Appendix E: Infiltration Guidelines

Introduction

As a stormwater management method, infiltration means retaining or detaining water within soils to reduce runoff. Infiltration can be a cost-effective method to manage stormwater – if the conditions on the project site allow. These infiltration guidelines identify categories of stormwater infiltration methods, and describe factors that affect the feasibility of their use.

E.1 Stormwater Controls that Promote Infiltration

A wide-range of site-design measures and stormwater treatment measures allow stormwater infiltration and can be categorized as described below and illustrated in Figure E-1.

A. ***Site design measures*** -- such as clustering development or otherwise laying out the site to reduce impervious area, routing drainage from building roofs to landscaped areas, and using pervious pavement.

B. ***Indirect infiltration methods***, which allow stormwater runoff to percolate into surface soils. The infiltrated water may either percolate down into subsurface soils and eventually reach groundwater, or it may be underdrained into subsurface pipes. Examples of indirect infiltration methods include bioretention areas (formerly described as "vegetated swales" as in Figure E-1 below).

C. ***Direct infiltration methods***, which are designed to bypass surface soils and transmit runoff directly to subsurface soils and eventually groundwater. These devices must be designed with a pretreatment system to limit the potential for groundwater contamination. Examples of direct infiltration methods include infiltration trenches, infiltration basins, and dry wells.

D.

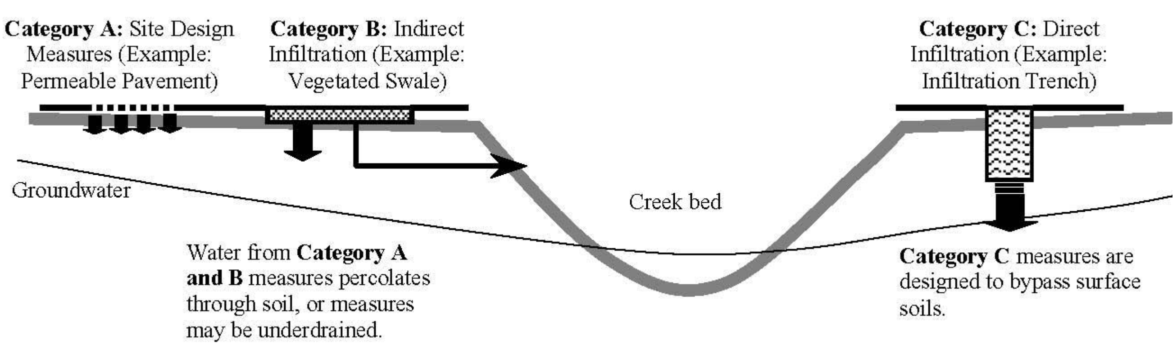

Figure E-1: Stormwater Infiltration Methods (Source: Contra Costa County Clean Water Program, 2005)

Table E-1 describes common stormwater controls and groups them according to whether they meet the above definitions of categories A, B and C. References to the applicable section of Chapter 4 or 6 are given for stormwater controls that have specific technical guidance included in this C3 Guide.

