CITY OF ANAHEIM BMP DESIGN GUIDELINES

To be utilized in conjunction with the City of Anaheim WQMP Review Checklist, City of Anaheim WQMP Template, and City BMP Sizing Worksheets on all WQMPs initially submitted during the 2021 calendar year

Introduction

The following requirements and standards shall be used during the BMP design process for all proposed projects within the City of Anaheim. All standards were developed in order to improve BMP functionality and lifespan and improve stormwater treatment for all new projects within the City.

Compliance with these standards should be reflected within both the grading plans and Water Quality Management Plan (WQMP) submitted to the City through both design narrative and construction details. See below for Table of Contents to assist with navigating through this document.

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Permeable Concrete /Pervious Pavement – LID BMP Criteria

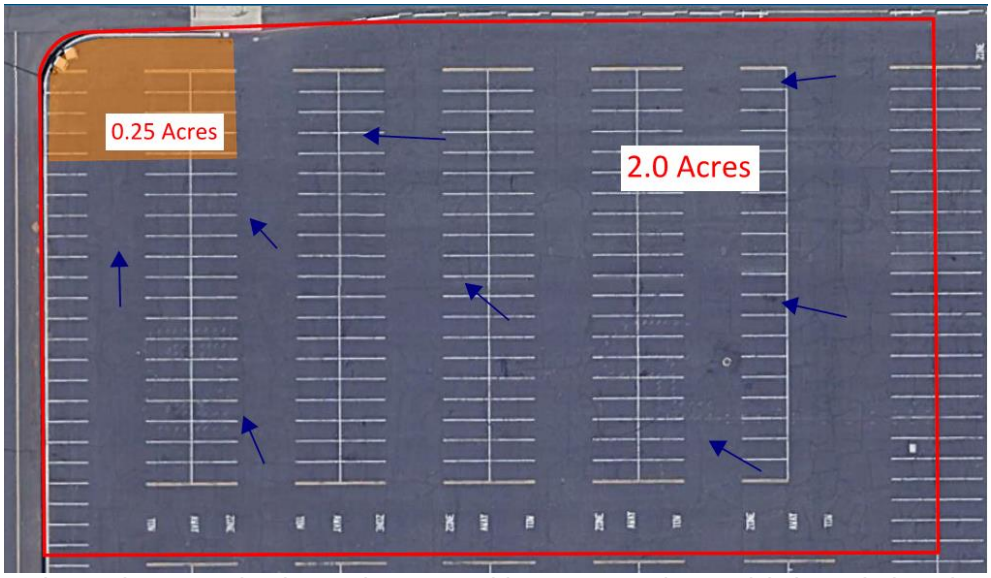
Permeable concrete and other pervious pavements are designed to allow liquids to pass through into an aggregate reservoir layer prior to infiltrating into the native soils below. All proposed permeable pavements should use the terms “Permeable” or “Pervious” rather than “Porous”, as porosity refers only to the amount of void space within the concrete and not the passage of water through the concrete layer.

Due to maintenance and functionality concerns, porous asphalt is not permitted as a BMP within the City of Anaheim.

Design Standard #1 – 4:1 Ratio Design Guidelines: *If permeable pavement is implemented and the ratio of the total tributary area to the permeable pavement area exceeds 4:1, the applicant must demonstrate that flows will not bypass the permeable pavement during the 85th percentile storm event. This can be implemented in the following ways.* ***Note that in any scenario where the proposed permeable pavement aggregate layer is deeper than the length and width of the footprint, the BMP shall be considered to be focused infiltration, and associated requirements from the TGD and this document will apply.***

1. *<u>Provide Opportunity for Ponding within Permeable Surface:</u> In order to prevent bypass of the permeable pavement system, the permeable pavement should be surrounded by a barrier or in a sump condition, with all sides sloping towards the infiltrating area. This will ensure stormwater flows will infiltrate rather than bypass in the event that the system is clogged. This will also result in ponded stormwater which will be an indicator that the site manager must maintain the BMP. An overflow should be provided so that high flows beyond the design storm event are able to bypass the system.*

