



# Extension FactSheet

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## Multi-Functional Landscaping: Putting Your Parking Lot Design Requirements to Work for Water Quality

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Stormwater runoff is now the leading cause of impairment to Ohio's streams and waterways. Agricultural drainage—sediments and chemicals—is a major source of this impairment. However, nonpoint source (NPS) pollution from urban impervious surfaces (i.e., parking lots, roadways, sidewalks, rooftops, etc.) is also a major contributor. Parking lots collect grease, oil, anti-freeze, and other vehicle leakage, heavy metals from brake dust, as well as litter, other debris, and pathogens. All of these pollutants are flushed into waterways by rain and melting snow. In addition, impervious areas hasten the movement of stormwater runoff across the surface, into a series of curbs, gutters, drains, and pipes, increasing flood occurrence and stream bank erosion. State laws, as well as some local ordinances, now mandate that detention areas be constructed to detain excess runoff from large parking lots. These offsite, rock-edged basins are often unattractive, unsafe, and wasteful of valuable property. In addition, federal regulations require most urban communities to reduce the amount of polluted stormwater runoff.

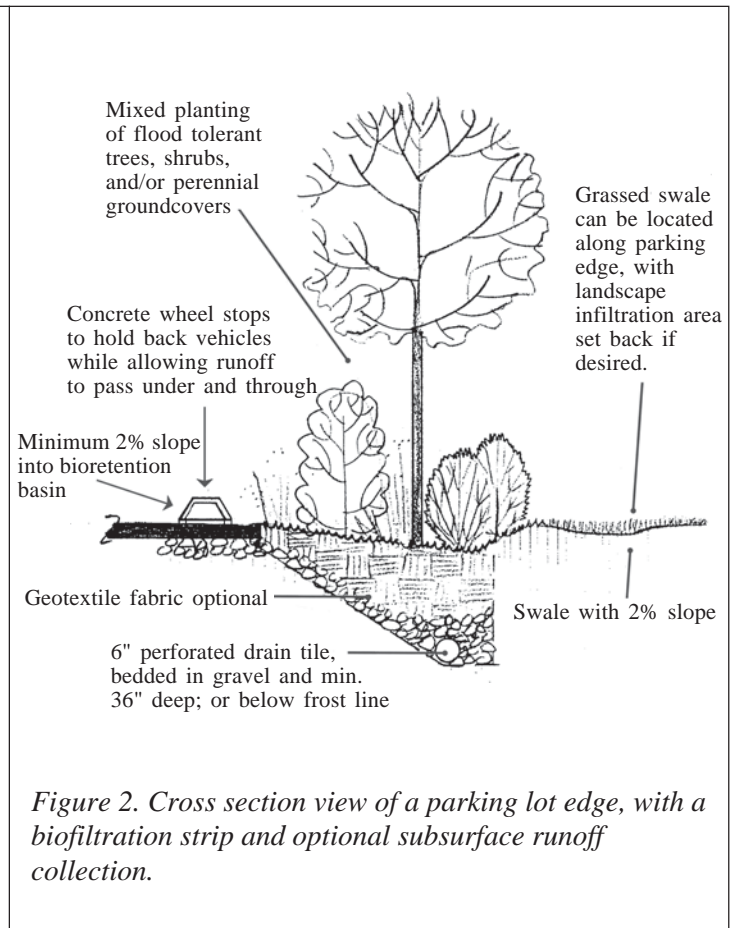
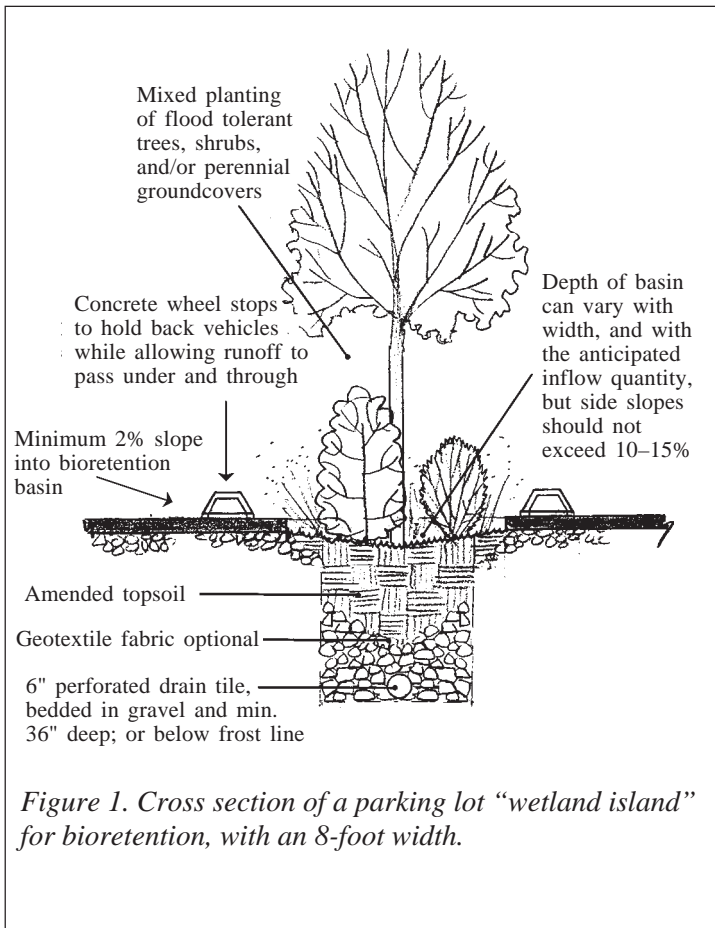
One relatively low cost<sup>1</sup> alternative to separately built, highly engineered, and questionably effective detention ponds is to integrate the absorption of parking lot runoff into landscape islands. Commonly known as "bioretention" areas, these landscaped islands treat stormwater using a combination of microbial soil process, infiltration, evapo-