Table E-1: Infiltration Methods in Commonly-Used Stormwater Controls

Stormwater Control	Description	Guidance in Section
Category A: Site Design Measures		
Disconnected Downspouts	Instead of connecting directly to storm drains, roof runoff is directed away from the building to nearby landscaped areas.	4.3, 4.6
Site Grading	Using gentler slopes and concave areas to reduce runoff and encourage infiltration.	4.2, 4.3, 4.6
Site Layout Practices	Examples: Use compact, multi-story buildings to reduce building footprint, cluster buildings to reduce street length and protect sensitive areas, design narrow streets, use sidewalks on one side of street.	4.2, GI Design Guide – 3.2
Pavers	Traditional bricks, natural stones or other pavers over a bed of fine crushed aggregate with a reduced load-bearing surface.	4.2, 4.6
Green Roofs	May be "extensive" with a 3-7 inch lightweight substrate and a few types of low-profile plants; or may be "intensive" with a thicker substrate, more varied plantings, and a more garden-like appearance.	4.2, 6.8
Category B: Indirect Infiltration ("Infiltration Measures")		
Bioretention Area	Briefly ponds stormwater on the surface of a shallow depression and allows it to percolate through permeable soil. Underdrain is typically required, but is elevated to maximize infiltration to underlying soils, where conditions allow.	6.1
Pervious Pavements	Special mixes of concrete and asphalt. Require a base course of crushed aggregate and installation by experienced crews.	6.6
Permeable Paver	A load-bearing, durable surface of impermeable concrete unit pavers separated by joints with crushed aggregate in the joints as well as underneath. A sub-type is constructed of pavers which are themselves permeable and separated by smaller joints with fine aggregate.	6.6
Reinforced Grid Paving	A load-bearing, durable surface of a grid of plastic cells or blocks separated by joints with aggregate or in which soil is planted with turf or other plants.	6.7
Rainwater Harvesting and Use	Rain barrels and cisterns act as storage vessels, sometimes with a manually operated valve, to provide infiltration if runoff is stored for post-storm discharge to landscaping or other infiltration-type systems.	6.9

	Category C: Direct Infiltration ("Infiltration Devices")	
Infiltration Trench	A trench filled with rock or open graded aggregate.	6.4
Infiltration Basin	An excavation that exposes relatively permeable soils and impounds water for rapid infiltration.	
Dry Well	An excavation, underground storage facility, or drilled shaft filled with open graded aggregate.	
Sources: CCCWP, 2005; CASQA, 2003; ACCWP, 2006; SCVURPPP 2016.		

E.2 Factors Affecting Feasibility of Infiltration

The Harvest and Use, Infiltration and Evapotranspiration Feasibility/Infeasibility Criteria Report (Feasibility Report) submitted to the Regional Water Board by BASMAA on April 29, 2011, identified the factors listed below that affect the feasibility of infiltration. These factors are grouped according to whether they apply to both indirect and direct infiltration, or whether they apply only to direct infiltration.

As indicated in Table E-1, "***infiltration measures***" are stormwater treatment measures that provide indirect infiltration. Examples of infiltration measures include bioretention areas, self-treating and self-retaining areas and pervious pavement.

"***Infiltration devices***" [54] are designed to bypass surface soils and transmit runoff directly to subsurface soils and eventually groundwater. These types of devices must be located and designed to limit the potential for groundwater contamination and include pretreatment devices for that purpose. Examples of direct infiltration methods include dry wells, injection wells, and infiltration trenches (includes French drains).

Infiltration measures and infiltration devices are referred to collectively as "***infiltration facilities***."

E.2.1 Factors Affecting Feasibility of Both Indirect and Direct Infiltration

The following factors are used to determine the feasibility of any infiltration facility, whether it provides indirect infiltration (infiltration measures) or direct infiltration (infiltration devices):

- The permeability of the underlying soil;
- Whether the development site has underlying soil or groundwater contamination;
- Whether the site has potential geotechnical hazards;
- Whether there are conflicts with the location of existing or proposed underground utilities or easements.

[54] The reissued MRP defines "infiltration device" as any structure that is designed to infiltrate stormwater into the subsurface and, as designed, bypass the natural groundwater protection afforded by surface soil.

