Date: May 20, 2020

To: Management Committee

From: Dan Cloak

Subject: Staff Report __ — Bioretention Sizing Update

Recommendation:

Per the Development Committee's recommendation, approve the attached interim update to the *Stormwater C.3 Guidebook, 7th Edition.* The update addresses requirements for sizing stormwater facilities for treatment only.

Background:

MRP Provision C.3.d. states minimum hydraulic design criteria for stormwater treatment systems constructed for Regulated Projects. The criteria were originally developed for sizing extended detention basins (volume hydraulic design basis) and sand filters (flow hydraulic design basis) and were included when the C.3 requirements were added to Contra Costa's stormwater NPDES permit (2003).

Since the first edition (2005), CCCWP's *Stormwater C.3 Guidebook* has included an adaptation of the Provision C.3.d. flow-based criteria to be used for sizing bioretention facilities. Bioretention facilities must be sized to a minimum of 4% of tributary equivalent impervious area.

Provision C.3.d.i.(3) was included in MRP 1.0 (2009) and carried forward into MRP 2.0 (2015). It allows "treatment systems that use a combination of flow and volume capacity…" to be sized "to treat at least 80 percent of the total runoff over the life of the project, using local rainfall data."

Sometime during the MRP 1.0 term, Permittees in Alameda, Santa Clara, and San Mateo counties began using an interpretation of the Provision C.3.d.i.(3) criterion to allow bioretention facilities to be sized smaller (typically closer to 3% of tributary equivalent impervious area). This created a slight advantage, in development costs, to land developments in those counties over land developments in Contra Costa. Contra Costa Permittees continued to use the 4% criterion (with a few exceptions) because (1) the regulatory and technical basis of the method used in the southerly counties is questionable and (2) the 4% criterion is feasible on the great majority of development sites and the smaller facilities provide only a slight cost advantage in the context of overall cost of a typical land development.

In MRP 2.0 (2015), Provision C.3.j.i.(g) requires Green Infrastructure projects to meet the treatment and hydromodification management sizing requirements in Provision C.3.d. but—for non-Regulated Projects—allows Permittees to collectively propose a single approach with their Green Infrastructure Plans for how to proceed should project constraints preclude fully meeting the C.3.d. sizing requirements.

In early 2016, CCCWP initiated, through the BASMAA Development Committee, a project to evaluate bioretention sizing via Provision C.3.d.i.(3). The purpose was to determine the relationship between bioretention facility size and percent of total runoff treated over the life of the project. This will facilitate decision-making about when it is appropriate to build bioretention facilities in street locations where space is constrained.

BASMAA selected Dubin Environmental Consulting to implement the bioretention sizing evaluation project. Dubin used long-term hourly rainfall data from Bay Area gauges and a standard continuous-simulation model (HSPF) to simulate runoff flows. Dubin's report was accepted by BASMAA and forwarded to Water Board staff in June 2019. The report is available (as an attachment to guidance prepared by BASMAA) on CCCWP's Green Infrastructure Planning Resources webpage and is referenced in Permittees' Green Infrastructure Plans.

In a June 21, 2019 letter, Water Board staff stated "conditional acceptance" of the BASMAA guidance. The Water Board's letter includes the following paragraph:

> One aspect of the approach is that it has minimized safety factors, which, as noted in the Guidance, is likely to result in the construction of controls that have a greater need for operation and maintenance work over their lifetime, a higher rate of failure, and may be more likely to have reduced effectiveness and a reduced effective life in the absence of that attention. This calls into question whether the approach meets the C.3.d. sizing requirements for Regulated Projects, and whether it should be applied beyond non-Regulated Green Streets retrofit projects. In the absence of additional evaluation of this issue, the reduced sizing approach should not be applied to Regulated Projects.

Dubin found that the Provision C.3.d.i.(g) criterion could be met by bioretention facilities sized smaller than 4%, and that the minimum required sizing could be correlated linearly to Mean Annual Precipitation.

Presently, to meet *Stormwater C.3 Guidebook* treatment requirements, land development projects must either incorporate bioretention facilities sized to the 4% minimum criterion, or—if they qualify as higher-density "Special Projects"—may substitute non-LID vault-based media filters or tree-box-type high-rate filters to treat runoff from some or all of the impervious area created or replaced.

Permittee staff has sought additional alternatives to these two options for higher-density projects because (1) the non-LID options are less desirable for communities and (2) Water Board staff has declared their intent to eliminate the "Special Projects" option in future permits (possibly in MRP 3.0).

In October 2019, the Development Committee formed a workgroup to pursue the 2019-2020 workplan task: "Integrate the outcomes of the BASMAA stormwater treatment facility sizing study into guidance for private and public land development projects."

