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SECTION 9 – INFILTRATION REQUIREMENTS, SITE CHARACTERIZATION, AND SITE SUITABILITY CRITERIA

9.1 INTRODUCTION

This Section specifies the site characterization and site suitability criteria that must be considered for siting infiltration treatment facilities. For infiltration treatment facilities site selection and design decisions, a geotechnical and hydrogeologic report shall be prepared by a qualified engineer with geotechnical and hydrogeologic experience. A comparable professional, acceptable to the City, may also conduct the work if it is under the seal of a Professional Engineer registered in the State of Oregon. The design engineer shall utilize a team of certified or registered professionals in soil science, hydrogeology, geology, and other related fields. A member of this design team shall be considered/designated the site professional (as referenced in this Section 9).

9.2 SITE CHARACTERIZATION

Applicant shall conduct a site characterization study prior to siting and designing infiltration treatment facilities. Information gathered during initial geotechnical investigations shall be used for the site characterization. Key data and issues to be characterized include, but are not limited to, the following.

9.2.1 Surface Feature Characterization

A. Topography within 500 feet of the proposed facility. The plan shall show existing ground contours (shaded) and proposed ground contours at a minimum 2-foot contour interval. Slopes steeper than 6H:1V shall be identified.
B. Anticipated site use (residential, commercial, or industrial).
C. Location of water supply wells within 500 feet of proposed facility.
D. Location of ground water protection areas and/or 1-, 5-, and 10-year time of travel zones for municipal well protection areas.
E. A description of local site geology, including soil or rock units likely to be encountered, the groundwater regime, and geologic history of the site.
F. Site location relative to identified flood plain or floodway.
G. Site location relative to surface water features, such as waterways, wetlands, etc.

9.2.2 Subsurface Characterization

A. Subsurface explorations (test holes or test pits) shall be performed to a depth of at least five times the maximum design depth of ponded water proposed for the infiltration treatment facility.
B. Continuous sampling (representative samples from each soil type and/or unit) to a depth below the base of the infiltration facility of 2.5 times the maximum design ponded water depth, but not less than 6 feet.
    1. For basins, at least one test pit or test hole per 5,000 square feet of basin infiltrating surface (in no case less than two per basin).
    2. For trenches, at least one test pit or test hole per 50 feet of trench length (in no case less than two per trench).
C. Prepare detailed logs for each test pit or test hole and a map showing the location of the test pits or test holes. Logs must include at a minimum, depth of pit or hole, soil descriptions, depth to water, presence of stratification.

9.2.3 Soil Testing

Soil characterization for each soil unit (soils of the same texture, color, density, compaction, consolidation, and permeability) encountered should include:

A. Grain-size distribution (ASTM D-422 or AASHTO T-311).
B. Textural class (USDA).
C. Percent clay content (include type of clay, if known) as determined by hydrometer testing (ASTM D-422 or AASHTO T-88).
D. Cation exchange capacity (CEC) and organic matter content for each soil type and strata. Where distinct changes in soil properties occur, to a depth below the base of the infiltration treatment facility of at least 2.5 times the maximum design water depth, but not less than 6 feet. Consider if soils are already contaminated, thus diminishing pollutant sorptive capacity.
E. For soils with low CEC and organic content, deeper characterization of soils may be required by the City (refer to Subsection "Site Suitability Criteria").
F. Color/mottling.
G. Variations and nature of stratification.

9.2.4 Infiltration Rate Determination

A. Determine the representative infiltration rate of the unsaturated vadose zone based on field infiltration tests and grain size/texture determinations. Field infiltration rates shall be determined using infiltration test methods as presented in the King County Surface Water Design Manual or comparable reference; infiltration testing shall be done in the soil stratum at the design elevation of the bottom of the infiltration facility.
B. Site testing shall be performed to verify infiltration rate estimates based on soil size distribution and/or texture. As a minimum, one soil grain-size distribution analysis (ASTM D-422 or AASHTO T-311) per soil stratum in each test hole shall be performed within 2.5 times of the maximum design water depth, but not less than 6 feet.
C. The infiltration rate is needed for routing and sizing purposes and for classifying the soil for treatment adequacy.