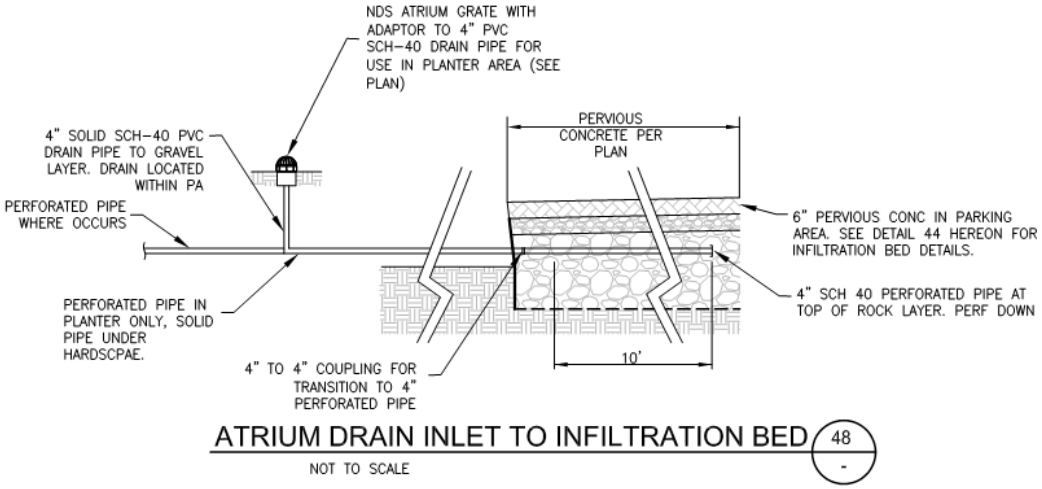
Graphic #1.1



<u>Ponding Opportunity:</u> In the scenario above, the permeable pavement (orange) is bounded on three sides by an existing curb. Stormwater will be unable to bypass which will ensure infiltration of the water quality volume. The site manager will also notice ponding in the case of heavy sediment loading. The 4:1 ratio can be exceeded in this scenario.

2. *<u>Design Trench Drain or Equivalent at Downstream End to Reroute Flows into Permeable Pavement:</u> Where the 4:1 ratio is exceeded, another option is to implement trench drains or equivalent inlets at the downstream end of the permeable pavement to redirect any flows that bypass the permeable pavement system due to clogging. The drain will route flows back into the permeable pavement area, ensuring that flows are adequately treated.* ***If this design is implemented, the BMP will be considered focused infiltration and the requirements within this guidance and the TGD shall apply.*** *As a focused infiltration BMP, pretreatment will be necessary prior to the trench drain inlet.*

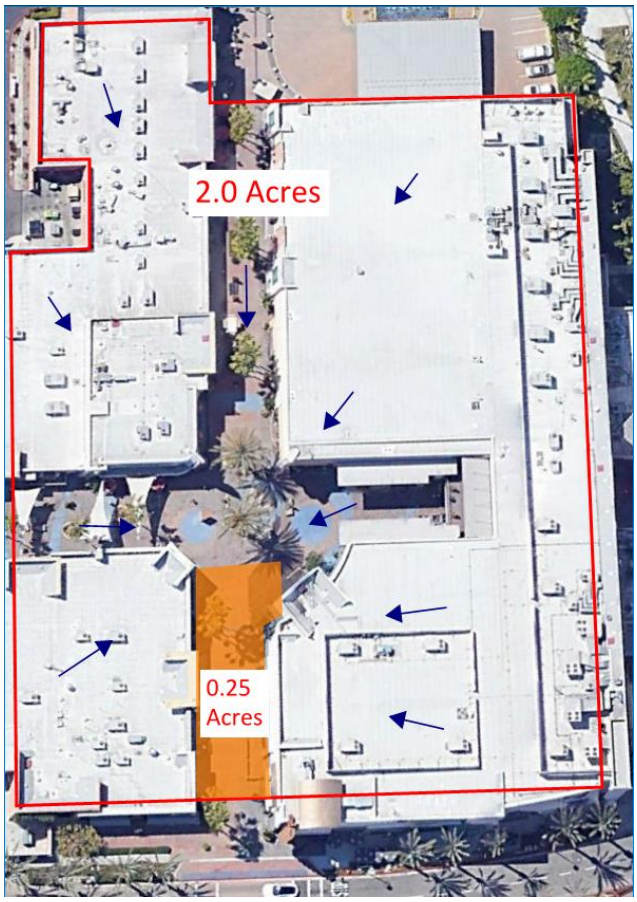
Graphic #1.2



<u>Post-Permeable Pavement Drainage</u>: In the example above, a DMA that flows to permeable pavement goes beyond the 4:1 ratio. Flows that bypass the permeable concrete are capture by a drain and redirected into the permeable pavement media for infiltration. Flows first travel through landscaping to receive pretreatment prior to entering the drain and media.

3. *<u>Demonstrate Clogging will not occur because of Proposed Land Uses within Tributary Area:</u> In cases where the proposed land uses tributary to the permeable pavement system will not contribute any sediment (roof runoff, sidewalks), the 4:1 ratio can be exceeded. The applicant must demonstrate to the City that clogging due to sediment will not occur.*

Graphic #1.3



<u>Pollutant Loading:</u> In the scenario above, the permeable pavement (orange) only receives runoff from roof and sidewalk areas. As there is no land use that would contribute to significant of sediment loading, the 4:1 ratio can be exceeded.

Design Standard # 2 – Cross Section Detail Guideline: *The construction detail in the grading plans and WQMP must include specific depths and materials for each layer within the permeable concrete system (e.g. 12" aggregate reservoir layer of AASHTO No. 57 stone), based on an existing proven design standard (OC TGD, Caltrans Standards, Greenbook, etc.) or other design that meets the performance of the standards above.*

Graphic #2:

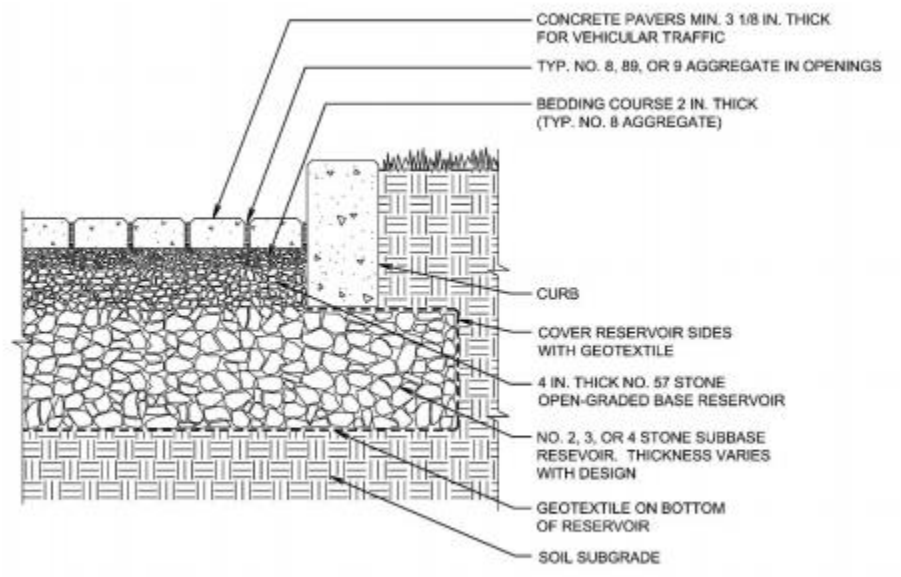


Figure 13: Typical permeable interlocking concrete pavement cross section

Sample permeable pavement cross section. Source: CASQA

Pre-Treatment for Focused Infiltration

Focused infiltration is defined as any infiltration BMP that receives focused (piped or routed) flow directly into the infiltrating media. Focused infiltration BMPs include drywells, infiltration trenches and subsurface infiltration galleries. Focused infiltration BMPs require pre-treatment. See below for design guidelines for pre-treatment scenarios involving focused infiltration.