The Development Committee's Bioretention Sizing Workgroup met on December 4 and on January 13. Discussion focused on how to limit the use of reduced sizing criteria to where the allowance is really needed (and continue to require the standard 4% sizing factor elsewhere) and how to ensure a reasonable factor of safety is incorporated on smaller facilities. The work group concluded that the best way to provide a factor of safety is to require, for facilities smaller than 4% of tributary equivalent impervious area, that the facilities be as large as feasible given site-specific constraints and to require—to the satisfaction of the municipal reviewer—an appropriate demonstration of those constraints. Use of the reduced sizing criteria is limited to projects where surface parking does not exceed 10 stalls or 10% of total parking stalls (including indoor parking) whichever is fewer. As a further safety factor, additional scrutiny will be applied during review of facility design and construction.

After reaching consensus on these issues, the work group decided to prepare and review language to be incorporated in an addendum to the *Stormwater C.3 Guidebook, 7th Edition.* A draft redline/strikeout was reviewed by the Development Committee on February 26. After incorporation of changes, the Development Committee approved a final redline/strikeout on March 25 to be forwarded to the Management Committee with a recommendation for approval.

The redline/strikeout shows changes to pp. 44-47 in Chapter 4 and additional changes to the technical background information in Appendix E.

Attachment: Redline/strikeout showing changes to the *Stormwater C.3 Guidebook, 7th Edition.*

Fiscal Impact: None

Edits to Chapter 4

~~Use of Non-LID Treatment Facilities~~Reduced Bioretention Sizing (treatment only)

Bioretention facilities must be sized so that the area of engineered soil mix that is flooded at the point of overflow (see pp. 67-68) is a minimum 4% of tributary equivalent impervious area. See Tables 3-2 and 3-5 and the accompanying instructions.

With justification—to the satisfaction of the municipal reviewer and documented as detailed below—the facility area may be smaller than 4% of tributary impervious area, but must be as large as feasible for the specific application. All facilities must be at least as large as the minimum sizes determined by the following equation:

4%—or smaller?
Appendix E.includes technical background and a policy rationale for Contra Costa municipalities' treatment-only sizing criteria.

$$\text{Sizing Factor} = 0.00060 \times \text{MAP} + 0.0086$$

where MAP = Mean Annual Precipitation in inches, per Contra Costa County Public Works Figure B-166.

► JUSTIFICATION REQUIRED FOR APPROVAL OF SMALLER FACILITIES

To justify sizing a facility area less than 4% of the tributary equivalent impervious area, all of the following must be demonstrated to the satisfaction of the municipal reviewer:

Project Characteristics. For the project as a whole, surface parking must not exceed 10 stalls or 10% of total parking stalls (including indoor parking) whichever is fewer. In addition, the project may include incidental surface parking. Incidental surface parking is parking for emergency vehicle access, American with Disabilities Act (ADA) accessibility, and passenger and freight loading zones.

Drainage Management Area and Facility Area Characteristics. For each bioretention facility proposed to be sized smaller than 4% of the tributary equivalent impervious area, all of the following must be shown:

- The available spaces to which flow can feasibly be directed from the tributary Drainage Management Area(s) are limited and cannot accommodate a facility sized to 4% of tributary equivalent impervious area.
- The proposed facility cannot be expanded or reconfigured to be larger without compromising the function of adjacent buildings, roadway, or pedestrian spaces.

- The Drainage Management Areas cannot be reconfigured so that more runoff is directed to facilities sized to 4% or more of tributary equivalent impervious area.

Bioretention Facility Characteristics. The bioretention facility must be surrounded by vertical walls or curbs rather than side slopes. The facility must conform to all *Guidebook* design and construction criteria, including the following:

- Each layer of the facility must be level throughout, and construction drawings must show elevations for facility rim, overflow grate, top of soil layer (TSL), top of gravel layer (TGL), and bottom of gravel layer (BGL).
- Facilities must be inspected at each stage of construction (see pp. 82-83).

Non-LID Treatment (Special Projects)

LID has been found to be feasible for nearly all development sites. If you believe LID design may be infeasible for part of or your entire development site, you should consult with municipal staff and seek additional technical assistance for incorporating LID into your site before considering non-LID options.

► SPECIAL PROJECTS

"Special Projects" that meet the criteria in Table 3-8 (page 48) may, subject to local staff review and approval—and subject to a demonstration that it is infeasible to use the LID to treat 100% of runoff—use the following non-LID treatment systems for up to the specified proportion of the total impervious area on the site:

- Tree-box-type high-flowrate biofilters.
- Vault-based high-flowrate media filters.

► TECHNICAL CRITERIA FOR NON-LID FACILITIES

Minimum design criteria for tree-box type high-flowrate biofilters and for vault-based high-flowrate media filters are in Appendix E.

If flow-control (HM) requirements apply, also review the options for compliance in Chapter One. Then consult with municipal staff before preparing an alternative design for stormwater treatment and HM.

