

LID Plant Guidance

Humid Continental (Cold) Climate



Low Impact Development (LID) aims to reduce the impact of human development on a site's hydrologic system. Strategies used include infiltration and evapotranspiration which work to slow runoff in order to prevent flooding and use native vegetation to reduce urban pollutants. In wet regions, LID is used to limit how much water goes into large, conventional end-of-pipe stormwater infrastructure, while in dry regions, LID can store water aiding in overall water savings.

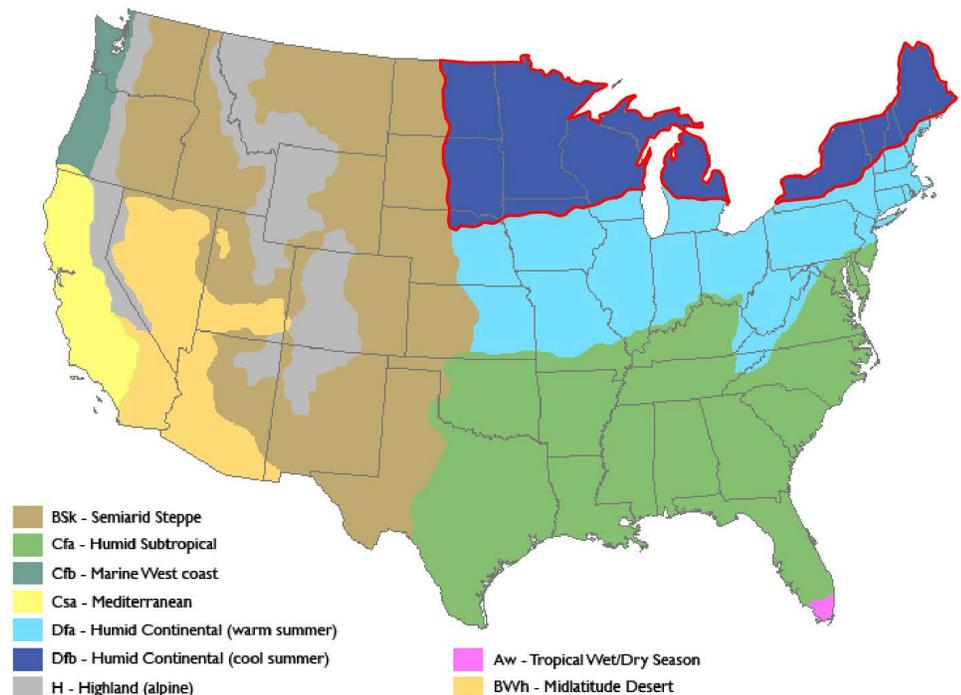
LID designs can natural resource area conservation, incorporate reduction of the development envelope, and minimization of impervious surfaces. LID Best Management Practices (BMP) are landscape and infrastructure controls for stormwater management. The selection of drought tolerant, native plantings is critical to enhance BMP functions and efficiencies. Because LID BMPs are designed to accommodate rain events, the vegetation used in LID systems needs to be adapted to both dry periods and flooding. To perform effectively, LID BMPs must be planned and maintained properly to provide pollutant removal and protection of predevelopment hydrological functions. This factsheet can be used by engineers, landscape architects, planners, landscapers, and developers in selecting appropriate vegetation in the development and implementation of LID BMPs for individual climatic regions.

Key Concepts

- Cost-effective
- Easy to maintain
- Aesthetic
- Maintain runoff near site
- Pollution removal
- Species management
- Noise and dust abatement
- Reduce heat islands

Humid Cold Climate

The Köppen Climate system divides the United States into nine zones. The Humid Continental climate encompasses the upper northeastern United States. It is characterized by dramatic temperature changes of up to 100°F between seasons, with long harsh winters and short, hot summers. Temperature variations are especially significant in areas far from the coast. The Humid Continental climate is subdivided into two subregions, warm and cool, due to the differences between summer temperatures for the two (although both zones have hot summers). Vegetation used for LID BMPs must be able to survive the extreme temperature differences between seasons in this climate of frigid, icy winters to warm summers. Using locally adapted native plants for the region's soils and climate will result in higher success rates, and less overall maintenance inputs than non-native ornamentals.



