

## 6.6 Bioretention Area



Source: California BMP Handbook (CASQA, 2003)

Bioretention areas function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through the buffer strip and is subsequently distributed evenly along a ponding area. Percolation of stored water in the bioretention area's planting soil will enter the underdrain, so that the bioretention area empties over two days.

### Design and Sizing Guidelines

- The bioretention area shall be sized to 4% of the impervious surfaces on the project site. The ratio is for planning review and is from 0.2 inches of rainfall per hour inflow versus 5 inches/hour infiltration rate.
- Bioretention area's planting soil shall have a minimum percolation rate of 5 inches/hour and a maximum percolation rate of 10 inches/hour. If native soils do not meet this percolation requirement, an admixture shall be mixed into planting soil to allow for a 5-inch/hour percolation rate. In-situ testing shall be conducted to verify that the material meets the percolation requirements.
- The bioretention area shall be sized to either:
  - Percolate the design treatment flow using a rate of 5 inches per hour. No additional allowance is provided for storage or for infiltration rates in excess of 5 inches per hour; or,
  - Store the 24-hour treatment volume, with a reduction of 1 inch per hour infiltration throughout the 24-hour time period.

### Best uses

- Any type of development
- Drainage area up to 2 acres
- Landscape design element

### Advantages

- Detains low flows
- Landscape feature
- Low maintenance
- Reliable once established

### Limitations

- Not appropriate for
  - Slopes greater than 5%
  - High water tables
  - Where soil is unstable
- Requires irrigation
- Susceptible to clogging – especially if installed prior to construction site soil stabilization.

- Bioretention areas shall have a vegetation layer with a 3-inch layer of non-pine mulch or grasses provided in areas between plantings. Shrubs and small trees shall be placed to anchor the bioretention area cover. Irrigation shall be provided to maintain plant life in the bioretention area.
- Where there is a positive surface overflow, bioretention areas shall have freeboard of at least 0.2 feet to the lowest structural member versus the 100-year storm water level in the bioretention area.
- Where the bioretention area is in a sump that depends on outflow through a catch basin, the bioretention area shall have a freeboard of at least 0.5 feet to the lowest building finished floor elevation (including garage and excluding crawl space) for conditions with the outlet 50 percent clogged. Where the freeboard cannot be provided, emergency pumps may be allowed on a case-by-case basis.
- Beneath the planting soil, a layer of sand/ loam, up to 2.5' deep, stores treated runoff before it seeps into native soil or underdrain.
- Surface ponding depths should vary, with a maximum depth of 12 inches.
- Plant species should be suitable to well-drained soil and occasional inundation. See planting guidance in Appendix B.
- The inlet to the overflow catch basin shall be at least 6-inches above the low point of the bioretention planting area.
  - The bioretention area shall have a minimum surface slope of 1 percent to local low points.
  - Only areas at least 2 inches below the overflow catch basin elevation shall be considered in the surface area of the bioretention basin.
- An underdrain system and liner shall be provided for the bioretention area except when percolation tests show that the native percolation rate is greater than 5 inches per hour and the depth to groundwater is greater than 10 feet from the surface of the bioretention area.
- One tree shall be provided per 50 square feet of planting area. If larger trees are selected, plant them at the periphery of bioretention area.
- A liner of concrete or impermeable fabric shall be used to limit groundwater contamination of a high water table.

#### Design Checklist for Bioretention

- Set back from structures 10' or as required by structural or geotechnical engineer.
- Surface area of planter shall be at least 4% of tributary impervious area.
- Tributary impervious area does not exceed 2 acres.
- Tributary area shall not contain a significant source of soil erosion, such as high velocity flows or high slopes.
- 50-foot minimum setback from, and no connection to, any on-site septic system or leach field.
- The surface area of the bioretention area shall be less than 5%. Sloped areas immediately adjacent to the bioretention area are less than 20% - but greater than 0.5% for pavement and greater than 1% for vegetated areas.
- Side slopes do not exceed 2:1; downstream slope for overflow shall not exceed 3:1.
- Inlets are protected with rock s, cobbles or splash blocks. Curb cuts have 12" minimum width.