► DEMONSTRATION OF INFEASIBILITY IS REQUIRED

To obtain approval to use any non-LID treatment systems, the applicant must demonstrate, to the satisfaction of the municipal reviewer, that it is infeasible to treat runoff from the same area using bioretention facilities, either sized to 4% of tributary equivalent impervious area or—as may be justifiable for the site and for specific Drainage Management Areas—reduced bioretention sizing (see preceding section).

For all non-LID designs, the applicant must submit a complete Stormwater Control Plan, including an exhibit showing the entire site divided into discrete Drainage Management Areas, and text and tables showing how drainage is routed from each DMA to a treatment facility.

In addition, to establish the infeasibility of implementing LID on the entire site, include in the Stormwater Control Plan an explanation of how routing of drainage has been optimized so that as much runoff as possible goes to LID features and facilities (if any). For DMAs draining to tree-box-type high-flow-rate biofilters and/or high-flow-rate media filters, briefly describe all areas not covered by buildings. Note the uses of all impervious paved areas and why LID treatment is precluded for these areas.

For any landscaped areas, note and briefly describe the following technical constraints as applicable:

- Inadequate size to accommodate bioretention facilities that meet sizing requirements for the tributary area
- Slopes too steep to terrace
- Environmental constraints (for example, landscaped area is within a riparian corridor and applicable regulations prohibit bioretention facilities within that corridor)
- High groundwater (within 2 feet of ground surface) or shallow bedrock
- Conflict with subsurface utilities
- Cap over polluted soil or groundwater
- Lack of head or routing path to route runoff to the landscaped area or from a bioretention underdrain to the municipal storm drain.
- Other conflicts, including required uses that preclude use for stormwater treatment (describe in detail)

Also include in your Stormwater Control Plan a narrative discussion of infeasibility of offsite treatment:

- Describe whether the project proponent owns or otherwise controls land within the same watershed of the project that can accommodate in perpetuity off-site bioretention facilities adequately sized to treat the runoff volume of the primary project.

- Identify any regional Low Impact Development stormwater mitigation programs available to the project for in-lieu C.3 compliance.

References and Resources

- *Municipal Regional Permit* Provision C.3.e.
- *Special Projects Proposal* (BASMAA, 2010)

Edits to Appendix E

Infiltration devices do not include:

- Bioretention facilities
- Self-retaining or self-treating areas
- Pervious pavements

Infiltration devices may not be used in areas of industrial or light industrial activity; areas subject to high vehicular traffic (25,000 or greater average daily traffic on main roadway or 15,000 or more average daily traffic on any intersecting roadway); automotive repair shops; car washes; fleet storage areas (bus, truck, etc.); nurseries, or other areas with pollutant sources that could pose a high threat to water quality, as determined by municipal staff.

The vertical distance from the base of any infiltration device to the seasonal high groundwater mark shall be at least 10 feet. Infiltration devices shall be located a minimum of 100 feet horizontally from any known water supply wells.

In addition, infiltration devices are not recommended where:

- The infiltration device would receive drainage from areas where chemicals are used or stored, where vehicles or equipment are washed, or where refuse or wastes are handled.
- Surface soils or groundwater are polluted.
- The facility could receive sediment-laden runoff from disturbed areas or unstable slopes.
- Increased soil moisture could affect the stability of slopes of foundations.
- Soils are insufficiently permeable to allow the device to drain within 72 hours.

Stormwater Treatment Facility Sizing Criteria

Criteria for sizing stormwater treatment facilities are in MRP Provision C.3.d. ~~All criteria are based on continuous simulation of runoff from a long-term (30-year or more) rainfall record. This is different from the “event-based” or “design storm” hydrology typically used to size drainage and flood-control facilities.~~

► TECHNICAL BACKGROUND

For **flow-based** facilities, the NPDES permit specifies the rational method be used to determine flow. The rational method uses the equation

Q = CiA, where

Q = flow

C = weighted runoff factor between 0 and 1

i = rainfall intensity

A = area

The permit identifies three alternatives for calculating rainfall intensity:

1. the intensity-duration-frequency method, with a hydrograph corresponding to a 50-year storm,
2. the 85th percentile rainfall intensity times two, and
3. 0.2 inches per hour.

An analysis conducted for the CCCWP determined all three methods yielded similar results.

~~The CCCWP used t~~The 0.2 inches per hour criterion is the basis for a ~~to develop a~~ consistent countywide sizing factor for bioretention facilities when used for stormwater treatment only (i.e., not for flow control). The factor is based on a design maximum surface loading rate of 5 inches per hour (~~now~~ mandated by MRP Provision C.3.c.i.(2)(b)(iv)). The sizing factor is the ratio of the design intensity of rainfall on tributary impervious surfaces (0.2 inches/hour) to the design ~~percolation~~ surface loading rate in the facility (5 inches/hour), or **0.04** (dimensionless).