Design Standard #1 – Utilization of Landscaped Areas as Pretreatment: *Applicants are encouraged to maximize the use of landscaped areas to serve as pretreatment BMPs upstream of focused infiltration BMPs. Landscaped areas can be sized as vegetated filter strips or swales with a minimum 5-minute residence time which is the City's preferred approach for pretreatment upstream of focused infiltration and should be implemented to the MEP.*

Design Standard #2 – Double Infiltration Gallery: *In cases where a traditional pre-treatment BMP cannot be incorporated for infiltration galleries, the gallery may be up sized to a two-gallery system, each sized to treat the DCV for the project site. A barrier must exist between the two chambers. If one chamber loses effectiveness as a result of sediment accumulation, the second system will still be operable and flows will drain to the second system via a connection after sediment had settled out.*

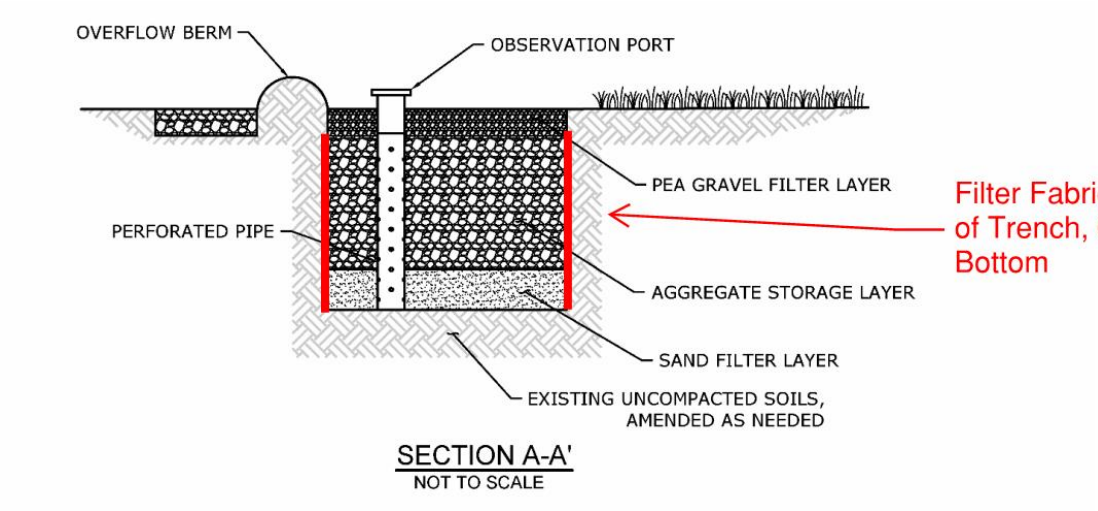
Design Standard #3 – Size Biotreatment BMP for 50% of Flow/Volume: *If biotreatment is utilized as pre-treatment, it can be sized for 50% of the DCV in the case of volume-based BMPs or 50% of the design flow-rate in the case of proprietary and flow-based biotreatment BMPs. Although only 50% of the design flow must pass through proprietary flow based biotreatment BMPs for pretreatment, the entire LID design flow/volume must be routed to the focused infiltration BMP through a bypass system. This is in accordance with the reduced sizing of filter strips as pretreatment outlined in the TGD.*

Design Standard #4 – Size Cartridge Media Filter for 100% of Flow Rate: *Cartridge media filters can be utilized as pre-treatment but must be sized for 100% of the design flow rate and can require a high level of maintenance.*

Infiltration Trenches

Design Standard #1 – Filter Fabric Liner: *Infiltration trenches must feature a filter fabric layer along sidewalls to prevent intrusion of dirt and debris into media layer. Filter fabric shall be non-woven polypropylene and shall be cleared for commercial or large-scale use.*

Graphic #1:



Source: South Orange County Technical Guidance Document

Bioretention With or Without Underdrain

Design Standard #1 – Planting and Storage Media Porosity: *Planting/storage media layer specifications provided and are consistent with the TGD or equivalent standard. 20% media porosity is required for assumptions unless otherwise supported by technical documentation.*

Design Standard #2 –Gravel Storage Porosity: *Gravel storage layers and sublayers shall be specified consistent with TGD or equivalent standard. For sizing calculations, an assumed porosity of 35% is required unless otherwise supported by technical documentation.*

Proprietary Biotreatment Systems

Proprietary biotreatment devices are manufactured to mimic natural systems such as bioretention planters by incorporating plants and planting media into a compact system. They are often utilized do to their compact design and flexible layout options. Common proprietary systems include Modular Wetland Systems and Filterra systems.

The purpose for the approach below is to ensure an elegant and efficient drainage system. Typically, routing flows via non-piped flows (sheet flow, v gutter) to surface-level biotreatment systems is preferable (improved maintenance ease; replacement cost). The guidance below is provided for flexibility in applications where space is constrained or there are limited options for surface conveyance of sheet flows.

