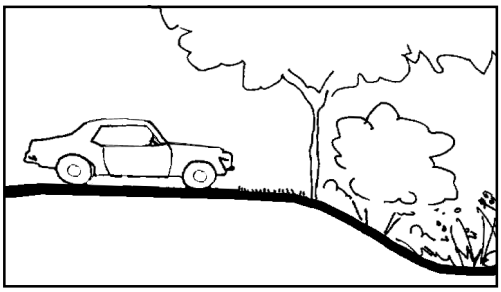
Parking Lot Design



Description

Two main strategies can help reduce runoff volume or provide water quality benefits in parking lots: reducing paved surface area and incorporating plants and infiltration swales into designs.

Reduced Paved Surface

Pavement reduction can be accomplished in three main ways:

- *Changing municipal codes to reduce parking requirements.* To avoid excessive paving, codes should set a minimum *and* maximum number of spaces a development can provide. Parking demand ratios should be based on site-specific parking generation studies.
- *Reducing stall dimensions*. This can be accomplished by creating dedicated compact car spaces and then offering spillover parking areas with pervious surfaces. Determine the most space-efficient design for the site, which may be angle parking (to reduce driving lane width) or conventional stalls.
- *Promoting shared parking lots*. Allow shared lots between businesses with peak parking demand at different times of the day or week. For example, a restaurant that requires parking primarily evenings and weekends could share parking with an office building with weekday parking needs.

Planting Strategies.

Vegetation is an effective and attractive way to reduce runoff, and smaller parking lots free up more space for landscaping.

Leaves, stems and branches intercept rainwater, which then evaporates. A significant amount of stormwater can evaporate from beds of tall grasses, wildflowers, shrubs, and trees. Furthermore, deep-rooted prairie plants create channels that help encourage infiltration (see Figure 1). They also hold up to a half-inch of stormwater on their leaves and in the thatch they create.

Purpose

Water Quantity

Flow attenuation	◧
Runoff volume reduction	■

Water Quality

Pollution prevention

Soil erosion	□
Sediment control	◧
Nutrient loading	◧

Pollutant removal *(only if runoff is directed into planted swales)*

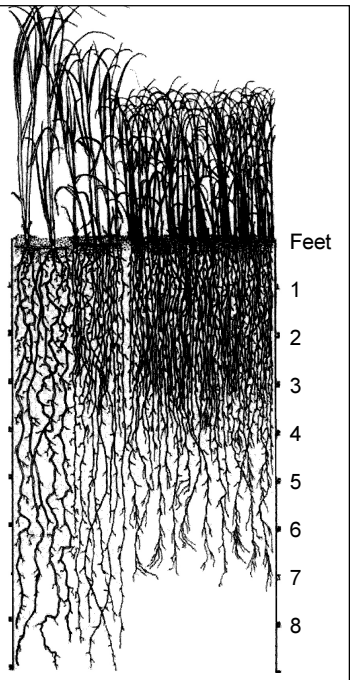
Total suspended sediment (TSS)	◧
Total phosphorus (P)	◧
Nitrogen (N)	◧
Heavy metals	◧
Floatables	◧
Oil and grease	◧

Other

Fecal coliform	□
Biochemical oxygen demand (BOD)	□

■ Primary design benefit
◧ Secondary design benefit
□ Little or no design benefit

Parking Lot Design



Deep-rooted native plants, especially grasses, help encourage infiltration.

Figure 1

Shallow-rooted turf grass is not nearly so effective; substitute deep-rooted perennial plantings for sod wherever possible.

Even if extensive perennial planting is not possible, include trees to canopy paved areas. In addition to intercepting rainwater, the summer shade they provide helps to reduce the urban heat island effect and make parking lots more pleasant places to be.

Infiltration

Planted areas can also be designed specifically to accept runoff of parking areas (as shown in Figures 2, 3 and 4), providing temporary storage and on-site infiltration. See Rain Garden information in On-Lot Infiltration BMP.

Advantages

- Reducing parking surface reduces the need for stormwater runoff management.
- Less paving means lower development and maintenance costs.
- Grasses, wildflowers, shrubs and trees hold water that is then evaporated, reducing runoff.
- Channels created by deep roots encourage infiltration.
- Shade from trees helps reduce the urban heat island effect and make the area more comfortable for people.
- Planting native vegetation creates wildlife habitat.
- A variety of vegetation creates a more interesting and aesthetically pleasing environment.
- Trees shade impermeable surfaces, keeping stormwater cool and reducing urban heat island effect.

