maintenance/replacement costs may be lower. Although it does not show up on a ledger balance, benefits to the watershed and water quality and a reputation as an innovative land steward have great value.

To offset installation costs and serve as an incentive to increase the acceptability of watershed-wise practices, conservation and stewardship grants from nonprofit, governmental and private sources may be available.

Examples of alternative, permeable surfaces.

(All sites were accessed on June 30, 2004).

➢In Minnesota: http://www.metrocouncil.org/environment/Watershed/BMP/ApB_LocalExamples.pdf

➢Soil binders:
http://www.stabilizersolutions.com/crush_stone1.html

➢Pavers:
http://www.concretenetwork.com/concrete/porous_concrete_pavers
http://www.uni-groupusa.org/projects.html

➢Enhanced soils, reinforced turf and gravel:
http://www.netlon.co.uk/_turfsystems/casestudies.htm
http://www.invisiblestructures.com/GP2/grasspave.html
http://www.invisiblestructures.com/GV2/gravelpave.html

➢Combinations:
http://www.lid-stormwater.net/intro/homedesign.html

Sources/Links
All sites were accessed on June 30, 2004. Inclusion in this list does not constitute product endorsement.

Center for Watershed Protection, Inc. The Stormwater Manager's Resource Center. Ellicott City, MD. http://www.stormwatercenter.net

Construction Industry Research and Information Association (CIRIA). Sustainable Drainage Systems (SUDS). United Kingdom. http://www.ciria.org.uk/suds/permeable_surfaces_and_filter_drains.html

Low Impact Development (LID) Center, Inc. Beltsville, MD.
http://www.lid-stormwater.net

Metropolitan Council. 2003. Urban Small Sites Best Management Practices Manual. Saint Paul, MN.
http://www.metrocouncil.org/environment/Watershed/BMP/manual.html

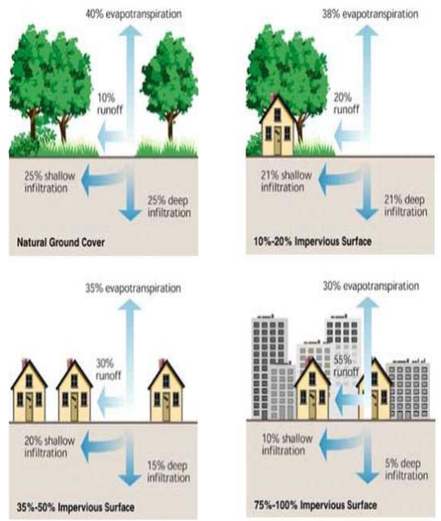
Netlon Turf System (Tensar International, Ltd). Blackburn, United Kingdom.
http://www.netlon.co.uk/_turfsystems/introduction.html

Stabilizer Solutions, Inc. Phoenix, AZ. http://www.stabilizersolutions.com/fiber_systems3.html

Sustainable Sources. Sustainable Building Sourcebook. Austin, TX
http://www.greenbuilder.com/sourcebook/PerviousMaterials.html

Trans-Agency Resources for Environmental and Economic Stability-A Project of Tree People. http://www.treepeople.org/trees/overView.html

Uni-Group, USA. Palm Beach Gardens, FL. http://



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Capitol Region Watershed District

"Our mission is to protect, manage and improve the water resources of the Capitol Region Watershed District"

This Fact Sheet is a cooperative effort of Great River Greening and the Capitol Region Watershed District

Impervious Surfaces and Alternatives

Fact Sheet #6
October 2004

Impervious Surfaces – What are they?

Development is rapidly replacing vegetated areas with impervious surfaces - hard surfaces that prevent water from soaking into the ground. Paved surfaces such as streets, sidewalks and parking lots as well as rooftops are examples of impervious surfaces. In urban areas, it is common to find more than 60% impervious cover. Impervious surfaces collect and move stormwater and snowmelt quickly through the watershed, flushing sediment, nutrients and contaminants directly into our surface waters. As outlying areas are built up, a watershed loses the ability to absorb and filter runoff causing our streams, rivers and lakes to become overburdened by large volumes of untreated stormwater.

Example of Impervious Surfaces

In contrast, permeable, porous or pervious surfaces (surfaces that allow water to soak into the ground) filter out pollutants and replenish groundwater by allowing runoff to soak into the ground, reduce stormwater volume and slow flow rates.

Alternatives to hard surfaces are available and their use becoming more widespread. Choosing to design for permeable surfaces can be relatively economical in urban areas where land for large stormwater basins may be scarce or prohibitively expensive.

Making a difference –

Strive to minimize how much water leaves the area where it falls.

Every piece of property – whether a home, school, or business- is a part of a watershed. Existing properties can be retrofitted to conserve and protect water. When an improvement or repair project is being planned, consider the environmental impact of your decisions and possible alternatives. One lot at a time, landowners can restore natural processes to the watershed. Understanding the issues and making informed choices can keep water from getting away from your piece of the watershed.

Permeable alternatives are described below for uses such as driveways and paths, playing areas, patios and decks, and parking areas on small urban properties in Minnesota. These options are feasible for more extensive, heavily used areas; however, site and maintenance limitations may be different when used on a larger scale.

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The physical site, type and intensity of use, accessibility and aesthetics will focus your choices. Clarify the use, duration (seasonal vs. year round), load-bearing needs, handicap accessibility, and soil type (poor vs. well draining) of the site in question. Consider special maintenance needs, frequency and equipment.