E.2.2 Sites Suitable for Direct Infiltration

Factors and design measures that make sites suitable for direct infiltration (infiltration devices) include the following:

- Policies of local water districts or other applicable agencies do not preclude infiltration and there are no known contamination sites.
- A minimum of 100 feet horizontally away from any known water supply wells, septic systems, and underground storage tanks (or greater if the site has highly porous soils or there are other concerns for groundwater protection).
- Vertical distance from the base of any infiltration device to the seasonal high groundwater mark of at least 10 feet (or greater if the site has highly porous soils or there are other concerns for groundwater protection);
- Appropriate pollution prevention and source control measures, including a minimum of two feet of suitable soil to achieve a maximum of 5 inches/hour infiltration rate (or an equivalent pretreatment system to remove pollutants that could affect groundwater quality); and
- Adequate maintenance practices provided to minimize risk to groundwater quality and maximize pollutant removal capabilities;

Unless stormwater is first treated by a method other than infiltration, infiltration devices are not allowed to be used as a treatment measure for stormwater runoff from areas of industrial areas, areas of high vehicular traffic or land uses that pose a high threat to water quality;

E.3 Dealing with Common Site Constraints

The following tips are intended to help manage constraints to infiltration that are common in San Mateo County.

- Where infiltration of the C.3.d amount of runoff is infeasible, bioinfiltration or bioretention areas may be used if drainage is sufficient or underdrains are provided. The design should maximize infiltration to the underlying soil, as shown in Section 6.1. Some indirect infiltration to groundwater will occur and will enhance the effectiveness of these treatment measures. Site design measures such as disconnected downspouts and pervious paving may be used if soils are amended and positively drained.
- Infiltration is generally infeasible on steep or unstable slopes. Site design measures that limit impervious area may be appropriate if approved by a geotechnical engineer. Consider detaining runoff in green roofs and cisterns, or using stormwater treatment measures that do not infiltrate water into the natural ground, such as flow-through planters or tree well filters.
- Green roofs, cisterns, flow-through planters, lined tree well filters, and other stormwater controls that are isolated from underlying soils are also appropriate for areas with high ground water and/or groundwater contamination.
- A variety of site design measures can often be used even on sites with the constraints described above, including (but not limited to) amended soils, structural soils, grading

landscaping to a concave form, designing taller buildings with smaller footprints, and concentrating development on less sensitive portions of the site.

E.4 Infiltration Devices and Class V Injection Well Requirements

In order to protect underground sources of drinking water, the USEPA regulates some infiltration devices as Class V wells under its Underground Injection Control (UIC) Program. A ***Class V injection well*** is defined as "… any bored, drilled, or driven shaft, or dug hole that is deeper than its widest surface dimension, or an improved sinkhole, or a subsurface fluid distribution system."[55] Infiltration trenches are typically not considered Class V injection wells because they are longer than they are wide. The USEPA's regulations state that stormwater drainage wells are "authorized by rule" (40 CFR 144), which means they do not require a permit from USEPA if they do not endanger underground sources of drinking water, and they comply with federal UIC requirements. (However, a permit may be required from San Mateo County Environmental Health – see box below.) For more information, see the USEPA's fact sheet, "When Are Storm Water Discharges Regulated as Class V Wells?" is included at the end of this appendix.

If the project includes one or more infiltration devices that are regulated as Class V injection wells, then basic inventory information about the device(s) will need to be submitted to the regional office of the USEPA. Instructions for submitting this information are available on the USEPA Region 9 website at https://www.epa.gov/uic/underground-injection-control-regulations-and-safe-drinking-water-act-provisions. Project sponsors are responsible for constructing, operating and closing the drainage well in a manner that does not risk contaminating underground sources of drinking water. The USEPA may place additional requirements on the infiltration device. Project sponsors should contact the appropriate USEPA staff, identified on the Internet link provided above, to learn what inventory information should be submitted, and when the submittal should be made.

In San Mateo County, the County Environmental Health Department issues well installation permits (except for the City of Daly City, which has local permitting authority). If a dry well or injection well depth exceeds 10 feet or if groundwater is encountered when installing the well, the well is required to be permitted by County Environmental Health. The requirement for a minimum 10-foot separation between the bottom of the well and seasonal high groundwater also applies. For more information, see: https://www.smchealth.org/gpp

[55] USEPA Office of Ground Water and Drinking Water, "When Are Storm Water Discharges Regulated as Class V Wells?" June 2003.