9.2.5 Infiltration Receptor

Infiltration receptor (unsaturated and saturated soil receiving the stormwater) characterization shall include:

A. Installation of ground water monitoring wells, unless the highest ground water level is known to be at least 50 feet below the proposed infiltration facility. Use at least three wells per infiltration treatment facility, or three hydraulically connected surface and ground water features. This will establish a three-dimensional relationship for the ground water table. The monitoring wells will:
    1. Monitor the seasonal ground water levels at site through a minimum of one wet-season.
    2. Consider the potential for unconfined and confined aquifers, or confining units, at the site that may influence the proposed infiltration facility as well as the ground water gradient. Other approaches to determine ground water levels at the proposed site could be considered if pre-approved by the Public Works Director or the Public Works Department authorized representative.
    3. Determine the ambient ground water quality, if there is a concern identified by the City.
B. Estimate the volumetric water holding capacity of the infiltration receptor soil. This is the soil layer below the infiltration treatment facility and above the seasonal high-water mark, bedrock, hardpan, or other low permeability layer. This analysis should be conducted at a conservatively high infiltration rate based on vadose zone porosity, and the water quality runoff volume to be infiltrated. Along with an analysis of ground water movement, this will be used in determining volumetric limitations that would adversely affect drawdown.

C. Depth to ground water table and to bedrock/impermeable layers.
D. Seasonal variation of ground water table based on recorded well water levels and observed mottling.
E. Existing ground water flow direction and gradient.
F. Lateral extent of infiltration receptor.
G. Horizontal hydraulic conductivity of the saturated zone to assess the aquifer's ability to laterally transport the infiltrated water.
H. Impact of the infiltration rate and volume at the project site on ground water mounding, flow direction, and water table; and the discharge point or area of the infiltrating water. A ground water mounding analysis shall be conducted at all sites where the depth to seasonal ground water table or low permeability stratum is less than 15 feet and the runoff to the infiltration treatment facility is from more than one acre. The site professional can consider conducting an aquifer test or slug test and the type of ground water mounding analysis necessary at the site.

9.3 SITE SUITABILITY CRITERIA

This section specifies the site suitability criteria that must be considered for siting infiltration treatment facilities. When a site investigation reveals that any of the nine applicable criteria cannot be met, appropriate mitigation measures must be implemented so that the infiltration treatment facility will not pose a threat to safety, health, and the environment.

9.3.1 Setbacks

Setback requirements shall follow City regulations, uniform building code requirements, and/or state regulations. Also evaluate on-site and off-site structural stability due to extended subgrade saturation and/or head loading of the permeable layer, including the potential impacts to down-gradient properties, especially on hills with known side-hill seeps.
The following setbacks are provided as guidance.

A. From drinking water wells, septic tanks or drain fields, and springs used for public drinking water supplies. Infiltration treatment facilities up-gradient of drinking water supplies and within 1, 5 and 10-year time of travel zones must comply with Oregon Health Division requirements.
B. From building foundations (a minimum of 20 feet down-slope and 100 feet upslope).
C. From the top of slopes steeper than 10% (setback a minimum of 50 feet from crest of slope).

9.3.2 Ground Water Drinking Water Protection Areas

A site shall be deemed not suitable if the infiltrated stormwater will be in violation of OAR 340-044-0014.

9.3.3 High Vehicle Traffic Areas

Infiltration treatment facilities may be considered for runoff from areas of industrial activity and the high vehicle traffic areas described below, if appropriate pretreatment (including oil removal) is provided to ensure that ground water quality standards will not be violated and that the infiltration treatment facility will not be adversely affected.
High Vehicle Traffic Areas are defined as:

A. Commercial or industrial sites subject to an expected ADT $\geq$ 100 vehicles/1,000 square feet gross building (trip generation); and
B. Road intersections with an ADT of $\geq$ 25,000 on the main roadway, or $\geq$ 15,000 on any intersecting roadway.

