

F.10 Subsurface Infiltration

F.10.1 Subsurface Infiltration Plan Standards

1. Verify that the plans include an appropriate sequence of construction that is specific to the construction of the subsurface infiltration SMP. Refer to Section 4.4.5 for guidance. [Section 2.3.1]
2. To avoid soil disturbance and compaction during construction, verify that the infiltration area is proposed to be clearly marked before any site work begins. [Section 4.4.5, 1]
3. Verify that the plans include an appropriate cross-sectional detail for the subsurface infiltration SMP. [Section 2.3.1]

F.10.2 Subsurface Infiltration Design Standards

1. Verify that the SMP drains within the acceptable 72-hour period after the 24-hour storm event. [Section 4.4.3, 1]
2. Verify that the loading ratio of DCIA to the horizontal footprint of the subsurface infiltration SMP does not exceed 10:1. [Section 4.4.3, 2]
3. Verify that positive overflow is provided for large storm events, up to and including the 100-year, 24-hour storm event, or, if the project is exempt from Flood Control, the ten-year, 24-hour storm. [Section 4.4.3, 3]
4. Verify that overflow structures and pipes are designed to convey at least the ten-year, 24-hour storm event. [Section 4.4.3, 3]
5. Verify that the distance between subsurface infiltration basins and any adjacent private property line is at least ten feet. This includes partially lined basins. It is acceptable for SMPs to be located directly adjacent to the public right-of-way (ROW) (unless a deed restriction is put in place extending at least ten feet from the perimeter of the infiltrating SMP). [Section 4.4.3, 4]
6. Verify that the distance between subsurface infiltration basins and any building or retaining wall is at least ten feet. This includes partially lined basins. The following requirements and exceptions apply: [Section 4.4.3, 5]
 - a. For existing and proposed buildings with basements, the setback is measured from the basement wall.
 - b. For existing buildings without basements and existing retaining walls, the setback is measured from the foundation and may be waived if a signed and sealed geotechnical analysis is submitted that evaluates the impacts of infiltration and excavation on the existing foundation and determines it to be feasible.
 - c. For proposed buildings without basements and proposed retaining walls, the setback is measured from the foundation and may be waived if the foundation is proposed to be designed with the basin's proximity in mind.
7. Verify that the invert elevation of the subsurface infiltration SMP is at least two feet above any poorly infiltrating soils, seasonal high groundwater table, bedrock, or other limiting zone. [Section 4.4.3, 6b]

8. For hydrologic modeling, verify that the design infiltration rate is applied to the horizontal surface area (SMP footprint), not the wetted area. [Section 4.4.3, 6c]
9. Verify that the soils underlying the subsurface infiltration SMP are determined to be infiltration feasible. If infiltration feasibility is unknown and determination is deferred until construction, the applicant must submit two complete designs (e.g. plans, calculations, Online Technical Worksheet, etc.) for both infiltrating and non-infiltrating scenarios to be fully reviewed. A PCSMP Conditional Approval will be issued, and the approval letter will feature both plan sets. Following infiltration testing, only the applicable design's plan set will be included on the PCSMP Approval Letter. [Section 4.4.3, 6d]
10. Verify that any soils with test infiltration rates in excess of ten inches per hour are proposed to receive soil amendments. [Section 4.4.3, 6e]
11. If the infiltration SMP is used as a temporary sediment basin during construction, verify that the invert elevation of the infiltration SMP is a minimum of three feet below the bottom elevation of the pre-basin-conversion sediment basin. [Section 4.4.3, 6f]
12. Verify that any infiltrating SMP within the zone of influence of any nearby sewers or sewer laterals is installed with an impervious liner. The zone of influence is defined by the area within a 1:1 (H:V) slope line from the outer edge of a sewer or sewer lateral. [Section 4.4.3, 6g]
13. Verify that pretreatment is provided for all runoff entering the subsurface infiltration SMP, including pretreatment of runoff from all inlets. At a minimum, this can be achieved through the use of sumps and traps for inlets, sump boxes with traps downstream of trench drains, and filter strips for overland flow. [Section 4.4.3, 8]
14. Verify that the storage area provides static storage for the Water Quality Volume (WQv) between the bottom elevation of the subsurface infiltration SMP and the elevation of the lowest outlet, including storage voids. Storage or distribution pipes alone are not sufficient in providing static storage. A minimum of at least three inches of forced storage via an outlet control device is recommended in order to give the statically stored volume time to infiltrate. [Section 4.4.3, 11]
15. Verify that the maximum storage volume statically stored within the subsurface infiltration SMP without supporting documentation (defined below) is the runoff volume from the one-year, 24-hour storm event. [Section 4.4.3, 12]
16. Verify that the maximum storage volume statically stored within the subsurface infiltration SMP with supporting documentation is the runoff volume from the ten-year, 24-hour storm event. Requirements for supporting documentation include a letter, signed and sealed by both the geotechnical and design engineer, indicating that the proposed design is recommended, with the following components acknowledged and considered. The designer is encouraged to contact PWD for further guidance when pursuing this design. [Section 4.4.3, 13]
 - a. A summary of the long-term impacts to the neighboring properties, including, but not limited to subsidence, change in basement moisture/ water, and structural damage;
 - b. The location of the groundwater table;
 - c. References to other projects that have successfully infiltrated more than the one-year, 24-hour storm event; and
 - d. Rigorous pretreatment to promote longevity of the infiltration SMP.
17. Verify that, when SMPs are used in series, the storage areas for all SMPs provide cumulative static storage for the WQv. [Section 4.4.3, 14]