Army Low Impact Development Technical User Guide. Washington, DC: U.S. Army Corps of Engineers, 4 January 2013.

US EPA. "Managing Wet Weather with Green Infrastructure." 2008.

LID BMPs

According to the Army Low Impact Development Technical User Guide (2013), there are seven primary types of structural LID BMPs. Of those seven types, there are three that require extensive planting designs to function properly: bioretention, vegetated swales, and vegetated filter strips. Selecting the right vegetation for the BMP ensures overall plant success as well as maximizing the benefits gained from the LID system.

Bioretention

- ✓ Holds stormwater to prevent flooding
- ✓ Allows water to infiltrate soil/ underdrain
- ✓ Filters out pollutants and sediments

Bioretention collects and holds stormwater runoff in flat-bottomed, shallow depressions or basins. The basins are vegetated and designed to filter pollutants as stormwater infiltrates into the soil or underlying drain.

Bioretention cells are designed for water infiltration, filtration, or a combination of both. Cells make use of the physical properties of water, soils, and vegetation to reduce or remove pollution from stormwater runoff (U.S. Army Corps of Engineers 2013, 2-26).

Since bioretention areas have flat bottoms, most of the plants used need to tolerate heavy saturation when the cell is at full capacity. However, complete drainage should be ensured to reduce standing water and opportunities for mosquitos and



other disease vectors. LID vegetation has been shown to produce benefits even in cold conditions (UNHSC, 2012). A varied selection of trees, shrubs, and grasses well suited for the winter can add aesthetic and functional value during the cold winters and intense precipitation events throughout the year in this zone.

Vegetated Swales

- ✓ Allows water to infiltrate soil/ underdrain
- ✓ Filters out pollutants and sediments
- ✓ Slows runoff

Vegetated swales are broad, shallow channels that direct stormwater surface runoff to a waterbody or stormwater system. Swales are densely planted with grasses, shrubs, and trees to slow and filter stormwater and snowmelt while enabling transpiration and infiltration. There are three types of vegetated swales: grass, wet, and bio-swales (USACE 2013, 2-30). Swales must accommodate intense summer rains and substantial volumes of water from snowmelt. While peak flow from snowmelt



may be less than rain events, the total volume can be higher. Plants must handle peak flood conditions from rainfall as well as prolonged flow from snowmelt. The depth and grade of swales installed in the Humid Continental Cold region should reflect a shorter but lush growing season, and vegetation must be tolerant of deeper soil frost

Vegetated Filter Strips

- ✓ Filters out pollutants and sediments
- ✓ Slows runoff

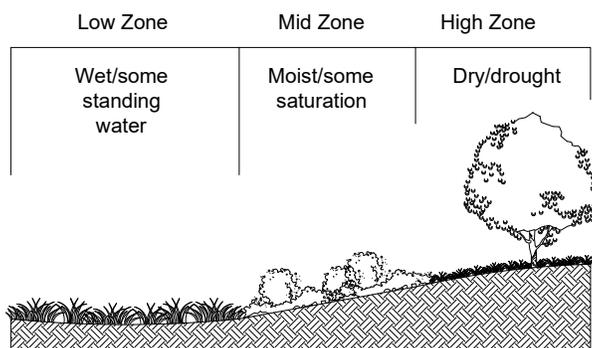
Vegetated filter strips are heavily planted, narrow depressions that collect sheet flow runoff from adjacent impervious areas. Vegetated filter strips can connect to other LID BMPs, vegetated areas, or receiving waterbodies as well as effectively treating runoff from isolated impervious areas such as roofs and parking lots (USACE 2013, 2-33). VFS should be designed to treat high volumes of water from runoff.



Vegetated filter strips are not meant to hold water for long, so they will require plants that can endure dry periods.

LID Planting Considerations

Because LID BMPs are strategically designed to slow and infiltrate runoff, plants selected for use must be able to accommodate periodic flooding as well as prolonged dry conditions. Selecting low maintenance, native vegetation ensures that a LID BMP will work within the Humid Continental (cold) climate to be more efficient and use fewer resources. Shrubs, grasses, perennials, and groundcovers should be used strategically to stabilize slopes, slow and absorb runoff, and filter pollutant loads. Planting choices should include assessment of plant growth speed and habits to anticipate maintenance requirements.