The City of Milpitas (2003) was the first Bay Area municipality to publish guidance incorporating the 4% sizing factor for bioretention facilities, followed by the first edition (2005) of this *Guidebook*. Other countywide programs' guidance soon followed. By the time the MRP was adopted in 2009, the 4% sizing criterion for bioretention was in common use by most municipalities.

For **volume-based** treatment facilities, MRP Provision C.3.d. references two methods, the **WEF method** and the **~~California~~ CASQA BMP Handbook method.** Both the WEF and California BMP methods are based on continuous simulation of runoff from a hypothetical one-acre area entering a basin designed to draw down in 48 hours. The CASQA BMP Handbook method is based on continuous simulation of runoff from a hypothetical unit tributary area entering a basin designed to draw down in 24 or 48 hours. The WEF method is a simplified procedure involving a regression equation for a runoff coefficient developed using rainfall/runoff relationships for 60 urban U.S. watersheds, and regression constants for determining the design runoff volume, for a 12-, 24-, or 48-hour drawdown time, based on analysis of long term rainfall records from seven U.S. cities, including San Francisco.[1]

Local rainfall data and the ~~California~~ CASQA BMP Handbook method were formerly used for sizing detention basins in Contra Costa County. The simulation was iterated to find the unit basin size that detains about 80% of the total runoff during the simulation period. The unit basin storage size is expressed as a depth which varies from about 0.45" to 0.85" in Contra Costa County. The results of the method are presented in a nomograph. The technical background is available in a 2005 technical memo.

Since the LID requirements in the MRP 2011 amendments took effect, **detention basins may not be used to meet stormwater treatment requirements for Regulated Projects.** The WEF method and ~~California~~ CASQA BMP Handbook method were included in the 2011 amendments and in the subsequent MRP 2.0, but are **obsolete** as design standards, but are sometimes used to calculate the volume associated with capture of 80% of annual runoff.~~.~~

In the 2009 MRP, a third option for sizing stormwater treatment facilities was added to Provision C.3.d. This option states that "treatment systems that use a **combination of flow and volume capacity** shall be sized to treat at least 80 percent of the total runoff over the life of the project, using local rainfall data."

This option can also be used to develop sizing factors for facilities with a standard cross-section (i.e., where the volume available to detain runoff is proportional to facility surface area). To calculate sizing factors, inflows, storage, infiltration to groundwater, underdrain discharge, and overflows are tracked for each time-step during a long-term simulation. The simulation is repeated, with variations in the treatment surface area, to determine the minimum area required for the facility to capture and treat 80% of the inflow during the simulation. Such an analysis was conducted for BASMAA by Dubin Environmental Consulting and is described in a Technical Report (Dubin, 2017) .

► APPLICABILITY OF REDUCED BIORETENTION SIZING

The criteria on p. 44 require that a minimum 4% sizing factor be used, unless justification is provided and documented. With justification, the facility area may be smaller than 4%, but must be as large as feasible. In addition, all facilities must be at least as large as the minimum sized determined from the equation in the Technical Report (Dubin, 2017). The rationale for this policy follows.

Generally, in projects with surface parking and/or substantial landscaping, bioretention facilities designed to the 4% sizing factor can be incorporated into the project at reasonable cost and in a way that complements other elements of the site

[1] WEF Manual of Practice No. 23/ASCE Manual and Report on Engineering Practice No. 87, "Urban Runoff Quality Management", 1998, pages 175-178.

and landscape design. Since 2005, hundreds of development projects have been built to this LID standard in Contra Costa municipalities.

The Technical Report (Dubin, 2017) includes curves and equations for determining a minimum sizing factor as a function of mean annual precipitation (MAP). These sizing factors are between 1.5% and 2.5% for most developable areas of Contra Costa, and up to nearly 4% in the wettest areas.

Use of the 4% sizing factor is practicable on most sites. Requiring that facilities be built to this minimum addresses the following uncertainties inherent in LID design and construction.

Uncertainties in Hydrologic Analysis. Variation in actual runoff from predicted runoff could result from any or all of the following factors:

- Geographic variability might not be fully captured by the rainfall analysis.
- Rainfall is simulated in hourly increments, but drainage management areas typically have a time of concentration less than one hour.
- Rain gauge records may not fully represent the range and timing of all runoff events, especially rare large events.
- Climate change is causing increased frequency of intense storms.
- The model is based on a 1-acre impervious tributary area. Actual tributary areas are more complex, with various slopes and surfaces, and sometimes complicated routing of runoff.

