Appendix C: Criteria for Infiltration-Based BMPs

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Careful consideration needs to be taken when siting infiltration-based green infrastructure in a dense urban environment, such as San Francisco.

This appendix summarizes the San Francisco Public Utilities Commission's (SFPUC's) and the Port of San Francisco's (Port's) siting and design requirements for infiltration-based stormwater controls (also known as Best Management Practices, or BMPs) and provides guidance about soil categories and infiltration rate testing.

Siting and Design Requirements for Infiltration-Based BMPs

The following siting and design requirements apply to infiltration-based BMPs:

- 4-foot minimum vertical separation from base of BMP to bedrock.
- 4-foot minimum vertical separation from base of BMP to seasonal high groundwater in all Bayside groundwater basins; 10-foot minimum vertical separation from base of BMP to seasonal high groundwater in the Lobos and Westside groundwater basins, with the potential for reduction to 4-foot separation with SFPUC approval. A map of San Francisco's groundwater basins is available at http://sfwater.org/index.aspx?page=194.

- Underdrains are required if the underlying native soils have an infiltration rate less than 0.5 inches per hour.
- For subsurface infiltration systems, infiltration trenches, and infiltration basins, runoff must be fully treated prior to infiltration if underlying native soils consist of coarse sands with a field-tested infiltration rate greater than 5 inches per hour. The treatment can be achieved by approved pretreatment facilities, upstream BMPs, or by installing an 18-inch layer of sand meeting ASTM C33 at the base of the infiltration BMP.

Setback Requirements

A setback is measured as the horizontal distance from the edge of a stormwater facility to an adjacent property boundary, face of structure, or other facility of concern. Table C1 summarizes standard and conditional setback requirements for infiltration-based BMPs in San Francisco. If conditions vary from those shown in the conditional setback table or project team proposes a setback closer to a new foundation, SFPUC or Port project review staff may allow reduced setbacks upon review a written letter of approval from the project's structural and geotechnical/soils engineers stating they have reviewed and approved the location of the infiltration facility and all related construction documents.

Contamination

Certain areas of San Francisco are suspected or known to be underlain by contaminated soil or groundwater and therefore have limited potential for infiltration. Areas with current or historical industrial use or zoning; areas within 100 feet of current or historical underground tanks; filled former bay, marsh, or creek areas; and areas within 150 feet of a current or historical highway are regulated by the San Francisco Department of Public Health (SFDPH) under the Maher Ordinance (San Francisco Health Code Article 22A[1]). The 2015 Expanded Maher Area map identifies current Maher Ordinance areas (available at http://www.sf-planning.org/ftp/files/publications_reports/library_of_cartography/Maher%20Map.pdf).

1 The full text of San Francisco Health Code Article 22A (known as the "Maher Ordinance") is available at http://www.amlegal.com/nxt/gateway.dll/California/health/healthcode?f=templates$fn=default.htm$3.0$vid=amlegal:sanfrancisco_ca$sync=1.

Soil Contamination

Project sites where soil contamination is likely shall submit the following documentation demonstrating the infeasibility of infiltration in the Supporting Documentation appendix of the Stormwater Control Plan (SCP):

- Excerpts of the Subsurface Investigation report (as required by the Maher Ordinance) indicating the presence of contamination, AND a letter stating that infiltration is not recommended from a qualified environmental consultant that is either a professional geologist, certified engineering geologist, or licensed civil engineer with experience investigating and evaluating contaminated sites, OR
- A copy of a letter from the SFDPH indicating the presence of contamination.

Conversely, Maher Ordinance area sites that wish to use infiltration-based BMPs shall submit:

- Excerpts of the Subsurface Investigation report indicating the absence of contamination, AND a letter stating that infiltration does not pose a pollutant mobilization threat from a qualified environmental consultant that is either a professional geologist, certified engineering geologist, or licensed civil engineer with experience investigating and evaluating contaminated sites, OR
- A copy of a letter from the SFDPH indicating the absence of contamination.

Table C1. Setback Requirements for San Francisco

Standard Setbacks for Infiltration BMPs in San Franicsco		
Distance (ft)	*Setback from*	*Conditions*
5	Property line	Standard for all infiltration facilities
10	Downgradient from adjacent foundations	Standard for all infiltration facilities
100	Upgradient from adjacent foundations	Standard for all infiltration facilities
100	Upgradient from ground slopes 15% or greater	Standard for all infiltration facilities
150	Drinking water well	Standard for all infiltration facilities
Conditional Setbacks for Infiltration BMPs in San Franicsco		
Distance (ft)	*Setback from*	*Conditions*
0	Foundations	The BMP is a waterproof, lined, flow-through facility with no infiltration.
0	Foundations	There is no run-on to the BMP facility and a waterproof separation barrier is provided between the BMP drain rock and adjacent foundations.
0	Downgradient from newly proposed foundations	If the drainage area < 1000 ft^2; OR if drainage area < 5000 ft^2 and adjacent buildings do not have basements or are designed with wall drains AND A signed letter from both a professional geotechnical engineer and a professional structural engineer is submitted with the SCP stating that the reduced setback will not result in negative structural impacts on newly proposed adjacent foundations.
50	Upgradient from newly proposed foundations	If the drainage area < 1000 ft^2; OR if drainage area < 5000 ft^2 and adjacent buildings do not have basements AND A signed letter from both a professional geotechnical engineer and a professional structural engineer is submitted with the SCP stating that the reduced setback will not result in negative structural impacts on newly proposed adjacent foundations.
50	Upgradient from existing foundations	If a signed letter from a professional geotechnical engineer is submitted with the SCP stating that the system was designed to protect existing adjacent foundations.

Projects regulated by the Maher Ordinance must submit a subsurface investigation report completed by a professional geologist, certified engineering geologist, or licensed civil engineer with experience investigating and evaluating contaminated sites. If the report indicates the presence of hazardous substances in the soils or groundwater, the site is typically unsuitable for infiltration BMPs, which could mobilize contaminants. Properties with known or potential contamination outside the current Maher area may be added to the Maher area or regulated by the SFDPH Voluntary Remedial Action Program.

Landslide Hazard Siting Requirements

Certain areas of San Francisco are prone to landslides (see http://pubs.usgs.gov/of/1997/of97-745/sf-sef.pdf for landslide hazard areas). In these areas, infiltration-based BMPs can only be used if written approval from the project's structural and geotechnical/soils engineers is provided in the Supplemental Documentation section of the Stormwater Control Plan (SCP). The *San Francisco Stormwater Management Requirements and Design Guidelines* (SMR) *Chapter 9: Stormwater Control Plan Requirements* provides more information about SCP requirements.

Class V Injection Well Requirements

Infiltration BMPs that are deeper than their widest surface dimension (e.g., dry wells) or receive flow via a subsurface pipe (e.g., infiltration galleries) are classified as Class V injection wells. Project proponents must register all BMPs that qualify as Class V injection wells at http://www.epa.gov/region09/water/groundwater/injection-wells-register.html, and must submit an inventory form for each to the Unites States Environmental Protection Agency (USEPA) Region 9 at http://www.epa.gov/region09/water/groundwater/uic-pdfs/7520-16.pdf.

Class V Injection Wells

A Class V injection well is defined by the US Environmental Protection Agency as "a shallow on-site disposal system used to place various non-hazardous fluids below the land surface (40 CFR 144.80)" that:

- **Consists of a drilled or driven shaft, or dug hole that is deeper than it is wide, relies on a naturally occurring sinkhole, or includes subsurface piping;**
- Relies on infiltration to collect and dispose of storm water runoff; and
- Discharges to the subsurface.

Soil Classification

Project proponents using the BMP Sizing Calculators (available online at www.sfwater.org/smr) must enter the hydrologic soil group (HSG) of native (or existing) soils at the project site. The HSG is a Natural Resources Conservation Service classification system in which soils are categorized into four groups according to runoff potential. The HSG definitions are summarized in Table C2.

Table C2. HSG Definitions (from Soil Conservation Service, 1986)

Group	Soil Types	Descriptions
A	Sand, loamy sand, or sandy loam	Low runoff potential. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels.
B	Silt loam or loam	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.
C	Sandy clay loam	Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures.
D	Clay loam, sandy clay, silty clay, or clay	High runoff potential. Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, and shallow soils over nearly impervious material.

Digging below the topsoil will reveal the profile of the underlying native soil. Photo: Jim Turenne

Local boring logs typically classify soils using the Unified Soil Classification System (USCS) rather than the HSG soil type. Table C3 below can be used to estimate the HSG soil type based on the USCS soil type for use in the BMP Sizing Calculators. If two classifications are given, the more poorly draining soil type should be used as the prevailing HSG soil type.

Infiltration Rate Testing

Infiltration rate testing methods allowed by the SFPUC and Port are provided with the SFPUC's *Green Stormwater Infrastructure Typical Details and Specifications*, *Infiltration Guidance* available on the SFPUC website at www.sfwater.org/smr.

Table C3. Converting USCS to HSG Soil Type

SCS Hydrologic Soil Group	Soil Textures	Corresponding Unified Soil Classification System Category
A	Gravel, sandy gravel, and silty gravels	GW – Well-graded gravels, sandy gravels GP – gap-graded or uniform gravels, sandy gravels GM – silty gravels, silty sandy gravels SW – well-graded, gravelly sands
	Sand, loamy sand, or sandy loam	SP – Gap-graded or uniform sands, gravelly sands
B	Silty sands, silty loam	SM – Silty sands, silty gravelly sands
	Loam	MH – Micaceous silts, diatomaceous silts, volcanic ash
C	Sandy clay loam	ML – Silts, very fine sands, silty or clayey fine sands
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay	GC – Clayey gravels, clayey sandy gravels SC – Clayey sands, clayey gravelly sands CL – Low plasticity clays, sandy or silty clays OL – Organic silts and clays of low plasticity CH – Highly plastic clays and sandy clays OH – Organic silts and clays of high plasticity

Source: Adapted from the Minnesota Stormwater Manual (2013), which presents compiled infiltration rate recommendations based on a review of 30 guidance manuals and many other stormwater references.

References and Resources

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