ration, and appropriate plantings<sup>2</sup>. Instead of the typical landscape islands that are set higher than paved grade (and which often require supplemental irrigation), these "biofiltration" or wetland landscape islands are recessed, and the pavement graded so that surface flow is into, rather than away from these areas. Even in small parking lots where there are no landscape islands, biofiltration of stormwater can be achieved through the diversion of the stormwater runoff to a landscaped area at the perimeter of the lot. In addition to bioretention areas two other options—sand filters, and/or grassed filter strips—may be considered for perimeter applications. The use of subsurface drains (under-drainage) is optional for both the islands and perimeter systems, depending on conditions of the particular site. Subsurface drains may also be designed to deliver water in times of drought.

Along with reduction of surface water flow rates and pollution loading, additional benefits of bioretention areas in parking lots include storage of snow from winter plowing, and groundwater recharge (if tile drainage is not installed, and infiltration is allowed to occur). One caveat is that bioretention islands and perimeter swales may not provide complete "quantity control," or capacity for retention during heavy rainfall. This may require the use of "shunt" pipes to bypass the biofiltration system and discharge the excess stormwater runoff directly into perimeter

<sup>1</sup>The Stormwater Management Fact Sheet: Bioretention ([http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6\\_Stormwater\\_Practices/Filtering%20Practice/Bioretention.htm](http://www.stormwatercenter.net/Assorted%20Fact%20Sheets/Tool6_Stormwater_Practices/Filtering%20Practice/Bioretention.htm)) refers to these systems as relatively expensive. However, costly landscaped areas and under-drains are often normally included in parking lot design. Bioretention areas can either eliminate or reduce the size of detention ponds, and combined with the environmental benefit that can be realized, the overall cost is relatively low.

<sup>2</sup>Bitter, Susan D., and J. Keith Bowers. 2000. Bioretention as a Stormwater Treatment Practice. *The Practice of Watershed Protection*: Article 110 548-550.



swales or conventional conveyance systems. Such bypasses may be designed to handle the 5 or 10 year storm event and may require the use of an additional infiltration or detention basin to meet the local discharge requirements.

Drainage can actually be used as a design element. Optimal minimum coverage for the bioretention areas is 5% of the entire paved surface. Proper engineering, design, and construction of these landscape features is mandatory, and their maintenance requirements are a little different from the normal parking lot landscape island. However, with appropriate plant selection, these small-scale plant

communities can be almost self-sustaining and require less upkeep than a typical landscape bed.