Limitations

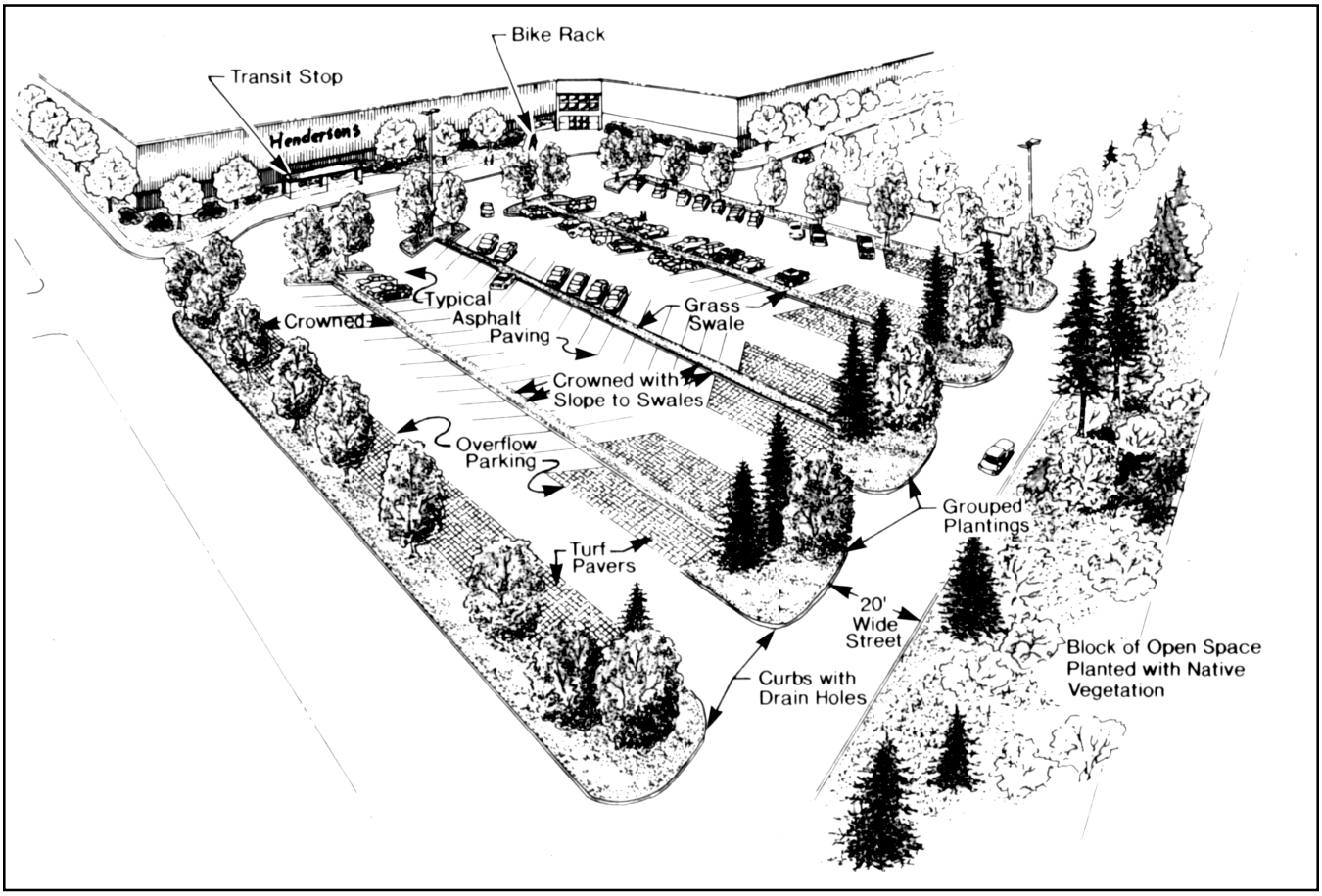
- Municipalities may have firm parking requirement that do not encourage innovation.
- Space allocated for parking lot in a given development may not be sufficient to include significant planted areas.
- Soil type may limit infiltration and/or planting success.