Uncertainties in Facility Design and Construction. The Permittees' experience is that this ideal configuration—the configuration simulated by the modeling in the Technical Report--is not always attained in built facilities. Despite best efforts to ensure project quality, the Permittees have somewhat limited authority, and limited resources, to enforce design and construction standards on private projects. Even on public projects, where the Permittee is both implementer and overseer, it is often necessary to make compromises in design and construction, because of unforeseen field conditions, or to accommodate other project purposes. Typical deviations from the ideal configuration include the following:

- Side slopes were counted when representing the facility area, but some or all of the side slope area is not actually inundated prior to overflow (i.e., is actually higher in elevation than the facility overflow).
- The facility is not built flat, reducing the amount of effective surface storage or subsurface storage.
- The overflow grate is placed too low, reducing the amount of surface storage.

- The surface reservoir is made shallow by an excess of sand/compost mix.
- The excavation for the gravel layer does not extend beneath the entire treatment area of the facility.
- The underdrain discharge elevation is lower than the top of the gravel layer.
- Subsurface utilities or footings intrude into the gravel layer
- Soil media is not to specification, or clayey sediment drains into the facility, causing the percolation rate to be less than 5 inches per hour

Projects where reduced sizing may be justified. Based on Contra Costa municipalities' experience reviewing applications for development project approvals, in projects where structures cover all or nearly all the site square footage, designers are more likely to encounter some or all of the following constraints:

- Tributary drainage areas (Drainage Management Areas, or DMAs) are smaller and the routing of runoff from the DMAs to the facilities becomes more complex.
- There is a greater variation in the ratio between DMA area and the available area for a bioretention facility. It is more difficult to adjust DMA boundaries to distribute runoff among facilities.
- There is insufficient room for side slopes between the facilities and surrounding grade. Perimeter curbs and walls may be required, and protective fences may sometimes be installed atop the walls. High walls around facilities can yield a well-like appearance and the soil surface may be shaded. The walls may need to be buttressed or engineered to avoid tipping, sliding, or other modes of failure.
- Facilities may be located adjacent to buildings or roadways, requiring the addition of moisture barriers or beefed-up foundations.
- Potential facility locations conflict with above-ground or below-ground utilities.
- Facilities are more visible to site users and maintaining a pleasing appearance is of greater concern.

To facilitate maximum effectiveness of LID stormwater treatment in situations with these constraints, the criteria on p. 44 include a project-wide requirement that the project include no surface parking or only incidental surface parking, and also require a demonstration, for each facility proposed to be smaller than the 4% criterion, that facility size has been maximized given the given the specific constraints.

~~Like the other options, this third option is best analyzed by using continuous simulation of runoff, based on a local long-term hourly rainfall record. Applied to a bioretention facility with standard cross-section dimensions (p. 67) this method could be used to track inflows, storage, and outflows for each time-step during the simulation. Results might demonstrate that sizing factors smaller than 0.04 could be used to calculate the minimum footprint, depending on bioretention facility's location. BASMAA intends to conduct such a study in 2017.~~

Technical Criteria for Non-LID Treatment Facilities

Non-LID Treatment Facilities may be either tree-box-type high-flowrate biofilters or vault-based high-flowrate media filters.

► GENERAL

- Inflow rate is that generated by a continuous rainfall intensity of 0.2 inches per hour.
- Landscape and non-impervious surfaces should be made self-treating or self-retaining and not drain to treatment facilities, if feasible.
- Use the runoff factors in Table 3-2.
- The applicant's Stormwater Control Plan (Plan) must include as an attachment a letter from the manufacturer stating the manufacturer has reviewed the Plan, the proposed device meets these technical criteria, and the manufacturer will provide a warranty for two years following activation of the facility.

► HIGH-FLOWRATE TREE-BOX-TYPE BIOFILTERS

- Maximum design surface loading rate of 50 inches per hour.
- Precast concrete construction.
- Inlet design to capture flows at least up to the maximum design surface loading rate and to bypass high flows.
- Minimum media depth of 1.8 feet (may be reduced, but maintaining the same media volume, if required because of inadequate head to discharge point).
- Media and facility configuration supports a healthy tree or other vegetation.

► VAULT-BASED HIGH-FLOWRATE MEDIA FILTERS

- Replaceable cartridge filters.

BIORETENTION SIZING UPDATE

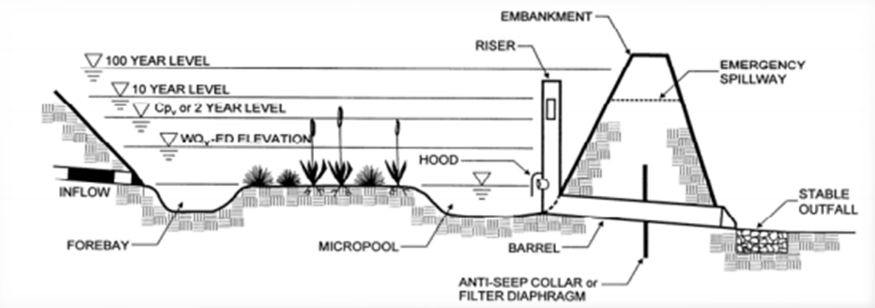
FOR THE *STORMWATER C.3 GUIDEBOOK, 7TH ED.*