The depressions of LID BMPs can be divided into three general moisture zones: low, mid, and high. The lowest sections collect and hold water for the longest amount of time. Flows from snowmelt and heavy rainfall must be accommodated. Vegetation in the lowest zone must be able to accommodate prolonged saturated periods as well as the dry conditions between rainfall. Mid zone plantings should provide slope stabilization and be able to withstand potentially high runoff volumes. Plants selected for the highest zone of a Humid Continental (cold) BMP require less tolerance to extreme wet conditions, but must still be able to survive with limited water and in extreme cold. Soil frost depths must also be assessed for plant viability.

References / More Information

<http://www.plants.usda.gov>

Missouri Botanical Garden. <http://www.missouribotanicalgarden.org/>

http://stormwater.pca.state.mn.us/index.php/Main_Page

Special Considerations for the Humid Continental Cold

There are many opportunities in this climate zone to develop highly diverse LID infrastructure systems due to the consistent precipitation year round. Conversely, the seasonal fluctuations of this zone require flexible LID systems that are able to endure a variety of soils, temperatures, and conditions. Pollutants of concern in this area may include salts directly adjacent to roadways during the winter, agricultural runoff, and generic stormwater runoff from impervious surfaces in urban areas. Strategic planting based on plant growth cycles and dormancy periods can facilitate year-round stormwater treatment. Doing so will save time, reduce costs and infrastructure demands, and improve overall water quality. Maintenance plans include mowing and pruning, especially during summer months. Certain plant species in this zone are similar to the Humid Continental Cool zone, but growth habits are slightly larger and/or more upright. Mosquitoes also are a concern for this area during spring and summer months when ponding is common. Vegetated LID BMPs should be designed to drain quickly to avoid standing water. If LIDs are accessible to wildlife, deer and rabbit resistance should be considered. Below are some suggested vegetation species applicable for the Humid Continental Warm zone. Proposed LID designs include but are not limited to suggested plant species shown below. Coordination with local plant nurseries and natural resource services will be essential to successful LID planning. Proposed LID plantings and planting locations shall be in accordance with applicable AT/FP (Anti-terrorism/Force Protection) guidelines and UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings.

LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness	Notes / Maintenance
Blanket Flower <i>Gaillardia aristata</i>	Forb	2-3'	1-2'	X	X		X	X		3-10	Can act as a groundcover, deer resistant
Blackeyed Susan <i>Rudbeckia hirta</i>	Forb	3'	1-2'	X	X		X	X		2-10	Spreading, clump forming forb with minimal maintenance, deer resistant
Purple Coneflower <i>Echinacea purpurea</i>	Forb	3'	1-2'	X	X		X	X		2-10	Clump forming forb with minimal maintenance, deer resistant
New England Aster <i>Symphotrichum novae-angliae</i>	Forb	2-6'	1-2'	X	X		X	X		2-9	Grows best in wet or moist soils but can tolerate dry periods, does well in loose soils, deer resistant
Bluebell Bellflower <i>Campanula rotundifolia</i>	Forb	1'	1'		X		X	X		3-8	Very drought tolerant, easily overrun by other plants
Wild Blue Phlox <i>Phlox divaricata</i>	Forb	1'	1'	X	X	X		X	X	2-10	Works well in shady areas, deer resistant
LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness	Notes / Maintenance
Buffalo Grass <i>Bouteloua dactyloides</i>	Grass	1'	1'	X			X			4-10	Drought tolerant, does well as a low-mow or no-mow turf
Pennsylvania Sedge <i>Carex pensylvanica</i>	Grass	1'	1'	X	X			X	X	3-8	Spreading, deer resistant
Bottlebrush Grass <i>Elymus hystrix</i>	Grass	2-3'	1.5'	X	X		X	X		4-7	Drought tolerant, deer resistant
Little Bluestem <i>Schizachyrium scoparium</i>	Grass	2-4'	1-2'	X	X		X			3-9	Deer resistant
Indian Grass <i>Sorghastrum nutans</i>	Grass	3-5'	1-2'	X	X		X			4-9	Drought tolerant, good for native wildlife
Muhly Grass <i>Muhlenbergia capillaris</i>	Grass	2-5'	2'	X	X		X	X		4-8	Muhly is common native grass which is well adapted to periods of saturation to drought
Big Bluestem <i>Andropogon gerardii</i>	Grass	4-6'	2-3'	X	X		X			4-9	Needs some shade from direct afternoon sun, deer resistant
Virginia Wildrye <i>Elymus virginicus</i>	Grass	2-4'	1'		X			X		3-9	Good for pollinators
Tussock Sedge <i>Carex stricta</i>	Grass	1-3'	1-2'		X	X	X	X		3-8	Good for pollinators, deer resistant