Design Standard #1 – Deep Modular Wetland System Unit Plant Selection: *As units can be specified with a variety of depths and inverts, it is important to ensure that the system still provides the benefits of biotreatment, including root uptake, microbiological processes, and pollutant removal. Therefore, any proprietary biotreatment system deeper than 8 feet will not be considered to be biotreatment, but rather will be considered a media-based filter system, and will not receive biotreatment BMP credit. In addition, all units deeper than the standard 3.6 feet must specify one of the following species of plant in final design:*

- *Vetiveria zizanioides (L.) Nash – Vetiver Grass*
- *Leymus condensatus – Giant Wild Rye*
- *Muhlenbergia capillaris – Gulf muhlygrass, mist grass*
- *Muhlenbergia lindheimeri – Lindheimer's muhlygrass, blue muhlygrass*
- *Equisetum hyemale – Horsetail, scouring rush*
- *Typha latifolia – Cattail, reed-mace*
- *Cyperus papyrus – Papyris, Egyptian papyrus, bulrush*

These species were selected by Bioclean, the manufacturer of Modular Wetlands Systems, for their ability to quickly develop deep root systems down to 8 feet below ground surface, and for their hardiness in Anaheim's climate.

The above criteria is intended to provide enhanced flexibility. However, the ultimate goal and preferred approach should be to route runoff to these systems as close to the surface as possible to ensure maximum filtration and treatment near the bulk of the root mass.

Parking Structure and Covered Parking Drainage Guidance

The purpose of the guidance below is to clarify requirements for drainage areas associated with parking structure and covered parking areas within the City of Anaheim, including but not limited to the following types: standalone parking structures, subterranean parking, podium type developments with parking below buildings, parking areas within buildings, and wrap style structures. Parking structures vary in design but typically can be planned with a roof area with parking, internal floors with and without side openings, and internal basement areas. Criteria for how stormwater and non-stormwater drainage should be routed and treated is presented below. The term "exposed" refers to areas that come into contact with direct, or wind driven rain whereas "non-exposed" refers to areas that do not receive direct or wind driven rain or any stormwater runoff.

Exposed Parking Structure Areas:

- **Roof Areas**: Parking structure roofs are exposed to direct rainfall
    - Drainage Connection: Exposed areas must be routed to a low impact development (LID) BMP and ultimately to the storm drain system.
    - Sizing Criteria: LID BMP must be sized for entire roof area following the 85th percentile, 24-hour storm depth methodology and BMP sizing criteria presented in the Model WQMP and the Technical Guidance Document (TGD) for Orange County.
    - Binding Documentation: This requirement is summarized in a WQMP associated with the parking structure project.
- **Internal Parking Structure Areas with Window Openings**: Openings within parking structures can be exposed to wind driven rain
    - Drainage Connection: Parking structure areas exposed to wind driven rain must also be routed to a low impact development (LID) BMP and ultimately to the storm drain system.
    - Sizing Criteria: LID BMP must be sized for 20% of the window opening area and applying the 85th percentile, 24-hour storm depth to this area only (not the entire parking structure floor) following the BMP sizing criteria presented in the Model WQMP and TGD for Orange County.
    - Binding Documentation: This requirement is summarized in a WQMP associated with the parking structure project.

Non-Exposed Parking Structure Areas:

- **Internal, basement areas**: Subterranean parking structure floors, parking garage basements.
    - Drainage Connection: Internal parking structure areas not exposed to rainfall or stormwater runoff must first follow IC24 protocols for disposal.
    - Sizing Criteria: Applicant's must adhere to IC24 Protocols. Depending on uses within parking structure, non-stormwater runoff can either be directed to the sewer system, a landscaped area, or hauled away by certified waste hauler. See IC24 fact sheet for more details (Attachment A) as well as additional specifications below.
        - Sewer Connections: Must follow applicable California Plumbing Code and local sewer agency requirements.
        - Landscape Area or Waste Hauler Disposal: If flows are to be ultimately routed to a landscaped area onsite or hauled away by a certified waste hauler, engineer for the project must also design a dead end sump. Dead end sump must be designed to capture ***4.5 gallons of nuisance flows for every 1,000 SF of parking structure area tributary to the dead end sump***. This dead end sump must include appropriate signage, meet all applicable State and City building codes, and shall be inspected on a quarterly basis to ensure against standing water.
    - Binding Documentation: This design detail must also be included in the WQMP associated with the parking structure project with applicable information in the WQMP's O&M Plan.