Land Use	"Better Site Design" Parking Ratio
Single family home	2 spaces or less per dwelling unit (driveway spaces count)
Professional offices	3.0 spaces or less per 1,000 $ft.^2$ gross floor area
Retail	4.0 - 4.5 spaces or less per 1,000 ft^2 gross floor area

Table 1

Source: Adapted from CWP, 2000.

Parking Lot Design



Source: Robert W. Droll, ASLA, in Wells 1994.

Requirements

Design

- Revise outdated, overly generous parking ratio requirements. (See Table 1.)
- Use minimum stall dimensions.
- Use the most space-efficient stall configuration for the site (See Turf Pavers BMP).
- In larger commercial parking lots, design 30 percent of the spaces for compact cars only.
- Use pervious surfacing in summer spillover parking areas.
- If soils are suitable, drain parking lot runoff into infiltration islands using curb cuts or flat curbs.
- If soils are unsuitable, excavate to a depth of 3 feet and fill with a planting soil mix.
- Plant native or vigorous nonnative perennials rather than turfgrass over as much of non-paved surfaces as possible. See Plant List on following page.

Parking Lot Design

- Aim to have canopy trees at maturity cover at least 50 percent of paved surfaces. Since tree height and spread will generally be smaller than normal in parking lot growing conditions, compensate by planting more trees closer together.
- Irrigation systems are usually necessary for parking lot island plantings, unless sufficient runoff is directed into them..

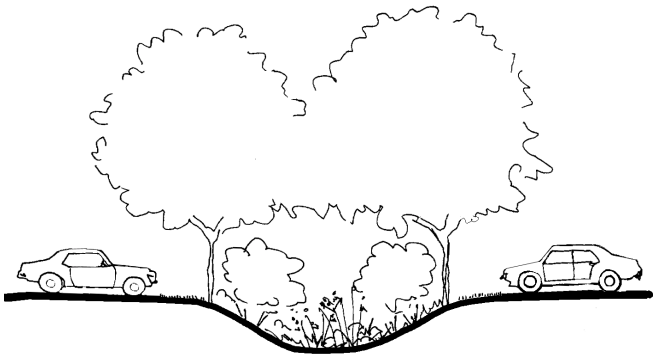
Requirements

Construction

- To avoid compaction, do not drive on planting areas during construction.
- After construction, loosen soils in planting areas to a depth of 24 inches, to a maximum compaction of 85 percent standard proctor density. Till the upper 10 inches of soil.

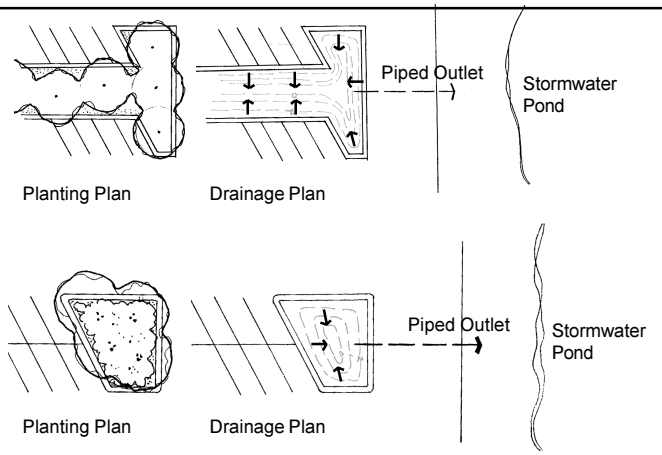
Maintenance

- Planted areas must be weeded monthly during the first two to three years. After that, weeding once or twice a growing season may suffice.
- Regular watering will be necessary during dry spells. Limit irrigation to a maximum of two inches per week.
- During winter plowing, push street snow away from swales whenever possible in order to avoid accumulation of road sand.



Infiltration island within parking lot.

Figure 3
Source: VBWD, 2000



Two alternative designs for parking lot infiltration islands. Parking lot sheet flow is directed to depressed islands, overflow drains to stormwater pond.