As with any installed landscape, proper plant choices are essential to the long-term success of landscape islands. Trees must be able to withstand both drought and periodic flooding of their root systems, and should be deep-rooted. Trees should neither drip sap on vehicles, nor have large or messy fruit. If possible, trees that shed large, persistent leaves should be avoided in favor of those with small leaves that biodegrade quickly. All shrubs and herbaceous perennials used under trees in bioretention islands should

**Table 1.** Pollutant Removal Effectiveness of Stormwater Management Practices for Parking Lots.

Stormwater Management Practices	Pollutant Removal Effectiveness			
	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Metals
Bioretention Facilities	N/A	65%	49%	95–97%
Dry Swales	93%	83%	92%	70–86%
Surface Sand Filters	87%	59%	32%	49–80%
Infiltration Trench	N/A	100%	100%	N/A

N/A indicates that data is not available.

Adapted from: Winer, Rebecca. 2000. National Pollution Removal Data Base. Center for Watershed Protection, Ellicott City, MD 21043

**Table 2.** Some landscape plants suitable for use in landscaped parking lot islands in Ohio and the upper Midwest. The plants listed here are mostly native to the Midwest, and there is some variation in their tolerance of flooding and winter salt. This list is only partial, and local nurseries or plant suppliers will be able to suggest other plants that will thrive in periodically flooded conditions or with poor drainage.

Scientific Name	Common Name	Remarks/Cultivars available	
<b>Trees tolerant of intermittent flooding</b>			
<i>Acer x freemanii</i>	Freeman Maple	‘Armstrong’, ‘Autumn Blaze’	C
<i>Acer rubrum</i>	Red Maple	‘Red Sunset’, ‘October Glory’	C
<i>Aesculus glabra</i>	Ohio Buckeye	May scorch in summer	N
<i>Aesculus pavia</i>	Red Buckeye	Good flower display	N
<i>Alnus glutinosa</i>	Common Alder	Multi-stem, fast-growing	N
<i>Betula nigra</i>	River Birch	‘Heritage’	C
<i>Carya cordiformis</i>	Bitternut Hickory	Deep tap root, drops nuts	N
<i>Celtis occidentalis</i>	Common Hackberry	Large, very tough	N
<i>Fraxinus americana</i>	White Ash	Avoid fruit, with male clone only	N
<i>Gleditsia triacanthos</i>	Thornless Honeylocust	‘Shademaster’	C
<i>Magnolia virginiana</i>	Sweetbay Magnolia	Semi-evergreen, fragrant	N
<i>Nyssa sylvatica</i>	Black Gum	Great fall color, deep taproot	N
<i>Quercus bicolor</i>	Swamp White Oak	Large, slow-growing	N
<i>Quercus nigra</i>	Water Oak	Dislikes alkaline soils	N
<i>Salix alba</i>	White Willow	“‘Britzensis’ has orange twigs	N
<i>Taxodium distichum</i>	Common Baldcypress	Very adaptable	C
<b>Shrubs: suitable for shade, and for root competition with canopy trees</b>			
<i>Aesculus parvifolia</i>	Bottlebrush Buckeye	Large shrub, showy flowers	N
<i>Aronia arbutifolia</i>	Red Chokeberry	‘Brilliantissima’	C
<i>Aronia melanocarpa</i>	Black Chokeberry	Low-growing, showy fruit	N
<i>Clethra alnifolia</i>	Clethra or Summersweet	‘Hummingbird’	C
<i>Cornus sericea</i>	Yellowtwig Dogwood	‘Flaviramea’: yellow in winter	C
<i>Cornus stolonifera</i>	Red osier Dogwood	Bright red winter twigs	N
<i>Ilex verticillata</i>	Winterberry	‘Winter red’ cultivar	C
<i>Itea virginica</i>	Virginia Sweetspire	‘Henry’s Garnet’	C
<i>Rosa rugosa</i>	Ramanas Rose	Hardy ground cover	I
<i>Thuja occidentalis</i>	Arborvitae	Many forms available	C
<i>Vaccinium macrocarpon</i>	Cranberry	Evergreen with red fruits	C
<i>Viburnum dentatum</i>	Arrowwood Viburnum	‘Chicago Luster’	C
<b>Groundcovers and flowering perennials for wet and/orshady conditions</b>			
<i>Aegopodium podagraria</i>	Bishop’s weed	Variiegated leaves; invasive	I
<i>Arisaema dracontium</i>	Greendragon	Deep shade	N
<i>Asclepias incarnata</i>	Swamp Milkweed	Full sun for best flowers	N
<i>Aster lateriflorus</i>	Farewell-summer	‘Prince’ cultivar is shorter	N
<i>Carex spp.</i>	Sedges—many kinds	Tolerate standing water	N
<i>Cimicifuga racemosa</i>	Black Snakeroot	Very tall flower spikes	N
<i>Cornus canadensis</i>	Bunchberry	Deciduous groundcover	N
<i>Epimedium spp.</i>	Epimedium	Various species, some showy	I
<i>Euonymus fortunei</i>	Wintercreeper	Evergreen, many cultivars	I
<i>Eupatorium maculatum</i>	Joe-Pye Weed	Tall with purple flowers	N
<i>Geum canadense</i>	White Avens		N
<i>Iris versicolor</i>	Blue Flag	Tolerates standing water	C
<i>Juncus effusus</i>	Soft Rush	Resembles grass	N
<i>Liriope spicata</i>	Creeping Lily-turf	Grass-like with lavender flowers	I
<i>Lobelia cardinalis</i>	Cardinal flower	Various colors available	C
<i>Lysimachia nummularia</i>	Creeping Jenny	Groundcover, yellow flowers	I
<i>Mertensia virginica</i>	Virginia Bluebells	Early spring flowers	C
<i>Mitchella repens</i>	Partridgeberry	Creeping, evergreen	N
<i>Phlox divaricata</i>	Wild Blue Phlox	Showy blooming, native	C
<i>Ranunculus repens</i>	Creeping buttercup	Flowering groundcover	I
<i>Tradescantia virginiana</i>	Spiderwort	Named garden varieties	C
• N = Native, indigenous to the upper midwest. • C = Cultivars (or hybrids) of native species are available. • I = Introduced to the United States.			



Figure 3. Photo of parking lot with established landscape islands for infiltration of runoff. (Courtesy of Prince George's County, MD)

be shade tolerant and, if winter salting is the norm, salt tolerant. Shrubs and perennials must be attractive at close range; weedy growth or sprawling habit can make the landscape appear unkempt. Evergreen leaves and showy flowers are a bonus. Maintenance for bioretention landscape islands is not much different from that required for a standard landscape island: annual testing of soil pH, mulching, inspection of plants for pests, pruning for shape and vigor, and regular litter removal. The specification of flood-tolerant woody and herbaceous perennial plants will ensure that any intermittent flooding is a benefit rather than a threat to plant health. Balanced combinations of both

evergreen and deciduous flowering trees, shrubs, and herbaceous perennials or groundcovers, these plants can help turn the potential eyesore of detention basins into an asset for any public landscape.

## Resources and References

- Better Site Design: A Handbook for Changing Development Rules in Your Community.* 1998. Center for Watershed Protection, Ellicott City, MD.
- Brown, W. and T. Schueler. 1997 *National Pollution Removal Performance Database for Stormwater Best Management Practices.* Center for Watershed Protection, Ellicott City, MD.
- Claytor, R. and T. Schueler. 1996. *Design of Stormwater Filtering Systems.* Center for Watershed Protection, Ellicott City, MD.
- Design Manual for Use of Bioretention in Stormwater Management.* 1993. Prince George's County Watershed Protection Branch, Landover, MD.
- Operation, Maintenance, and Management of Stormwater.* 1997. Watershed Management Institute, Inc., Crawfordville, FL.
- Start at the Source.* 1997. Bay Area Stormwater Management Agencies Association, Oakland, CA.
- For an up to date list of web related references visit the Ohio NEMO web site at <http://nemo.osu.edu>

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