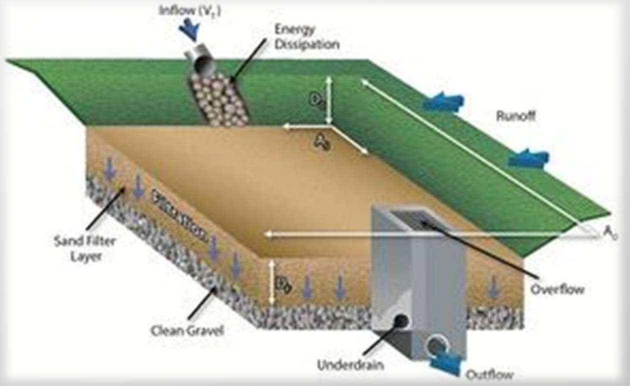
CCCWP Management Committee
May 20, 2020

STORMWATER FACILITY SIZING (TREATMENT ONLY)

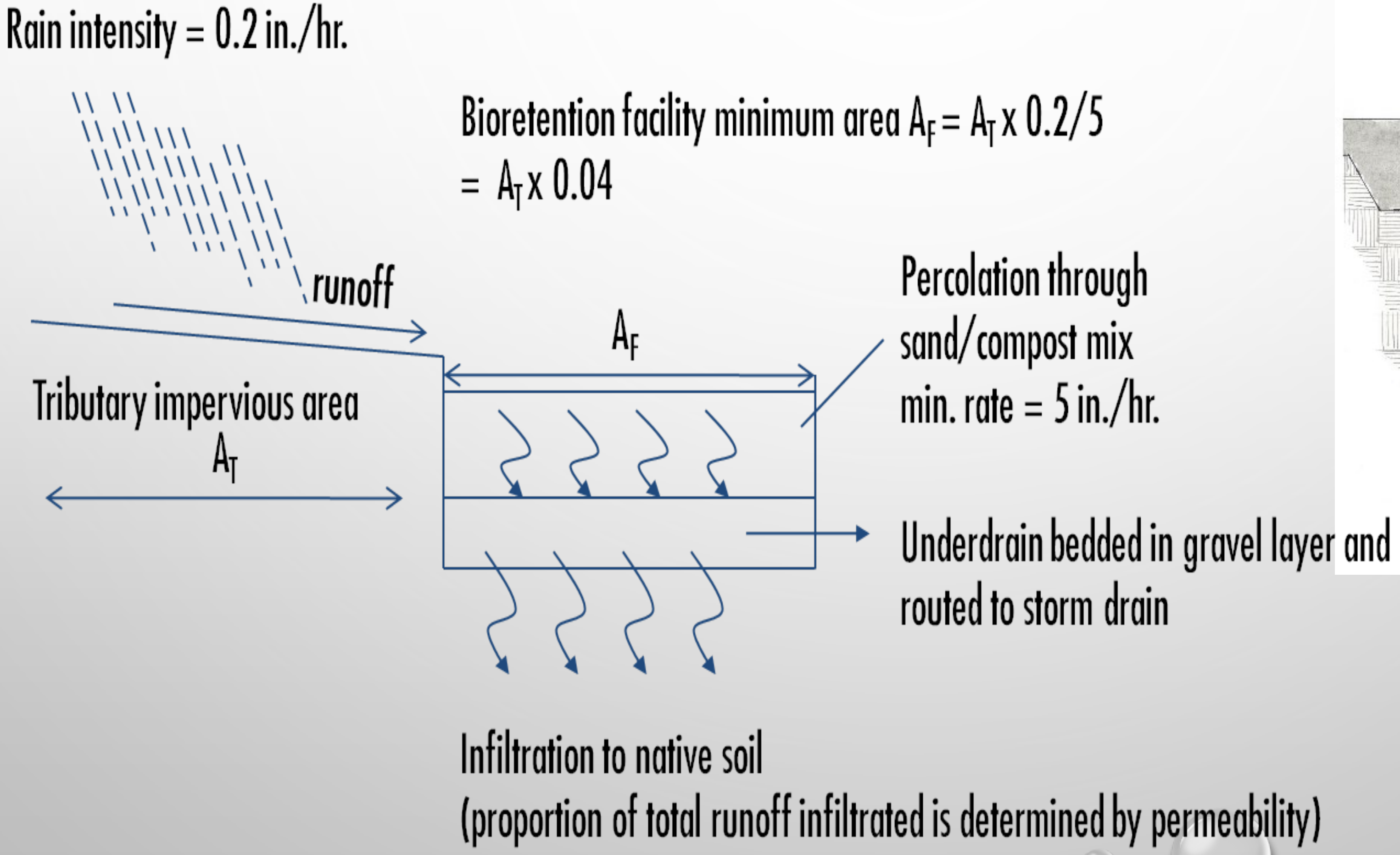
PROVISION C.3.D.

