Washington State
Department of Transportation

TECHNICAL MANUAL

Highway Runoff Manual

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Environmental and Engineering Programs
Design Office

Table 4B-1. Hydrologic soil series for selected soils in Washington State (continued).

Soil Type	Hydrologic Soil Group	Soil Type	Hydrologic Soil Group
Phelan	D	Sultan	C
Phoebe	B	Sultan variant	B
Pilchuck	C	Sumas	C
Potchub	C	Swantown	D
Tacoma	D	Vailton	B
Tanwax	D	Vassar	B
Tanwax, Drained	C	Verlot	C
Tealwhit	D	Wapato	D
Tekoa	C	Warden	B
Tenino	C	Wethey	C
Tisch	D	Whidbey	C
Tokul	C	Wilkeson	B
Townsend	C	Winston	A
Triton	D	Wolfeson	C
Tukwila	D	Woodinville	B
Tukey	C	Yelm	C
Uhlig	B	Zynbar	B
Urbana	C		

Hydrologic Soil Group Classifications, as defined by the Soil Conservation Service:

A = (Low runoff potential) Soils having low runoff potential and high infiltration rates, even when thoroughly wetted. They consist chiefly of deep, well- to excessively drained sands or gravels, and have a high rate of water transmission (greater than 0.30 in/hr).

B = (Moderately low runoff potential) Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well- to well-drained soils, with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15–0.3 in/hr).

C = (Moderately high runoff potential) Soils having low infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine textures. These soils have a low rate of water transmission (0.05–0.15 in/hr).

D = (High runoff potential) Soils having high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential; soils with a permanent high water table; soils with a hardpan or clay layer at or near the surface; and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0–0.05 in/hr).

* = From SCS, TR-55, Second Edition, June 1986, Exhibit A-1. Revisions made from SCS, Soil Interpretation Record, Form #5, September 1988 and various county soil surveys.

This information can also be found online at: websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Use the following equation to convert K_{sat} from cm/s to ft/day:

$$K_{sat}\,(\text{ft/day}) = K_{sat}\,(\text{cm/s}) \times 2{,}834.65$$

If the licensed professional conducting the investigation determines that deeper layers will influence the rate of infiltration for the facility, soil layers at greater depths must be considered when assessing the site's saturated hydraulic conductivity characteristics. Massmann (2003) indicates that where the water table is deep, soil or rock strata up to 100 feet below an infiltration facility can influence the rate of infiltration. Note that only the layers near and above the water table or low permeability zone (such as a clay, dense glacial till, or rock layer) need to be considered, as the layers below the groundwater table or low permeability zone do not significantly influence the rate of infiltration. Also, note that this equation for estimating saturated hydraulic conductivity assumes minimal compaction consistent with the use of tracked (low-to-moderate ground pressure) excavation equipment, as described in the Site Design Elements of Section 5-4.2.1.

If the soil layer being characterized has been exposed to heavy compaction, or is heavily overconsolidated due to its geologic history (for example, overridden by continental glaciers), the saturated hydraulic conductivity for the layer could be approximately an order of magnitude less than what would be estimated based on grain size characteristics alone (Pitt, 2003). In such cases, compaction effects must be taken into account when estimating saturated hydraulic conductivity. For clean, uniformly graded sands and gravels, the reduction in K_{sat} due to compaction will be much less than an order of magnitude. For well-graded sands and gravels with moderate-to-high silt content, the reduction in K_{sat} will be close to an order of magnitude. For soils that contain clay, the reduction in K_{sat} could be greater than an order of magnitude.

There are field tests that can estimate specific soil layer K_{sat} values. These tests include the packer permeability test (above or below the water table), the piezocone (below the water table), an air conductivity test (above the water table), and a pilot infiltration test (PIT), as described in Ecology's SMMWW. Note that these field tests generally provide a saturated hydraulic conductivity combined with a hydraulic gradient (see Darcy's Law, Equation 4-18). In some of these field tests, the hydraulic gradient may be close to 1.0. For this condition, Darcy's Law would show that the K_{sat} would be nearly equal to the infiltration rate of that soil layer. It is important to recognize that the gradient in theses field tests may not be the same as the gradient likely to occur in the full-scale infiltration facility in the long term (when groundwater mounding is fully developed). This issue will need to be evaluated on a case-by-case basis when interpreting the results of field tests.

For Infiltration Pond, Infiltration Trench, Infiltration Vault, and the underlying soils for CAVFS, once the saturated hydraulic conductivity for each layer has been identified, determine the effective average saturated hydraulic conductivity below the BMP. Saturated hydraulic conductivity estimates from different layers can be combined using the harmonic mean: