Chapter 4

RUNOFF TREATMENT AND CONTROL

Chapter 4

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4.01 General Provisions

a. The provisions of this chapter shall apply to all development projects within District and City jurisdiction. Interpretations of such provisions and their application in specific circumstances shall be made by the District and City.

b. Any City operating a local program may adopt stricter design specifications within its jurisdiction than the specifications stated in this chapter.

c. Where District and City standards conflict, the District's standards shall apply.

4.02 General Requirements for Water Quantity and Quality Facilities

4.02.1 Erosion Protection

a. Inlets to water quality and quantity facilities shall be protected from erosive flows through the use of an energy dissipater or rip rap stilling basin of appropriate size based on flow velocities. Flow shall be evenly distributed across the treatment area.

b. All exposed areas of water quality and quantity facilities shall be protected using coconut or jute matting. Coconut matting or high density jute matting (Geojute Plus or approved equal) shall be used in the treatment area of swales and below the water quality volume levels of ponds. Low density jute matting (Econojute or approved equal) may be used on all other zones.

4.02.2 Vegetation

a. Except as specified in section 4.07, vegetation shall be in accordance with Appendix A: Planting Requirements.

b. No invasive species shall be planted or permitted to remain within a facility which may affect its function, including, but not limited to the following:

1. Himalayan blackberry (Rubus discolor)
2. Reed canarygrass (Phalaris arundinacea)
3. Teasel (Dipsacus fullonum)
4. English Ivy (Hedra helix)
5. Nightshade (Solanum sp.)
6. Clematis (Clematis ligusticifolia and C. vitabla)
7. Cattail (Typhus latifolia)

8. Thistle (Cirsium arvense and C. vulgare)
9. Scotch Broom (Cytisus scoparius)

4.02.3 Fencing

a. Unless otherwise approved by the District or City, delineation fencing shall be required around facilities and/or tracts containing facilities. The fence shall be 4-foot high, vinyl-clad chain link fence conforming to CWS Standard Drawing No. 740.

b. When a facility is fenced, the fence shall include a 12-foot wide lockable gate for maintenance access conforming to CWS Standard Drawing No. 740.

c. If a facility is located adjacent to a Vegetated Corridor, wildlife friendly fencing shall be utilized.

4.02.4 Access

a. General Access Requirement

Access roads shall be provided for maintenance of all water quality and quantity facilities. The following criteria are considered to be the minimum required for facilities maintained by the District or Cities. Other permitting jurisdictions may have more restrictive requirements. If the design Engineer anticipates that any of the requirements will not be met due to the configuration of the proposed development, the design Engineer is advised to meet with District or City staff to gain approval for the deviation prior to submittal.

b. Standard Road Design

1. The road section shall be three (3) inches of class "C" asphaltic concrete; over two (2) inches of ¾"-0" compacted crushed rock; over six (6) inches of 1½"-0" compacted crushed rock; over subgrade compacted to 95-percent AASHTO T-99; or, the design Engineer may submit an alternate design certified as capable of supporting a 30-ton maintenance vehicle in all weather conditions.

2. Strengthened sidewalk sections shall be used where maintenance vehicles will cross.

3. Maximum grade shall be 10-percent with a maximum 3-percent cross-slope.

4. Minimum width shall be 12 feet on straight runs and 15 feet on curves.

5. Curves shall have a minimum 40-foot interior radius.

6. Access shall extend to within 10-feet of the center of all structures unless otherwise approved by the District or City.

7. The District or City may require a curb or other delineator at the edge of the road for drainage, a curb stop, or to demarcate the road where the road edge is not apparent.

8. The side slope for road embankments shall be 2H:1V or flatter.

9. A vehicle turnaround shall be provided when the access road exceeds 40’ in length.

c. Alternate Access Road

An alternate access road design meeting the requirements of this section may be approved by the District or City for facilities in which access is required for general maintenance and long term care of the facility, but where there is no structure, as determined by the District or City, requiring regular maintenance.

1. The road section shall meet the requirements of 4.02.4(b)(1) or an alternate section certified as capable of supporting AASHTO HS-20 loading.

2. As an alternative to the requirements of 4.02.4(c)(1)), a concrete grid paver surface may be constructed by removing all unsuitable material, laying a geotextile fabric over the native soil, placing pavers, filling the honeycombs/grids with soil, and planting appropriate grasses.