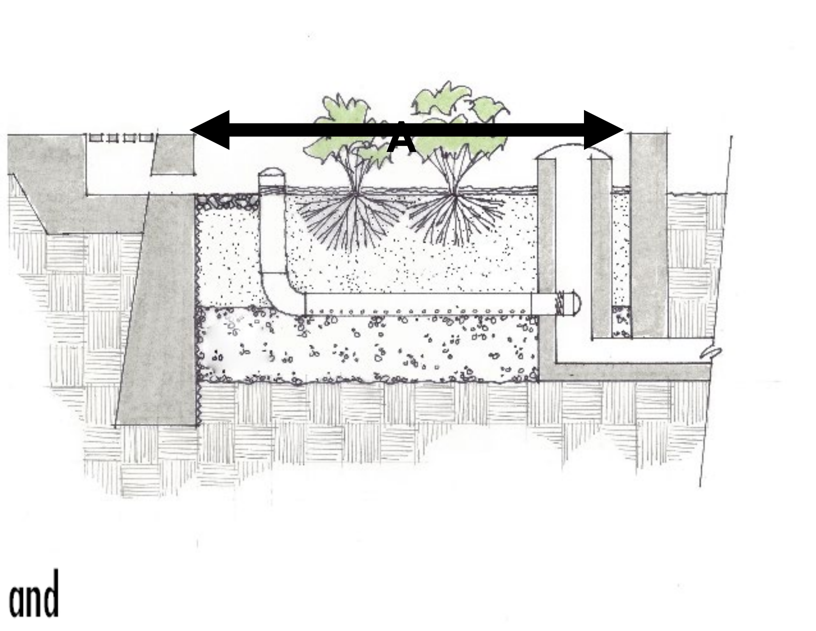
- VOLUME-BASED
  - FOR SIZING DETENTION BASINS
    (NO LONGER ALLOWED UNDER PERMIT)
- FLOW-BASED
  - FOR SIZING SAND FILTERS: 0.2 IN./HR. RAINFALL
  - ADAPTED FOR SIZING BIORETENTION FACILITIES
- COMBINATION VOLUME + FLOW
  - SHOW TREATMENT OF 80% OF RUNOFF (LONG-TERM)





BIORETENTION SIZING: 4% FOR TREATMENT ONLY





STUDY: SIZING FOR GREEN INFRASTRUCTURE

- QUESTIONS
  - WHAT IS THE RELATIONSHIP BETWEEN FACILITY SIZE AND PERCENT OF TOTAL RUNOFF TREATED?
- RESULTS
  - FACILITIES MUCH SMALLER THAN 4% WILL TREAT 80% OF AVERAGE ANNUAL RUNOFF
- WATER BOARD CONDITIONAL ACCEPTANCE
  - LESS SAFETY FACTOR
  - IN THE ABSENCE OF ADDITIONAL EVALUATION, DON'T APPLY TO REGULATED PROJECTS