Figure 4
Source: VBWD, 2000

Rainwater Gardens Plant List

Source: Fred Rozumalski, Barr Engineering

Mesic-Dry Soils (Sunny)

Native		***Non-Native***	
Butterfly Flower	*Asclepias tuberosa*	Yarrow 'Coronation Gold'	*Achillea 'Coronation Gold'*
Purple Prairie Clover	*Dalea purpureum*	Feather Reed Grass 'Karl Foerster'	*Calamogrostis 'Karl Foerster'*
Purple Coneflower	*Echinacea purpurea*	Daylily	*Hemerocallis spp.*
Bee balm	*Monarda fistulosa*	Blazingstar 'Kobold'	*Liatris 'Kobold'*
Little Bluestem	*Schizachyrium scoparium*	Silverfeather Grass	*Miscanthus sinensis*
Spiderwort	*Tradescantia bracteata*	Garden Phlox	*Phlox paniculata*
		Black-Eyed Susan 'Goldsturm'	*Rudbeckia fulgida 'Goldsturm'*

Mesic-Dry Soils (Shady)

Native		***Non-Native***	
Wild Columbine	*Aquilegia canadensis*	White Comfrey	*Symphytum grandiflorum*
Wild Geranium	*Geranium maculatum*	Tufted Hair Grass	*Deschamsia caespitosa*
Obedient Plant	*Physostegia virginiana*	Bigroot Geranium	*Geranium macrorrhizum*
Jacob's Ladder	*Polemonium reptans*	Daylily	*Hemerocalis spp.*
Solomon's Seal	*Polygonatum biflorum*	Hosta 'Royal Standard'	*Hosta 'Royal Standard'*
Zig Zag Goldenrod	*Solidago flexicaulis*	Tigerlily	*Lilium tigrinum*
Canada Violet	*Viola canadensis*		
Culver's Root	*Veronicastrum virginium*		

Wet Soil (Sunny)

Native		***Non-Native***	
Giant Hyssop	*Agastache foeniculum*	Joe-Pye 'Gateway'	*Eupatorium purpurescens 'Gateway'*
Canada Anemone	*Anemone canadensis*	Daylily	*Hemerocalis spp.*
Marsh Milkweed	*Asclepias incarnata*	Siberian Iris	*Iris sibirica*
New England Aster	*Aster novae-angliae*	Tigerlily	*Lilium tigrinum*
Turtlehead	*Chelone glabra*	Switchgrass 'Heavy Metal'	*Panicum virgatum 'Heavy Metal'*
Joe-Pye Weed	*Eupatorium maculatum*		
Obedient Plant	*Physostesia virginianum*		
Boneset	*Eupatorium perfoliatum*		
Queen of the Prairie	*Filpendula rubra*		
Blueflag Iris	*Iris versicolor*		
Great Blue Lobelia	*Lobelia siphilitica*		
Switchgrass	*Panicum virgatum*		
Mountain Mint	*Pycnanthemum virginianum*		
Tall Meadow Rue	*Thalictrum dasycarpum*		
Culvers Root	*Veronicastrum virginicum*		
Golden Alexander	*Zizia aurea*		

-list continued on next page-

Parking Lot Design

Plant List (continued)

Wet Soils (Shady)

Native		*Non-Native*	
Cardinal Flower	*Lobelia cardinalis*	Pink Turtlehead	*Chelone layonii*
Ostrich Fern	*Matteuccia struthiopteris*	Daylily	*Hemerocalis spp.*
Virginia Bluebells	*Mertensia virginica*	Obedient Plant	*Physostegia virginiana*
Sensitive Fern	*Onoclea sensibilis*		

Shrubs (Sunny)

Black Chokeberry	*Aronia melanocarpa*
Red-Osier Dogwood	*Cornus sericia*
Low Bush Honeysuckle	*Diervilla Ionicera*
Annabelle Hydrangea	*Hydrangea arborescens 'Annabelle'*
Pussy Willow	*Salix discolor*
High Bush Cranberry	*Viburnum trilobum*

Shrubs (Shady)

Black Chokeberry	*Aronia melanocarpa 'alata'*
Red-Osier Dogwood	*Cornus serecia*
Low Bush Honeysuckle	*Diervilla Ionicera*
Annabelle Hydrangea	*Hydrangea arborescens 'Annabelle'*

Trees (consider soils when making selections)

Autumn Blaze Maple	*Acer x freemanii 'Jeffersred'*
Black Ash	*Fraxinus nigra 'Fallgold'*
Seedless Green Ash	*Fraxinus pennsylvanica 'Marshall's Seedless'*
Swamp White Oak	*Quercus bicolor*
Kentucky Coffeetree	*Gymnocladus dioica*

Sources

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