9.3.4 Soil Infiltration Rate/Drawdown Time

A. Infiltration rates short-term and long-term:

1. For treatment purposes the short-term soil infiltration rate should be 2.4 inch/hour, or less, to a depth of 2.5 times the maximum design pond water depth, or a minimum of 6 feet below the base of the infiltration treatment facility. This infiltration rate is also typical for soil textures that possess sufficient physical and chemical properties for adequate treatment, particularly for soluble pollutant removal (see Subsection "Soil Physical and Chemical Suitability for Treatment"). It is comparable to the textures represented by Hydrologic Groups B and C. Long-term infiltration rates up to 2.0 inches/hour can also be considered, if the infiltration receptor is not a sole-source aquifer, and in the judgment of the site professional, the treatment soil has characteristics comparable to those specified in criteria #6 to adequately control the target pollutants.
2. The long-term infiltration rate should also be used for maximum drawdown time and routing calculations.

B. Drawdown time:
It is necessary to empty the maximum ponded depth (water quality volume) from the infiltration basin within 24 hours from the completion of inflow to the storage pond in order to meet the following objectives:
1. Restore hydraulic capacity to receive runoff from a new storm.
2. Maintain infiltration rates.
3. Aerate vegetation and soil to keep the vegetation healthy.
4. Enhance the biodegradation of pollutants and organics in the soil.

9.3.5 Depth to bedrock, Water Table, or Impermeable Layer

The base of all infiltration basins or trench systems shall be $\geq$ 5 feet above the seasonal high-water mark, bedrock (or hardpan) or other low permeability layer. A minimum separation of 3 feet may be considered if the ground water mounding analysis, volumetric receptor capacity, and the design of the overflow and/or bypass structures are judged by the site professional to be adequate to prevent overtopping and to meet the site suitability criteria specified in this section.

9.3.6 Soil Physical and Chemical Suitability for Treatment

The soil texture and design infiltration rates should be considered along with the physical and chemical characteristics specified below to determine if the soil is adequate for removing the target pollutants. The following soil properties must be carefully considered in making such a determination:

A. CEC of the treatment soil must be $\geq$ 5 millequivalents (meq) CEC/100 g dry soil (USEPA Method 9081). Consider empirical testing of soil sorption capacity, if practicable. Ensure that soil CEC is sufficient for expected pollutant loadings, particularly heavy metals. Lower CEC content may be considered if it is based on a soil loading capacity determination for the target pollutants that is accepted by the Public Works Director or the Public Works Department authorized representative.
B. Depth of soil used for infiltration treatment must be a minimum of 18 inches.
C. Organic content of the treatment soil as determined by ASTM D-2974: Organic matter can increase the sorptive capacity of the soil for some pollutants. The site professional should evaluate whether the organic matter content is sufficient for control of the target pollutant(s).
D. Waste fill materials should not be used as infiltration media nor should such media be placed over uncontrolled or non-engineered fill soils.
E. Engineered soils may be used to meet the design criteria in this section. Field performance evaluation(s), using acceptable protocols, would be needed to determine feasibility, and

acceptability by the Public Works Director or the Public Works Department authorized representative.

9.3.7 Seepage Analysis and Control

Determine whether there would be any adverse effects caused by seepage zones on nearby building foundations, basements, roads, parking lots or sloping sites.

9.3.8 Impact of Roadway Deicers

Potential impact of roadway deicers on potable water wells must be considered in the siting determination. Mitigation measures must be implemented if infiltration of roadway deicers can cause a violation of ground water quality standards.

9.3.9 Verification Testing of the Completed Facility

Verification testing of the completed full-scale infiltration treatment facility is recommended to confirm that the design infiltration parameters are adequate to manage the design volume and meet the pollutant capture objectives of the infiltrating soil. The site professional should determine the duration and frequency of the verification testing program for the potentially impacted ground water. The ground water monitoring wells installed during site characterization may be used for this purpose. Long-term in-situ drawdown and water quality monitoring for a two-year period, would be preferable.