**Potential MDC for Bioretention Cells**

**for MDC Team Discussion on October 27, 2014**

**(all potential MDC are from the BMP Manual)**

1. EXCESS FLOWS. Bioretention cells shall include an overflow device for bypassing storm flows in excess of the design flow.
2. SETBACKS FROM WATER SUPPLY WELLS. The cell shall be located a minimum of 100 feet from water supply wells.
3. SITING 1. Bioretention cells shall not be used where the SHWT or confining layer is less than two feet below the bottom of the cell.
4. SITING 2. Bioretention cells shall not used in drainage areas that are not permanently stable. (Note to MDC Team: Should this be a general MDC?)
5. SITING 3. Bioretention cells shall not be used where slopes are greater than 20%.
6. SIZING. The bioretention cell shall be designed to hold the design storm volume assuming no infiltration will occur during the storm event.
7. PONDING DEPTH. Ponding depth shall be 12 inches or less. Nine inches is preferred.
8. CELL GEOMETRY. The geometry of the cell shall be such that no dimension is less than ten feet (width, length or radius).
9. PRETREATMENT. Pretreatment devices must be provided to prevent clogging, except for stormwater conveyed from a rooftop. Pretreatment devices may include measures such as sumps in catch basins, gravel verges, screens on patio drains, filters, filter strips, grassed swales and forebays.
10. INFLOW. Inflow must be sheet flow (one foot/second for mulch and three feet/second for grass) or use energy dissipation devices.
11. MEDIA MIX. The media shall be a homogeneous soil mix of by volume of: 85-88 percent sand (USDA Soil Textural Classification) 8 to 12 percent fines (silt and clay), and 3 to 5 percent organic matter (such as peat moss). Higher percentages of fines may be used when total nitrogen is the target pollutant. The media shall be free of stones, stumps, roots or other material greater than 2 inches.
12. MEDIA PERMEABILITY. Media permeability of 1-6 inches per hour is required, 1-2 inches per hour is preferred.
13. MEDIA DEPTH. The maximum depth of the media shall be four feet. The minimum depth of the media depends on the type of bioretention cell as follows:
* Grassed with no IWS: two feet
* Tree/shrub plantings or grassed bioretention cells with IWS: three feet
1. MEDIA P-INDEX. The phosphorus index (P-index) for the media must be low, between 10 and 30. This is enough phosphorus to support plant growth without exporting phosphorus from the cell.
2. DRAWDOWN RATE. Ponded water shall completely drain into the soil within 12 hours. It shall drain to a level of 24 inches below the soil within 48 hours.
3. UNDERDRAIN. An underdrain shall be installed if in-situ soil drainage is less than 2 inches/hour or if there is in situ loamy soil (12% or more fines). This is usually the case for soil tighter than sandy loam or if there has been significant soil compaction from construction. Trees should not be planted within 5 feet of slotted drains (in the manual but seems to conflict with specs to include trees as plantings.)
4. CLEAN-OUT PIPES. A minimum of one clean-out pipe shall be provided for every 1,000 square feet of surface area if underdrains are provided. Clean out pipes shall be capped. It is recommended that the clean-out pipes extend 6-8 inches above the mulch layer to prevent damage by maintenance equipment.
5. PLANTING PLAN 1. A minimum of one tree, three shrubs and three herbaceous species shall (should?) be incorporated in the bioretention planting plan unless it is a grassed cell. A recommended planting density is 400 stems per acre.
6. PLANTING PLAN 2. Plant size shall (should?) be no less than 2.5” dbh for trees, 3 gallons for shrubs, and 1 quart for herbaceous plants.
7. PLANTING PLAN 3. Woody vegetation should not be planted at inflow locations.
8. PLANTING PLAN 4. For best survival, trees and shrubs should be planted with 1/3 to ½ of the root ball within the media, leaving ½ to 2/3 of the root ball above the media.
9. PLANTING PLAN 5. Grassed bioretention cells shall be vegetated with sod that has been washed or has been grown in soil with a high infiltration rate.
10. MULCH 1. Mulch shall (should?) be free of weed seeds, soil, roots and other material that is not bole or branch wood or bark.
11. MULCH 2. Commercially available double or triple shredded hardwood mulch shall (should?) be used because it is less likely to be washed away.
12. MULCH 3. Mulch shall (should?) be uniformly placed 2 to 4 inches deep.
13. MULCH 4. Mulch shall (should?) be renewed as needed to maintain a 2 to 4 inch depth. It shall (should?) be added 1-2 times per year and completely removed/replaced every 2 years.
14. INTERNAL WATER STORAGE. An Internal Water Storage Zone may be created by the addition of an elbow in the underdrain piping at a 90 degree angle to the horizontal underdrain. This will increase the volume of stormwater infiltrated by the practice and remove a greater mass of nutrients.
15. NUTRIENT DC. The nutrient removal of a grassed bioretention cell may be increased by providing at least 30 inches of media depth.
16. RECOMMENDATION 1: The predominant plant material should be facultative species adapted to stresses associated with both wet and dry conditions.
17. RECOMMENDATION 2: Plant selection should consider the surrounding conditions including: light pollution tolerance, wind, above and below ground utilities. Plants with taproots should not be used.
18. RECOMMENDATION 3: Number 57 stone should be installed around the underdrain.
19. RECOMMENDATION 4: Bioretention cells may be designed with terraces to accommodate steeply sloped areas.
20. RECOMMENDATION 5: If the drainage system allows, bioretention cells may be designed to be above-ground with a berm to contain the media. This can be a good solution when the SHWT is too high to allow for the required 2-foot separation.