to:

- Previous geotechnical investigations conducted at the site and documented in a report by a qualified geotechnical consultant
- Septic system percolation testing on-site, within 200 feet of the proposed infiltration system and at the same elevation (septic system percolation testing cannot be used for determining field infiltration rates – see below)
- Natural Resources Conservation Service (NRCS) soil mapping showing Hydrologic Soil Groups (HSG)
- Areas classified as Somewhat Poorly Drained, Poorly Drained, or Very Poorly Drained based on NRCS Soil Drainage Class mapping.

If the results of the initial screening step as determined by a Qualified Professional show that an infiltration rate greater than the minimum required infiltration rate (see General Design Guidance) is probable, the project proponent should proceed with test pits/soil borings and, under certain conditions, field infiltration testing, as discussed below. Initial screening results cannot be used in place of test pits/soil borings and field infiltration (or conductivity) testing.

Test Pits and Soil Borings

Test pits or soil borings are required for ALL proposed stormwater infiltration systems (and all other structural stormwater BMPs) to verify soil type, USDA soil textural class, and NRCS HSG soil classifications.

- Perform test pits or soil borings to a minimum depth of 3 feet below the elevation of the bottom of the proposed infiltration system (i.e., the portion of the system in contact with the underlying soil) and within 20 feet horizontally of the proposed system.
- Excavate test pits or install encased soil or hollow stem auger borings at a frequency of:
    - 1 test pit or boring per 2,000 square feet of infiltration area, but no fewer than 1 test pit or boring per location where infiltration is proposed
    - 1 test pit or boring per 5,000 square feet of permeable paving surface for permeable pavement installations, but no fewer than 2 test pits or borings per location where permeable pavement is proposed
    - 1 test pit or boring per 100 linear feet of linear BMP (infiltration trench, linear underground infiltration system, linear bioretention system, and water quality swale) but no fewer than 1 test pit or boring per linear BMP
    - Minimum test pit or soil boring frequencies for other structural stormwater BMPs are addressed in Chapter 13 - Structural Stormwater BMP Design Guidance
    - Sites with historic fill (due to the highly variable subsurface) should include additional borings and/or assure infiltration proceeds below the elevation of the fill and into natural subsoil.
- Test pit/soil boring stakes are to be left in the field for inspection purposes and survey and should be clearly labeled as such.
- Test pits should be of adequate size, depth, and construction to allow a person to enter and exit the pit and complete a soil profile description.
- If borings are drilled, continuous soil borings should be taken using a probe, split-spoon sampler, Shelby tube, or equivalent device. Samples should have a minimum 2-inch diameter.

- Determine USDA soil textural class at the bottom of the proposed infiltration system and 3ft below the bottom of the proposed infiltration system through visual field inspection by a Qualified Professional. Soil textural class represents the relative composition of sand, silt, and clay in soil. Classification of soil texture should be consistent with the USDA Textural Triangle. Geotechnical lab testing (grain-size sieve analysis and hydrometer tests) of soil samples collected from the test pits or soil borings may be used for the soil textural analysis and USDA textural soil classification. Soils must not be composited from one test pit or bore hole with soils from another test pit or bore hole for purposes of the textural analysis.

- The soil description should include all soil horizons in the test pit or soil boring.

- Determine depth to seasonal high groundwater table (SHGT) (if within 3 feet of the bottom of the proposed infiltration system). Depth to SHGT may be identified based on redoximorphic features in the soil. When redoximorphic features are not available, installation of temporary push point wells or piezometers should be considered. Ideally, such wells should be monitored in the spring when groundwater is typically highest and the results should be compared to nearby groundwater wells monitored by the USGS to estimate whether regional groundwater is below normal, normal, or above normal.

- Determine depth to bedrock (if within 3 feet of the bottom of the proposed infiltration system).

Field Infiltration Testing

Field infiltration testing is required when one or more of the following conditions exist:

- Stormwater infiltration is proposed in HSG C or D soils, as field verified through test pits or soil boring

- The Dynamic Method is used for infiltration system sizing (see below for sizing methods) regardless of USDA soil textural class or Hydrologic Soil Group

- Highly compacted soils are observed indicated or in areas of sand/gravely soils

In general, field infiltration testing is not required for infiltration systems proposed in HSG A or B soils, as field verified through test pits or soil borings, when the Static Method is used for system sizing; default infiltration rates based on the field verified USDA soil textural class may be used as the design infiltration rate. Field infiltration testing is not required for Filtering BMPs or Dry Water Quality Swales that are not designed for infiltration (i.e., designed with an impermeable liner). However, these exclusions from testing do not apply to coastal areas.

The field infiltration test method should be representative of vertical water infiltration through the soil, excluding lateral flows, under field saturated conditions. The testing should be performed by a Qualified Professional. Acceptable test methods include:

- Double-ring infiltrometer (most current ASTM method)
- Turf-tec infiltrometer method (commercially adapted version of the double-ring infiltrometer method)
- Guelph permeameter (most current ASTM method)
- Falling head permeameter (most current ASTM method)
- Borehole infiltration test (falling head infiltration test conducted in a borehole casing)
- Other equivalent methods approved by the review authority

Septic system percolation testing, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not acceptable for determining field infiltration rates because percolation tests overestimate the saturated hydraulic conductivity rate. Septic system percolation testing may be used as a screening tool to determine whether a site is suitable for stormwater infiltration practices (see the Initial Screening step above). Lab permeability testing is also not acceptable for determining soil infiltration rates since lab tests do not adequately represent in-situ or field conditions.

- Perform infiltration testing at or below the elevation of the bottom of the proposed infiltration system (i.e., the portion of the system in contact with the underlying soil) and within 10 feet horizontally of the proposed system.
- Perform infiltration testing at a frequency of:
    - 1 infiltration test per 2,000 square feet of infiltration area, but no fewer than 1 test per location where infiltration is proposed
    - 1 infiltration test per 5,000 square feet of permeable paving surface for permeable pavement installations, but no fewer than 2 tests per location where permeable pavement is proposed
    - 1 infiltration test per 100 linear feet of linear BMP, including Infiltration BMPs (infiltration trenches, linear underground infiltration systems), unlined Filtering BMPs (linear bioretention systems), and unlined dry water quality swales, but no fewer than 1 test pit or boring per linear BMP.

Soil Evaluation Documentation

The project proponent should prepare a plan of the site clearly delineating the NRCS Hydrologic Soil Groups throughout the entire site and the specific location(s) where infiltration is proposed. Deviations from the NRCS Soil Surveys and special conditions discovered during additional investigations (relative to infiltration potential) should be noted on the plan and described. The plan should identify the locations of all borings, test pits, and infiltration tests, including the

location of any known prior tests. Test pit or boring logs should be provided with the plan, identifying in cross section the soil types, seasonal high groundwater table elevation, depth to bedrock and other restrictive layers, and other appropriate information. Infiltration test results/logs should also be included.