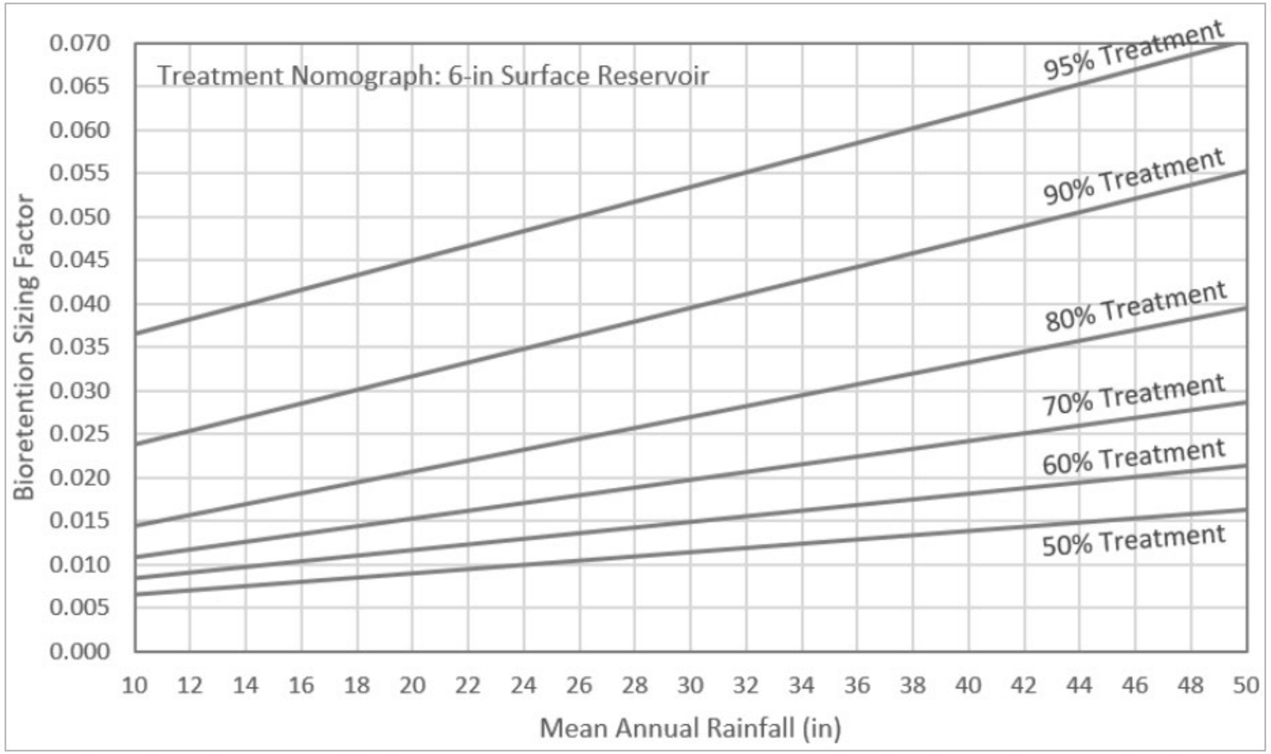


Figure 6. Percent of annual runoff treatment nomograph for bioretention facility with 6-in surface reservoir

BIORETENTION IN HIGH-DENSITY DEVELOPMENTS

- DIFFICULTY IMPLEMENTING LID IN HIGHER-DENSITY PROJECTS
- DISADVANTAGES OF NON-LID MEDIA FILTERS
- POTENTIAL LOSS OF SPECIAL PROJECTS (ALLOWANCE FOR NON-LID) IN MRP 3.0
- OPPORTUNITY TO ACHIEVE 100% LID, OR MORE % LID

PROCESS

- DEVELOPMENT COMMITTEE CREATED A BIORETENTION SIZING WORKGROUP
- MET IN DECEMBER IN JANUARY
- RECOMMENDED LANGUAGE TO ADDRESS “SAFETY FACTOR” ISSUE
  - LIMIT APPLICATION TO SITES WITH NO SURFACE PARKING OR LIMITED SURFACE PARKING
  - SIZE AS LARGE AS POSSIBLE (UP TO 4%), BUT NO SMALLER THAN SHOWN ON CURVE
  - ADDITIONAL SCRUTINY OF DESIGN AND CONSTRUCTION (NO SIDE SLOPES)
- DEVELOPMENT COMMITTEE ACCEPTED RECOMMENDATION

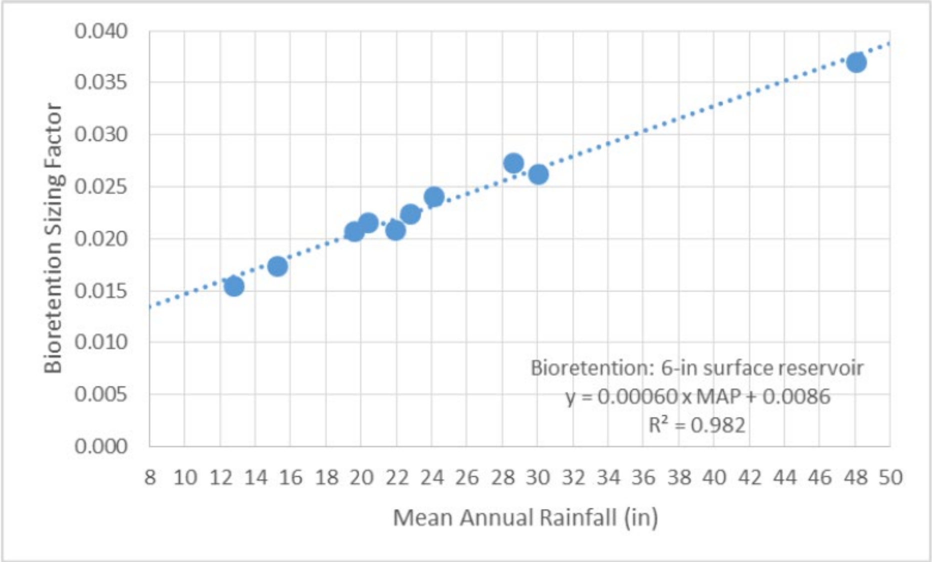


Figure 4. Bioretention size needed to provide treatment of 80 percent of annual runoff; 6-in surface reservoir

ACTION

- APPROVE REDLINE/STRIKEOUT AS INTERIM GUIDEBOOK UPDATE
- PUBLISH INTERIM UPDATE AT CCCLEANWATER.ORG NOW
- INTEGRATE INTO THE GUIDEBOOK 8TH EDITION WHEN IT IS PUBLISHED