3. Strengthened sidewalk sections shall be required where maintenance vehicles will cross.

4. Maximum grade shall be 20-percent with a maximum 3-percent cross-slope.

5. Minimum finished width shall be 12 feet.

6. The District or City may require a curb or other delineator at the edge of the road for drainage, a curb stop, or to demarcate the road where the road edge is not apparent.

7. The side slope for road embankments shall be 2H:1V or flatter.

8. A vehicle turnaround shall be provided when the access road exceed 40’ in length.

4.02.5 Maintenance Responsibilities

a. Unless otherwise approved by the District, newly constructed water quality or quantity facilities serving multiple parcels or public roads shall be publicly maintained.

b. Publicly maintained water quality or quantity facilities shall be covered by a surface and stormwater management easement dedicated to the District or City. The District or City shall also be granted an access easement to maintain the facility. The District will typically not own the land the facility is on.

c. Unless otherwise approved by the District or City, development creating multiple parcels intended for separate ownership shall enclose the publicly maintained water quality and quantity facilities in a tract.

4.03 Water Quantity Control Requirements

4.03.1 Mitigation Requirement for Quantity

Each new development shall incorporate techniques for mitigating its impacts on the public stormwater system in accordance with Section 5.05. The District or City shall determine which of the following techniques may be used to satisfy this mitigation requirement.

a. Construction of permanent on-site stormwater quantity detention facilities designed in accordance with this chapter; or

b. Enlargement or improvement of the downstream conveyance system in accordance with this chapter and Chapter 5;
or

c. Payment of a Storm and Surface Water Management System Development Charge (SWM SDC), as provided in CWS Ordinance 28, which includes a water quantity component to meet these requirements.

4.03.2 Criteria for Requiring On-Site Detention

a. If District or City requires that an on-site detention facility be constructed, the development shall be eligible for a credit against SWM SDC fees, as provided in District Ordinance and Rules.

b. On-site facilities shall be constructed when any of the following conditions exist:

1. There is an identified downstream deficiency, and the District or City determines that detention rather than conveyance system enlargement is the more effective solution.

2. There is an identified regional detention site within the boundary of the development.

3. Water quantity facilities are required by District-adopted watershed management plans or adopted subbasin master plans.

4.03.3 Hydraulic Design Criteria

a. Detention design shall be assessed by dynamic flow routing through the basin. Documentation of the proposed design shall be included in the drainage report. Acceptable analysis programs include those listed below, as well as others using the SBUH or TR-55 methodology, provided the considerations outlined in Section 5.04.2 are followed.

1. HYD
3. HEC-1
4. HEC-HMS
5. SWMM
6. HYDRA
7. Others as approved by the District

b. Peak runoff rates shall not exceed pre-development rates for the specific range of storms, per Subsection 4.03.4(b).

c. A pond overflow system shall provide for discharge of the design storm event without overtopping the pond embankment or exceeding the capacity of the emergency spillway.

d. Provide an emergency spillway sized to pass the 100-year storm event or an approved hydraulic equivalent. Emergency spillway shall be located in existing soils when feasible and armored with riprap or other approved erosion protection extending to the toe of the embankment.

4.03.4 Other Requirements

a. All water quantity facilities shall be designed in accordance with District guidance documents and be consistent with this Chapter.

b. When required, stormwater quantity on-site detention facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development runoff rates from the site, based on 24-hour storm events ranging from the 2-year return storm to the 25-year

return storm. Specifically, the 2, 10, and 25-year post-development runoff rates will not exceed their respective 2, 10, and 25-year pre-development runoff rates; unless other criteria are identified in an adopted watershed management plan or subbasin master plan.

c. When required because of an identified downstream deficiency, stormwater quantity on-site detention facilities shall be designed such that the peak runoff rates will not exceed pre-development rates for the specific range of storms where the downstream deficiency is evident.

d. Construction of on-site detention shall not be allowed as an option if such a detention facility would have an adverse effect upon receiving waters in the basin or subbasin in the event of flooding, or would increase the likelihood or severity of flooding problems downstream of the site.

e. Low impact development approaches, designed in accordance with this Chapter, can be utilized to meet all or part of any detention requirements on a site.