These details are also summarized in the table below.

Parking Structure Area	Ultimate Drainage Connection Point	BMP Guidance & Sizing Criteria
Roof Areas – Exposed to Rain	Storm Drain + BMP	Entire exposed roof area must flow to BMP sized for the 85th percentile, 24-hour storm event
Areas with Open Sides – Exposed to Rain	Storm Drain + BMP	Calculate area of all windows or openings; multiply this area by 20%. Size BMP for the 85th percentile, 24-hour storm event for this area only
Internal Basement Floors – Not Exposed to Rain	Follow IC24 Guidance Document for Various Options (Sewer connection; landscaped area; or waste hauler) For landscaped area and waste hauler options, dead end sump must also be included in design.	Follow IC24 Protocols. For landscaped area and waste hauler options, see below for dead end sump sizing criteria: Dead End Sump Option: Size for 4.5 gallons / 1,000 SF of parking structure area tributary to dead end sump Dead End Sump must also include signage "IF WATER IS OBSERVED IN THIS CATCH BASIN, OR FLOWING FROM IF, CONTACT THE MANAGEMENT TEAM IMMEDIATELY."

As shown above, different sizing criteria and drainage exist for different portions of a parking structure. If for any reason there are challenges to following the guidelines above for your project, please reach out to your project's Case Engineer for additional guidance.

On-site BMP Upsizing to Offset ROW improvement or Other Area

For certain projects, capturing the full extent of the project area may prove difficult. This is especially the case with new or redeveloped drive approaches that typically slope away from the project site and its BMP. Similarly, other Right-of-Way (ROW) improvements are also infeasible to capture with an on-site BMP and are a part of the City's jurisdiction rather than the project property owner. Off-site and ROW improvements can range from minor improvements such as sidewalk enhancements or relocation of drive approaches, to more significant improvements including roadway widening and modifications to the curb and gutter line.

The City allows applicants to upsize on-site infiltration BMPs to offset these areas that are for certain applications. Based on a pollutant loading model developed based on standardized BMP pollutant capture values and local rainfall data, off-site improvement area thresholds and corresponding on-site upsizing values were developed for use by the applicant.

Definitions:

Drainage Management Area (DMA): DMAs are the extent of an area draining to an individual BMP, as identified in the WQMP.

Project Area: The extent of all development/redevelopment areas as identified in the WQMP.

Off-Site Improvement Area: Off-site Improvement Areas are developed/redeveloped areas that are not directly treated by a BMP. These can be areas within the Project Area that drain away from BMPs and cannot be captured, or can be areas that are outside of the identified Project Area, such as off-site ROW improvements.

Design Standard #1

Projects utilizing infiltration BMPs up to 4 acres in total Project Area are eligible to upsize on-site BMPs to offset the pollutants generated by an untreated off-site improvement area. ROW or off-site improvement areas up to 2.5% of an individual DMA (or combination of all on-site DMAs) can be offset following the thresholds in the table below:

Off-Site Improvement Area	Equivalent On-Site BMP Upsize
Up to 1% of DMA	10% Upsize of On-Site BMP
1% to 1.25% of DMA	20% Upsize of On-Site BMP
1.25% to 1.75% of DMA	30% Upsize of On-Site BMP
1.75% to 2% of DMA	40% Upsize of On-Site BMP
2% to 2.5% of DMA	50% Upsize of On-Site BMP

Upsizing ratios may be utilized for BMPs sized using both simple method and 80% capture efficiency methodologies. It is also assumed, for the purpose of this BMP Design Guideline, that all BMPs are appropriately sized for their respective DMA following City and TGD sizing guidelines.

Equivalent Upsize Areas

In cases where both the ratio of off-site improvements to an individual DMA or multiple DMAs are eligible, the applicant may select the solution that best fits site design and constraints. For example, a 1-acre site with two 0.5-acre DMAs with an off-site improvement that represents 1% of the total Project Area may choose whether to upsize both on-site BMPs by 10%, or a single BMP by 40%, as both methods satisfy the off-site improvement area to DMA ratio.