Minimize creation or addition of hard surfaces on a lot:

➢ *Consider impacts and alternatives*
Instead of pouring concrete for a patio, consider a raised deck with gravel base or pavers set in sand.

Instead of widening an asphalt or concrete driveway to add room for another vehicle, consider using permeable materials (such as gravel, reinforced turf or pavers).

Reduce runoff from existing impervious surfaces:

➢ *Prioritize* - Reduce and replace in critical areas, such as those near or adjacent to waterways.

➢*Absorbent materials* - Disrupt ability to collect and move runoff by surrounding them with materials that absorb and intercept water (such as vegetation, mulch or gravel).

➢*Redirect runoff* - from paved areas and rooftops onto permeable surfaces by grading or using gutter extensions.

➢ *Create breaks* - in the larger network of hard surfaces. For example, interrupt the connection between the top of a driveway and the street using permeable materials or devices to collect and infiltrate water.

Replace impervious surfaces with alternatives:

➢ Turf and other vegetation. - Plants intercept and use precipitation that falls on a site, physically cool an area and convey a softer, more welcoming feel than pavement. Roots strengthen and stabilize soils, enhance water infiltration and can grow more than 5 feet deep (native grasses). Plantings can be designed to control people and/or vehicle traffic. Maintenance and appearance varies depending on the location and choice of plants. Vegetation is often used in combination with other techniques (below).

Woodchip path – U of M, St. Paul Campus

➢ *Gravel, cobble.* - Natural, readily available material that allows water to flow through, not over, the top of the surface. Various sizes are available. Load bearing needs dictate thickness of the base. May be used in conjunction with a soil binder (see below). Consider snow removal and access for wheelchairs. Maintenance may include replenishment and evening out.

Gravel path to Peace Garden
Lake Harriet, Minneapolis

➢ Mulch. Wood chip mulch absorbs and stores water, improves nutrient content and absorbing capacity of soils as it decomposes, blocks weeds and provides a soft surface. Consider snow removal and access for wheelchairs. Replenishment is the major maintenance requirement.

➢ *Porous, or pervious* - pavement/concrete. Permeable pavement surfaces are underlayed by a stone base (reservoir) that temporarily stores runoff before it filters into the subsoil. Looks like traditional asphalt and concrete but manufactured without fine particles and with small spaces to allow water infiltration. This is an option where soils drain well; the pavement is 2-5 feet above the seasonally high water table, and stormwater is not heavily contaminated. In cold climates, the base of the stone reservoir must extend below the frost line. Proper maintenance requires vacuum sweeping and is critical to prevent clogging. It cannot be used in areas that are sanded in winter. Some designs incorporate overflow edges to allow some infiltration even when clogged.

➢ *Enhanced/reinforced soils* - A proprietary technique in which polypropylene fibers (in some cases made from recycled plastic) are incorporated into a 4-12 inch layer of sandy soil that is seeded or covered with sod to create a stronger soil that bears loads, resists sinking and rutting, and infiltrates water. Resilience of buried plastic fibers prevents compaction and by flexing under pressure may improve soils by keeping them porous. Maintenance is dictated by choice of vegetation. Consider snow removal and access for wheelchairs.

➢ *Solid or porous pavers* - with gaps between units. Natural stone, bricks, individual concrete blocks are installed on a pervious base with spaces filled with sand between each unit. Water flows into gaps and infiltrates the subsurface. Consider use, load bearing, soil type and site location to determine whether there is a need for a gravel sub-base or underdrain to increase water capacity. Maintenance varies depending on materials and desired appearance. Repairs can be made to individual pieces, which are easily removed and replaced.

Pavers intercept run-off before reaching the street.

➢ *Open (grass or gravel-filled)* - pavers. Paving units, or cells, with large spaces that can be filled with gravel or vegetation (typically turf grass). Various versions of interlocking and modular, plastic and concrete units are available. Some concrete options are cast in place. All versions allow for water to infiltrate and provide structural stability and evenness. Consider use, load bearing, soil type and site location to determine whether there is a need for a gravel sub-base or underdrain to increase water capacity. Maintenance varies depending on materials and desired appearance. Repairs can be made to individual pieces, which are easily removed and replaced. Turf-filled cells can be mowed. Sanding in winter may slow water infiltration through gravel-filled cells. Snow removal with plows and shovels can be easily adapted to prevent moving or damaging cells.

➢ *Reinforced Turf* - Plastic grids, netting or snap in place modular units are filled with sand and/or soil and vegetated usually with turf grass. Some plastic materials are rolled out or snapped in place. Stabilizes soil, strengthens turf; intercepts and infiltrates water. Site considerations determine whether a sub-base is needed. Turf-filled cells can be mowed.

➢*Soil Binders* - Proprietary, non-toxic product derived from plant materials (Indian wheat, *Plantago* sp.) that is mixed with crushed aggregate (such as gravel). Creates a pervious paving material that does not erode. Has a resilient surface and can be dug with a shovel for planting. Available in different colors, lighter colors have cooler surfaces. Does not crack during freeze/thaw cycles. Durability affected by weight and intensity of use. Maintained as needed by reapplying.

➢ *Creative combinations* - Permeable surfaces can be used in combination with traditional pavement or with each other to minimize runoff. Add beauty, habitat and filtration by planting hardy native species of grasses and wildflowers instead of turf grass in the different applications.

The cost –
Installation and material costs of permeable surfaces may be higher because they are specialized products and still not a streamlined, standard construction practice. When comparing products, consider the long-term expense. The longevity of innovative products may be extended and