4.04 Water Quantity Facility Design Standards

4.04.1 Facility Design Criteria

a. The facility can be a combined water quality and quantity facility provided it meets all relevant criteria.

b. Interior side slopes up to the Maximum Water Surface: 3H:1V or flatter.

c. If interior slopes need to be mowed side slope: 4H:1V or flatter.

d. Exterior Side Slopes: 2H:1V or flatter, unless analyzed for stability by a geotechnical engineer.

e. Minimum Freeboard: 1-foot from 25-year design water surface elevation.

f. Provide an approved outlet structure for all flows.

g. Certain situations require use of multiple orifice plates to achieve desired outflow rates.

4.04.2 Walls in Water Quantity Facilities

a. Retaining walls may serve as pond walls if the design is prepared and stamped by a registered professional engineer and a fence is provided along the top of the wall. At least 25% of the pond perimeter shall be vegetated to a side slope of 3H:1V or flatter.

b. Walls that are 4 feet or higher shall meet all of the following criteria:

1. Be approved by a licensed structural or geotechnical engineer;

2. The District shall not have maintenance responsibility for the wall. The party responsible for maintenance of the walls within the water quantity tract or easement shall be clearly documented on the plat or in alternate form as approved by the District.

4.05 Water Quality Treatment Requirements

4.05.1 General

Owners of new development and other activities which create new impervious surfaces or increase the amount of stormwater runoff or pollution leaving the site are required to construct or fund permanent water quality facilities to reduce contaminants entering the storm and surface water system.

4.05.2 Criteria for Requiring Construction of a Water Quality Facility

a. A water quality facility shall be constructed on-site unless, in the judgment of the District or City, any of the following conditions exist:

1. The site topography or soils makes it impractical, or ineffective to construct an on-site facility;

2. The site is small, and the loss of area for the on-site facility would preclude the effective development.

3. There is a more efficient and effective regional site within the subbasin that was designed to incorporate the development or is in the near vicinity with the capacity to treat the site.

4. The development is for the construction of one or two family (duplex) dwellings on an existing lot of record.

b. If construction of an onsite facility is not required as a result of meeting conditions outlined in Section 4.05.2 (a) (1)-(3), the Owner of the development shall pay a System Development Charge In-Lieu of Construction of On-Site Facilities in accordance with District Rules and

Regulations. This charge shall be calculated on an equivalent basis of constructing the minimum Standard Water Quality Swale. This In-Lieu fee shall not apply to single-family residential partitions.

4.05.3 Required Treatment Design Efficiency

a. Stormwater quality facilities shall be designed to remove 65 percent of the total phosphorous from the runoff from the impervious area that is tributary to the facility.

b. The phosphorous removal efficiency specifies only the design requirements and is not intended as a basis for performance evaluation or compliance determination of the stormwater quality control facility installed or constructed pursuant to this Chapter.

c. The following alternative approaches are available for meeting the treatment design efficiency standard in this section:

1. Pretreatment as specified in section 4.05.7 in combination with one of the following facilities:
   A) Vegetated Swale
   B) Extended Dry Basin
   C) Constructed Water Quality Wetland

2. Proprietary treatment systems meeting the requirements of section 4.05.8

3. Low impact development approaches that can be demonstrated, to the satisfaction of the District, to meet the removal efficiency standard in this section.

4.05.4 Design Considerations

a. If an onsite water quality facility cannot be constructed to treat the runoff from the development's impervious surface, then with District or City approval, an on- or off-site water quality facility may be designed to treat runoff from an equivalent area of adjacent untreated impervious surfaces.

b. Facilities shall be designed such that flow from the development is treated off-line from the storm conveyance system and reconnected to upstream flows following treatment. If an off-line facility is not feasible, additional capacity may be required for upstream flow.

c. Discharges to sensitive areas shall maintain the hydro period and flows of pre-development site conditions to the extent necessary to protect the characteristic functions of the sensitive area. Conversely, discharge of flows that may be critical to downstream water quality sensitive areas into

other catchments will not be permitted unless addressed in the applicant's Service Provider Letter.

d. The stormwater quality facilities shall be designed for a dry weather storm event totaling 0.36 inches of precipitation falling in 4 hours with an average storm return period of 96 hours.

e. All water quality facilities shall be designed in accordance with this Chapter.