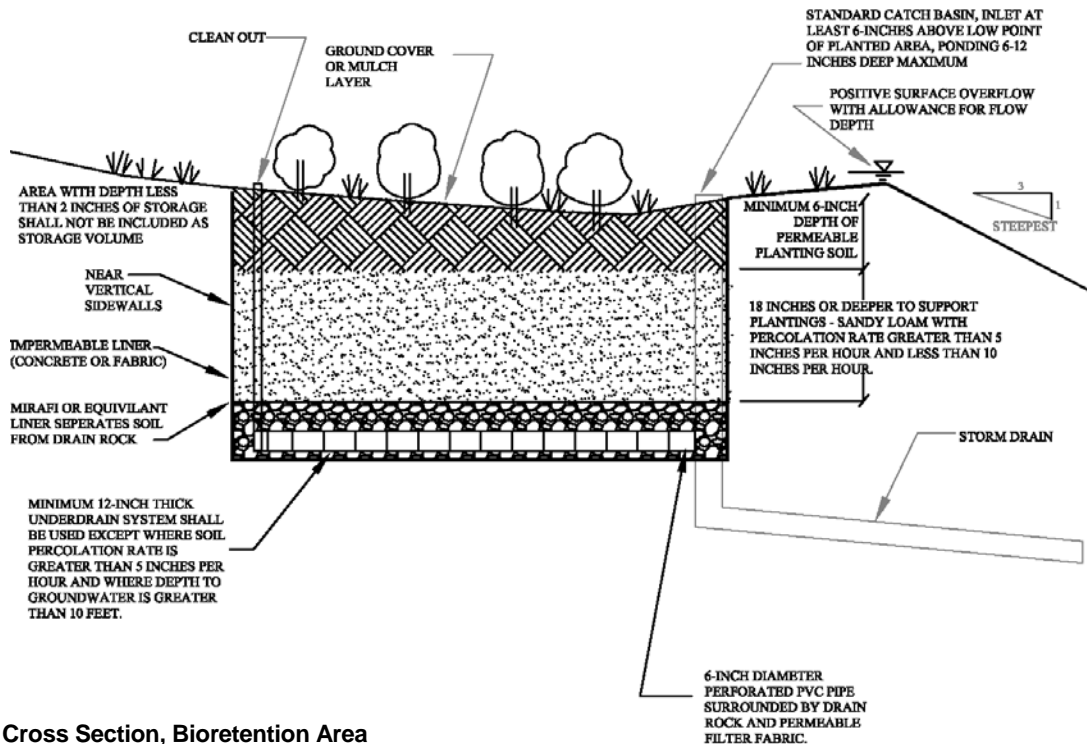
- Overflow inlet can safely convey design flood flows to a downstream storm drain or discharge point.
- Trees and vegetation do not block inflow, create traffic or safety issues, or obstruct utilities.
- Filter fabric between soil and gravel layers.
- Underdrain has a clean-out consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap fit flush with the ground.
- When excavating, avoid spreading fines of the soils on bottom and side slopes.
- Minimum compaction of native soils. Protect the area from construction site runoff.

Soil Considerations

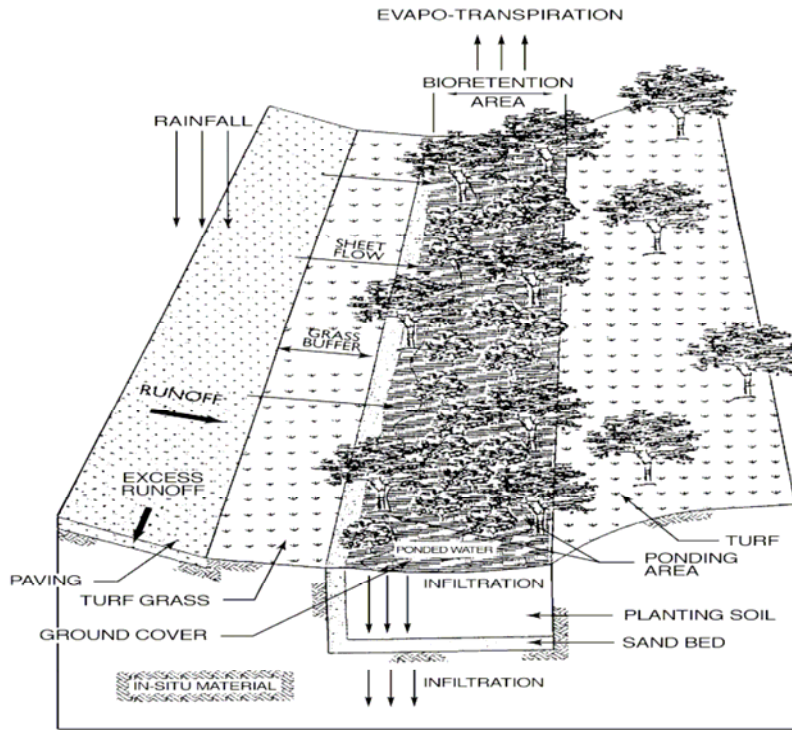
- If import soil is used, it shall have the following properties for loamy sand. A typical soil mix comprises 85% construction sand, 10% topsoil with less than 5% maximum clay content and 5% organic leaf compost. A 6-inch layer of planting soil will be placed above loamy sand soil to allow for plant growth.

**MAINTENANCE**

- Bioretention areas shall be inspected monthly for:
  - Obstructions and trash.
  - Ponded water. If ponded water is observed, the surface soils shall be removed and replaced with sand.
- The use of pesticides and quick-release synthetic fertilizers shall be minimized, and the principles of integrated pest management (IPM) followed. Check with the local jurisdiction for any local policies regarding the use of pesticides and fertilizers.
- Soils and plantings must be maintained, including routine pruning, replenishment of mulch, and weeding.
- Erosion at inflow points must be repaired.



Cross Section, Bioretention Area



Source: PGDER, 1993