18. Verify that void space provided by linear chamber systems, plastic grids, or other related structures is as specified by the manufacturer and noted in supporting documentation. [Section 4.4.3, 16]
19. Verify that pipe, vault, grid, and chamber storage areas are adequately bedded with stone to prevent settling or subsidence. [Section 4.4.3, 17a]
20. Verify that bedding thickness is not less than six inches. [Section 4.4.3, 17b]
21. Verify that foundations/footers are provided as warranted by system loading, geotechnical conditions, and manufacturer's recommendations. Foundation designs must be performed by an appropriate design professional. [Section 4.4.3, 17d]
22. Verify that the storage design accounts for potential loading from vehicles, as appropriate, based on expected maximum active loading, including consideration for emergency vehicles. [Section 4.4.3, 18]
23. Verify that the porosity values used for storage volume calculations are as follows: [Section 4.4.3, 19]
 - a. Soil media: 0.20
 - b. Sand: 0.30
 - c. Stone: 0.40
24. Verify that the stone storage layer, if proposed, is separated from soil media by a geotextile or pea gravel filter to prevent sand, silt, and sediment from entering the system. [Section 4.4.3, 20]
25. Verify that stone storage systems have a level bottom or use a terraced system if installed along a slope. [Section 4.4.3, 21]
26. Verify that an adequate number of appropriately placed cleanouts, manholes, access panels and other access features are provided to allow unobstructed and safe access to the subsurface infiltration SMP for routine maintenance and inspection of inflow, outflow, underdrains, and storage systems. [Section 4.4.3, 23]
27. Verify that an observation well is provided for a subsurface infiltration SMP that includes stone storage and that it meets the following requirements:
 - a. The observation well must be placed at the invert of the stone bed. [Section 4.4.3, 24a]
 - b. An observation well must be located near the center of the stone bed system to monitor the level and duration of water stored within the SMP (drain down time). [Section 4.4.3, 24b]
 - c. Adequate inspection and maintenance access to the observation well must be provided. [Section 4.4.3, 24c]
 - d. A manhole may be used in lieu of an observation well if the invert of the manhole is installed at or below the bottom of the SMP and the manhole is configured in such a way that stormwater can flow freely between the SMP and the manhole at the SMP's invert. [Section 4.4.3, 24d]
28. Verify that access features are provided for any subsurface infiltration SMP that is not comprised of a stone storage bed. [Section 4.4.3, 25a]
29. Verify that a sufficient number of access points in the SMP are provided to efficiently inspect and maintain the infiltration area. [Section 4.4.3, 25b]
30. For cast-in-place vault systems, verify that access features consist of manholes or grated access panels or doors. Grated access panels are preferred to maintain airflow. [Section 4.4.3, 25c]

31. For grid storage or other manufactured systems, verify that the manufacturer's recommendations are followed. [Section 4.4.3, 25d]
32. Verify that ladder access is proposed for vaults greater than four feet in height. [Section 4.4.3, 25e]
33. Verify that header pipes, at minimum 36-inch diameter, connected to manholes at each corner of the subsurface infiltration SMP are provided. Alternatively, smaller header pipes may be used if cleanouts are provided on the manifold/header pipe junction for each distribution pipe. The cleanouts must be on alternating sides of the SMP. [Section 4.4.3, 25f]

F.10.3 Subsurface Infiltration Material Standards

1. Verify that stone designed for stormwater storage, if proposed, is specified on the plans as being uniformly graded, crushed, clean-washed stone and that it is noted that PWD defines "clean-washed" as having less than 0.5% wash loss, by mass, when tested per the AASHTO T-11 wash loss test. AASHTO No. 3 and No. 57 stone can meet this specification. [Section 4.4.4, 3]
2. Verify that sand, if proposed, is specified on the plans to be AASHTO M-6 or ASTM C-33 sand and to have a grain size of 0.02 inches to 0.04 inches. [Section 4.4.4, 4]
3. Verify that storage pipe, if proposed, is specified on the plans as meeting the following specifications:
 - a. Pipe used within the subsurface infiltration SMP must be continuously perforated and have a smooth interior with a minimum inner diameter of four inches. [Section 4.4.4, 5a]
 - b. High-density polyethylene (HDPE) pipe, if proposed, must meet the specifications of AASHTO M252, Type S or AASHTO M294, Type S. [Section 4.4.4, 5b]
 - c. Any pipe materials outside the SMP are to meet City Plumbing Code Standards. [Section 4.4.4, 5c]
4. Verify that geotextile, if proposed, is specified on the plans to consist of polypropylene fibers and to meet the following specifications (AASHTO Class 1 or Class 2 geotextile is recommended): [Section 4.4.4, 6]
 - a. Grab Tensile Strength (ASTM-D4632): ≥ 120 lbs
 - b. Mullen Burst Strength (ASTM-D3786): ≥ 25 psi
 - c. Flow Rate (ASTM-D4491): ≥ 95 gal/min/ft²
 - d. UV Resistance after 500 hrs (ASTM-D4355): $\geq 70\%$
 - e. Heat-set or heat-calendared fabrics are not permitted
5. Verify that observation wells are specified on the plans as consisting of perforated plastic pipe with a minimum inner diameter of six inches. [Section 4.4.4, 8]
6. Verify that cleanouts are made of material with a smooth interior having an inner diameter that is no less than four inches and matches that of its connecting pipe up to eight inches. If the pipe is larger than eight inches in diameter, verify that the cleanout is eight inches in diameter. [Section 4.4.4, 9]