4.05.5 Impervious Area Used In Design

a. For single family and duplex residential subdivisions, stormwater quality facilities shall be sized for all impervious area created by the subdivision and for all existing impervious area proposed to remain on site, including all existing and proposed residences on individual lots at the rate of 2640-square feet of impervious surface area per dwelling unit. For the purpose of design calculations, the actual impervious surface can be utilized as an alternative to 2640 square feet per dwelling unit when the average lot size on a single-family residential project is less than 2000 sq.ft.

b. Except as noted in subsection (d) below, for all developments other than single family and duplex, including row houses and condominiums, the sizing of stormwater quality facilities shall be based on the impervious area created by the development and for all existing impervious area proposed to remain on site, including structures and all roads and impervious areas. Impervious areas shall be determined based upon building permits, construction plans, or other appropriate methods of measurement deemed reliable by District and/or City.

c. The impervious area used in design shall be modified in accordance with subsection 4.07 when approved low impact development approaches are utilized.

d. For redevelopment sites, the impervious area used to design water quality facilities shall be based on Table 4-1.

TABLE 4-1
IMPERVIOUS AREA REQUIRING TREATMENT
ON REDEVELOPMENT SITES

Existing Impervious Area on Site	Existing Impervious Area Disturbed by Redevelopment	Impervious Area Required to Treat
< 5,280 sq.ft.	≤ 100%	No new treatment required
≥ 5,280 sq.ft. and < 0.5 acres	< 1,000 sq.ft.	No new treatment required
	≥ 1,000 sq.ft.	100% of impervious area
≥ 0.5 acres and < 5 acres	< 1,000 sq.ft.	No new treatment required
	≥1000 sq.ft. and < 25%	Disturbed impervious area + 25% of undisturbed impervious area
	≥ 25% and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	≥ 50%	100% of impervious area
≥ 5 acres	< 1,000 sq.ft.	No new treatment required
	≥1000 sq.ft. and < 50%	Disturbed impervious area + 50% of undisturbed impervious area
	≥ 50%	100% of impervious area

4.05.6 Water Quality Volumes and Flows

a. Water Quality Storm
The water quality storm is the storm required by regulations to be treated. The storm defines both the volume and rate of runoff. The water quality storm is defined in subsection 4.05.4 (d).

b. Water Quality Volume (WQV)
The WQV is the volume of water that is produced by the water quality storm. The WQV equals 0.36 inches over the impervious area that is required to be treated as shown in the formula below:

$$\text{Water Quality Volume (cu.ft)} = \frac{0.36\text{ (in.)} \times \text{Area (sq.ft.)}}{12\text{ (in./ft.)}}$$

c. Water Quality Flow (WQF)
The WQF is the average design flow anticipated from the water quality storm as shown in the formulas below:

$$\text{Water Quality Flow (cfs)} = \frac{\text{Water Quality Volume (cu.ft.)}}{14{,}400\text{ seconds}}$$

or

$$\text{Water Quality Flow (cfs)} = \frac{0.36\ (\text{in.}) \times \text{Area (sq.ft.)}}{12(\text{in/ft})(4\ \text{hr})(60\ \text{min/hr})(60\ \text{sec/min})}$$

4.05.7 Pretreatment

a. Pretreatment Required

Unless approved by the District, sheet flow of impervious surfaces into water quality facilities shall not be allowed without pretreatment. Incoming flows to the water quality facility shall be pretreated using a water quality manhole in accordance with subsection 4.06.1 or other pre-treatment method as approved by the District or City. Other methods of pretreatment may include proprietary devices, filter strip, trapped catch basin, or other methods as approved by the District or City.

b. Proprietary Pre-Treatment Devices

1. The use of proprietary pre-treatment devices shall be permitted on a case by case basis with approval by the District or City.

2. The devices will be sized in accordance with the manufacturer's recommendations; however, the minimum treatment flow must be the water quality flow.

3. Technical submittals from the manufacturer are required, including hydraulic design criteria, particulate removal efficiency, and maintenance requirements and schedule.