Wild Rice <i>Zizania aquatica</i>	Grass	1'	1'				X	X			3-8	Does best in wet soils
Sallow Sedge <i>Carex lurida</i>	Grass	2-3'	1-2'				X	X	X	X	3-8	Tolerates long periods of saturation, deer resistant
Blue Joint Grass <i>Calamagrostis canadensis</i>	Grass	4'	2-3'				X	X	X		3-6	Spreads in moist soils, good for stabilizing stream banks, drought resistant when established
Switch Grass <i>Panicum virgatum</i>	Grass	3-6'	2-3'				X	X	X		5-9	Drought tolerant, deer resistant
LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness		Notes / Maintenance
Stoncrop Sedum <i>Sedum ternatum</i>	Ground Cover	3"	9"	X	X		X	X			4-8	Wide ranging, full ground coverage, tolerates moisture better than most sedums, highly drought tolerant, but takes several seasons to fill in
LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness		Notes / Maintenance
Blackhaw Viburnum <i>Viburnum prunifolium</i>	Shrub	12-15'	6-12'	X			X	X			2-8	Drought tolerant, prune in early spring
Chokecherry <i>Prunus virginiana</i>	Shrub	20-30'	15-20'	X	X		X	X			2-7	Drought tolerant
Black Chokeberry <i>Aronia melanocarpa</i>	Shrub	3-6'	3-6'		X		X	X			3-8	Spreading, drought tolerant, deer resistant
Winterberry <i>Ilex verticillata</i>	Shrub	3-12'	3-12'		X	X	X	X			3-9	Drought tolerant, prefers well-drained soils
Wild Black Currant <i>Ribes americanum</i>	Shrub	3-6'	3-6'				X	X	X	X	3-6	Drought tolerant
LID Plant Suggestions	Form	Height	Width	High Zone	Mid Zone	Low Zone	Sun	Part Sun	Shade	Hardiness		Notes / Maintenance
American Hornbeam <i>Carpinus caroliniana</i>	Tree	20-35'	20-35'	X	X			X	X		3-9	Drought tolerant, height varies depending on cultivar
Black Oak <i>Quercus velutina</i>	Tree	60-80'	30-60'	X	X		X	X			3-8	Should be only used where space is available due to size
American Hazelnut <i>Corylus americana</i>	Tree	10-16'	8-13'		X		X	X			4-9	Prefer well-drained soils, require watering during dry periods, prune suckers yearly
American Elderberry <i>Sambucus canadensis</i>	Tree	5-12'	5-12'		X	X	X	X			3-9	Require watering during periods of drought, prune in early spring
Common Witch Hazel <i>Hamamelis virginiana</i>	Tree	15-20'	15-20'		X	X	X	X			3-8	Prefers moist, well-drained soils, does not do well in compacted soils, moderately deer resistant
Ohio Buckeye <i>Aesculus glabra</i>	Tree	20-40'	20-40'		X	X	X	X			3-7	Prefers moist soils, shade tolerant
River Birch <i>Betula nigra</i>	Tree	40-70'	40-60'		X	X	X	X			4-9	Drought tolerant
Sugar Maple <i>Acer saccharum</i>	Tree	40-80'	30-60'		X	X	X	X			3-8	All maples act as a water pump in low areas and bare areas can develop under the canopy due to this
Red Maple <i>Acer rubrum</i>	Tree	40-70'	30-50'			X	X	X			3-9	All maples act as a water pump in low areas and bare areas can develop under the canopy due to this