4.05.8 Proprietary Treatment Systems

a. Proprietary treatment systems shall meet the removal efficiency requirement defined in section 4.05.3(a) and be approved by the District for use in the situations identified in subsection (c) below.

b. Maintenance
   1. Proprietary treatment systems shall be maintained by the District or Cities except those systems used in the situations specified in section 4.05.8(c)(1) and (2) below.
   2. Proprietary systems require a long-term maintenance plan identifying maintenance techniques, schedule, and responsible parties. This maintenance plan shall be submitted and approved with the drainage report for a project.

c. Proprietary treatment systems shall be allowed in situations meeting one of the following criteria:
   1. Treatment of runoff from a single parcel.
   2. Treatment of runoff from an adjoining commercial, industrial, or multi-family, or condominium parcels which share a common parking lot.
   3. Treatment of runoff from new and expanded collector and arterial roadways where no other opportunities exist for treatment without necessitating the removal of homes or businesses.
   4. Treatment of runoff from new developments in transit-oriented or similar high-density zoning classifications where the development is primarily single-family residential and the average lot size is less than 2500 square feet.
   5. Treatment of runoff as part of a master planned regional facility approved by the District.

4.06 Water Quality Facility Design Standards

4.06.1 Water Quality Manholes

a. Hydraulic Criteria:

   1. Minimum Design Flow: Water Quality Flow
   2. Upstream flow splitter may be used to bypass conveyance flows in excess of the Water Quality flow.

b. Design Criteria:

   1. Shall conform to CWS Standard Drawing No. 250 or an equivalent detail approved by the District or City.
   2. Minimum Manhole Diameter: 60-inch
   3. Maximum size of incoming pipe: 18-inch
   4. Sump Depth: No deeper than 5 feet from invert out to bottom of sump
   5. Volume of sump: 20 cubic feet/ 1.0 cfs of flow into the water quality manhole, up to the 25-year flow. Flow calculations shall include the effect of an upstream flow splitter.
   6. Maintain a 3-foot clear access zone between the inside structure.
   7. Orient access to structure in a clear zone.

4.06.2 Vegetated Swale

a. Hydraulic Design Criteria

   1. Design Flow: Water Quality Flow
   2. Minimum Hydraulic Residence Time: 9 minutes
   3. Maximum Water Design Depth: 0.5 feet

4. Minimum Freeboard: 1.0 foot (for facilities not protected from high flows)
5. Manning "n" Value: 0.24
6. Maximum Velocity: 2.0 fps based on 25-year flow

b. Design Criteria

1. Provide an energy dissipater at the entrance to swale, with a minimum length of 4 feet. It will be designed to reduce velocities and spread the flow across the treatment cross section.
2. The use of intermediate flow spreaders may be required.
3. Minimum Length: 100 feet
4. Minimum Slope: 0.5%
5. Minimum Bottom Width: 2 feet
6. Maximum Treatment Depth (measured from top of gravel): 0.5 feet
7. Side Slope:
   A) In Treatment Area: 4H:1V or flatter
   B) Above Treatment Area: 2.5H:1V or flatter
8. The treatment area shall have 2"-¾" river run rock placed 2.5 to 3 inches deep on high density jute or coconut matting over 12 inches of topsoil or base stabilization method as approved by the District or City. Extend river rock, topsoil, and high density jute or coconut matting to top of treatment area (or WQV level). Extend topsoil and low density jute matting to the edge of water quality tract or easement area.
9. Provide an approved outlet structure for all flows.
10. Where swales wrap 180-degrees forming parallel channels, freeboard shall be provided between each of the parallel channels. A 1-foot (above ground surface) wall may be used above the treatment area to provide freeboard while enabling a narrower system. As an alternative, a soil-based berm may be used. The berm shall have a minimum top width of 1 foot and 2.5H:1V or flatter side slopes.
11. Where swales are designed with ditch inlets and outlet structures and design of maintenance access to such structures may be difficult due to swale location, swales may be designed as flow-through facilities with unsumped structures. Maintenance access to one end of the facility will still be required.

4.06.3 Extended Dry Basin

a. Hydraulic Design Criteria:

1. Permanent Pool Depth: 0.4 feet
2. Permanent pool is to cover the entire bottom of the basin.
3. Minimum Water Quality Detention Volume: 1.0 x Water Quality Volume (WQV)

4. Water Quality Drawdown Time: 48 hours
5. Orifice Size:
   USE: $D = 24 * [(Q/ (C[2gH]^{0.5}) / \pi]^{0.5}$
   Where:
   D (in) = diameter of orifice
   Q(cfs) = WQV(cf) /(48*60*60)
   C = 0.62
   H(ft) = 2/3 x temporary detention height to centerline of orifice.
6. Maximum Depth of Water Quality Pool (not including Permanent Pool): 4-feet or as limited by issuing jurisdiction.

b. Design Criteria:

1. Minimum of 2 cells, with the first cell (forebay) at least 10% of surface area. The forebay shall also constitute 20-percent of the treatment volume. Where space limits multi-cell design, use one cell with a forebay at the inlet to settle sediments and distribute flow across the wet pond.
2. Inlet and outlet structures shall be designed to avoid direct flow between structures without receiving treatment (i.e. short circuiting of flow).
3. Minimum Bottom Width: 4 feet
4. Side Slopes in Basin Treatment Area: 3H:1V
5. Minimum Freeboard: 1-foot from 25-year design water surface elevation.
6. The treatment area shall have high density jute or coconut matting over 12 inches of topsoil or base stabilization method as approved by the District or City. If required by the District or City, 2"-¾" river run rock shall be placed 2.5 to 3 inches deep in areas where sustained flow is anticipated to occur. Extend river rock (if required), topsoil, and high density jute or coconut matting to top of treatment area (or WQV level). Extend topsoil and low density jute matting to the edge of water quality tract or easement area.
7. Provide an approved outlet structure for all flows.
8. The Engineer shall certify that the pond storm sewer design is in compliance with Chapter 5 of this Resolution and Order and that at normal design water surface that the upstream storm sewer will not be in a surcharged condition for longer than 24 hours

4.06.4 Constructed Water Quality Wetland

a. Hydraulic Design Criteria:

1. Permanent Pool Volume: 0.55 x Water Quality Volume (WQV)
2. Water Quality Detention Volume: 1.0 x Water Quality Volume (WQV)
3. Water Quality Drawdown Time: 48 hours

4. Orifice Size:
   USE: $D = 24 * [(Q/ (C[2gH]^{0.5}) / \pi]^{0.5}$
   Where:
   D (in) = diameter of orifice
   Q(cfs) = WQV(cf) /(48*60*60)
   C = 0.62
   H(ft) = 2/3 x temporary detention height to centerline of orifice.
5. Maximum Depth of Permanent Pool: 2.5-feet or as limited by issuing jurisdiction
6. Maximum velocity through the wetland should average less than 0.01-fps for the water quality flow. Design should distribute flows uniformly across the wetland.
7. Provide for a basin de-watering system with a 24-hour maximum drawdown time.

b. Design Criteria:

1. Minimum of 2 cells, with the first cell (forebay) at least 10% of surface area. The forebay shall also constitute 20-percent of the treatment volume. Where space limits multi-cell design, use one cell with a forebay at the inlet to settle sediments and distribute flow across the wet pond.
2. Permanent pool depth to be spatially varied throughout wetland.
3. Provide a perimeter zone 10 to 20-feet wide, which is inundated during storm events.
4. Side Slopes for Wetland Planting: 5H:1V or flatter
5. Side Slopes for Non-Wetland Planting: 3H:1V or flatter
6. Over-excavate by a minimum of 20-percent to allow for sediment deposition.
7. Minimum Freeboard: 1-foot from 25-year design water surface elevation.
8. Provide an approved outlet structure for all flows.

4.06.5 Walls in Water Quality Facilities

a. Walls are not allowed in the treatment areas of any water quality facility.

b. Walls that are 4 feet or higher or that are periodically inundated shall meet all of the following criteria:

1. Be approved by a licensed structural or geotechnical engineer.

2. The District shall not have maintenance responsibility for the wall. The party responsible for maintenance of the walls within the tract shall be clearly documented on the plat or in alternate form as approved by the District.

4.07 Low Impact Development Approaches (LIDA)

4.07.1 Purpose

The advantages of LIDA continue to be documented for providing pollutant reduction associated with urban development. Generally, the first priority for LIDA is to minimize stormwater runoff generated from urban development to reduce hydrologic impacts.

Low impact development approaches can offer greater flexibility for the overall use of space on a site, potentially eliminating the need to construct a separate stormwater treatment facility.

Selection of appropriate LIDA, including surface infiltration, should ensure there are no adverse downstream drainage impacts and an appropriate maintenance program can be developed to sustain the functionality of the LIDA.

4.07.2 LIDA Design Considerations

a. LIDA may be used in combination or with standard water quantity and quality facilities to meet the requirements of this Chapter.

b. The applicant shall provide an analysis in the drainage report of the ability of any proposed LIDA to meet the water quantity and quality requirements for a project.

c. LIDA shall be approved on a case by case basis by the District based on their ability to meet the requirements of these rules.

d. Approval of use of an LIDA by the District does not eliminate the need for the applicant to secure approval from other appropriate agencies for use of LIDA on their project.

4.07.3 LIDA Approvable by the District

a. Table 4-2 shows the LIDA the District may approve to meet the requirements of this chapter. The table shows where LIDA can be used in a publicly maintained system and whether LIDA can be designed to meet the quality or quantity requirements of the Chapter. The descriptions provided are general and designers should consult the District's LIDA Handbook for more specific design considerations.

b. Where the impervious area to be treated by an LIDA is less than 15,000 square feet, the Sizing Factor shall be used to calculate the required

surface area of the selected LIDA. For impervious areas greater than 15,000 square feet, a specific design for the site shall be required. The Sizing Factor does not apply to quantity control. LIDA used for quantity control shall require a specific design for a site.

c. LIDA not included in Table 4-2 may be approved by the District if the applicant can demonstrate that the LIDA can meet the requirements of this Chapter.

d. LIDA require a long-term maintenance plan identifying maintenance techniques, schedule, and responsible parties. This requirement shall be noted in a maintenance plan and a maintenance agreement shall be submitted and approved with the drainage report for a project.

TABLE 4-2
APPROVABLE LOW IMPACT DEVELOPMENT APPROACHES

LID	Description	Public Systems	Quantity Control	Quality Control	Sizing Factor/ Restrictions
Porous Pavement	Pourous pavement is a water permeable structural ground cover which infiltrate precipitation, attenuates stormwater runoff flows and volumes, and reduces temperature. Pervious concrete and asphalt resemble their solid pavement counterparts, but have more void spaces that allow water to pass through. Pervious pavers are typically made of pre-cast concrete, brick, stone, or cobbles and set to allow water to flow between them.	No	Yes	No	1:1 impervious area deduction
Green Roof	A green roof (or ecoroof) is a vegetated roof system with waterproofing material, drainage, growing medium, and specially selected plants. A green roof can be used to reduce site impervious area and manage stormwater runoff. Green roofs also help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in dry seasons. The design must be low maintenance and use irrigation only to sustain the health of vegetation. Building Official approval is required for installation of eco-roofs and roof gardens.	No	No	Yes	1:1 impervious area deduction
Infiltration Planters/Rain Gardens	Infiltration planters or rain gardens are landscaped reservoirs used to collect, filter, and infiltrate stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil and infiltrates into the ground. Depending on the site, infiltration planters can be constructed with or without walls to contain the facility.	Yes	Yes	Yes	0.06 Min. Width: 30in Max. Slope 0.5%

LID	Description	Public Systems	Quantity Control	Quality Control	Sizing Factor/ Restrictions
Flow-through Planters	Flow-through planters are landscaped reservoirs that collect and filterstormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil until flowing through to an approved conveyance. These are appropriate where soils do not drain well or there are site constraints. Depending on the site, flow-through planters can be constructed with or without walls to contain the facility.	Yes	No	Yes	0.06 Min. Width: 30in Max. Slope 0.5%
LIDA Swales	LIDA swales are narrow, gently sloping depressions planted with dense vegetation or grasses designed to receive, filter, and infiltrate the runoff, allowing pollutants to settle and filter out as the water percolates through the swale soil and infiltrate into the ground. Swales can include check dams to help slow and detain the flow.	Yes	No	Yes	0.06 Min. Bottom Width: 2ft Slope 0.5% to 6.0%
Vegetated Filter Strips	Vegetated filter strips, are gently sloping areas designed to receive sheet flow from adjacent impervious surfaces. Vegetated filter strips are vegetated with grasses and groundcovers that filter and reduce the velocity of stormwater.	Yes	No	Yes	0.06 Min. Width: 5ft Slope: 0.5% to 6.0%

4.07.4 Small Developments and LIDA

For development or redevelopment projects with overall site area less than 1 acre, no additional stormwater treatment is required when all the following conditions are met:

a. At least 75% of the post-development impervious area shall be treated with LIDA providing water quality treatment; and

b. An increased level of erosion control, as identified by the District, shall be used during construction; and

c. The site is vacuumed prior to acceptance by the District, if appropriate for the LIDA utilized.