Appendix D

Growing Richmond's Green Infrastructure

Green Infrastructure Toolkit

- Urban Water
- Site Planning
- Community spaces
- Community stewardship

Developed by E² Inc. for the Green Infrastructure Center and the City of Richmond

Green Infrastructure Toolkit

Urban Water and Site Planning

Low impact development (LID) features that help manage stormwater can be incorporated into almost every section of urban environments including open space, rooftops, streetscapes, parking lots, sidewalks, and medians. This versatile approach can be applied to new development, urban retrofits, and redevelopment / revitalization projects. These features are more environmentally and economically sustainable ways to address the adverse impacts of urbanization. By managing runoff close to its source through intelligent site design, these green infrastructure tools can enhance the local environment, protect public health, and improve community livability.

Urban water

Vegetated swales/bioswales

Rain gardens/bioretention ares

Vegetated filter strips

Stormwater wetland

Site planning

Street design

Reducing impervious surfaces

Vegetated landscaping

Urban forestry

Urban stream restoration

Riparian buffers

Source for LID practices: Low Impact Development Center, Inc.

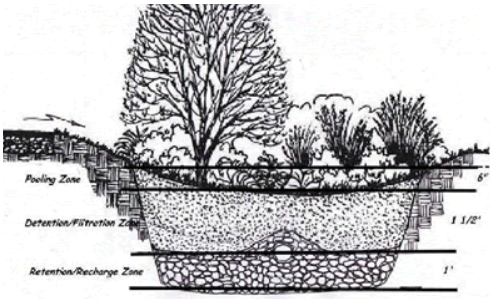
Vegetated swales/bioswales

Vegetated swales, sometimes referred to as bioswales, are broad, shallow channels designed to convey and infiltrate stormwater runoff. Swales reduce stormwater volume and improve water quality through infiltration and vegetative filtering. They also reduce runoff velocity by increasing flow path lengths and channel roughness.

Swales can be planted with grasses, perennials, shrubs and trees to provide a neighborhood amenity with aesthetic and habitat value.

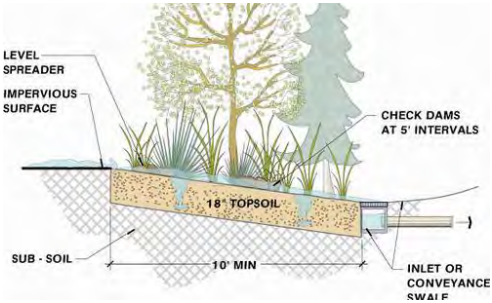
Rain gardens/bioretention areas

Rain gardens, also known as bioretention cells, are vegetated depressions that store and infiltrate runoff. Rain gardens are designed to encourage vegetative uptake of stormwater to reduce runoff volume and pollutant concentrations. A well designed rain garden has engineered soil which maximizes infiltration and pollutant removal, while avoiding stormwater ponding for longer than 24 hours.



Vegetated filter strips

Filter strips are linear vegetated areas that treat sheet flow and increase water quality from adjacent impervious areas. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice, and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal.



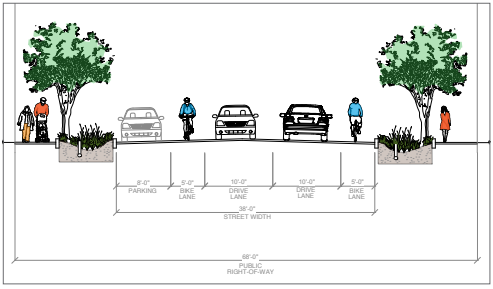
Stormwater wetland

Stormwater wetlands are constructed wetland systems designed to control stormwater volume and facilitate pollutant removal. These wetlands generally have less biodiversity than natural wetlands, but still provide habitat. They require a base flow through the wetland to support the aquatic vegetation present. Pollutant removal in these systems occurs through the settling of larger solids and coarse organic material and also by uptake in the aquatic vegetation.

Street design

"Complete" streets are streets designed to safely accommodate all users - pedestrians, bicyclists, motorists, transit riders and drivers of motor vechicles, and people of all ages and abilities, including children, older adults, and people with disabilities.

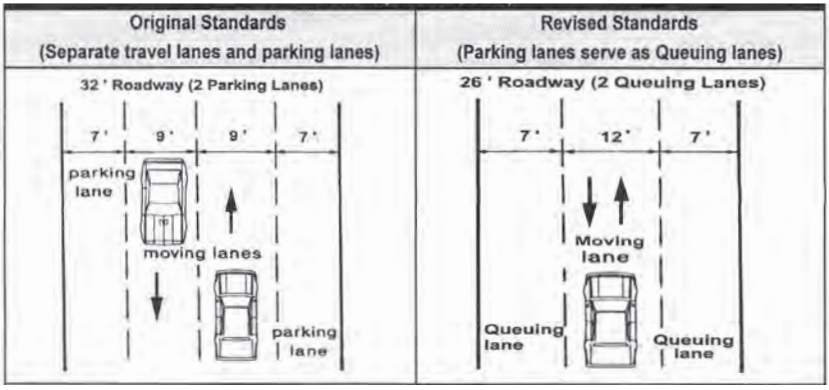
In addition to supporting neighborhood sustainability through alternative transportation, innovative street design can include design mechanisms, such as curb cuts, tree plantings and adjacent bioswales, to manage stormwater and improve the health of urban watersheds.



Reducing impervious surfaces

This best management practice reduces the amount of impervious cover by narrowing streets where possible to one lane for parking and selecting porous materials for places that have been traditionally paved. The recommended width of a narrow street is 24-26 feet.

Porous concreate and permeable asphalt have proven viable alternatives to reduce stormwater runoff volume, rate, and pollutants.



Vegetated landscaping

Natural and reintroduced vegetation provides stormwater management and pollutant removal. Vegetated areas intercept and infiltrate rainfall, decreasing stormwater volumes. Plants, trees, and other vegetation remove pollutants from infiltrated stormwater through root zone uptake. Incorporating vegetation into the landscape is a stormwater management technique that utilizes environmentally beneficial mechanisms that occur naturally in the environment.

Urban forestry

Trees reduce runoff volume through evapotranspiration (ET) and interception and improve the infiltration capacity of the soil, thereby reducing runoff potential. Afforestation involves planting trees in an area where they were absent for a significant period of time (e.g. a riparian buffer). Reforestation is the planting of trees in an area that was forested in the recent past (e.g. an area that was cleared for residential development).

Many city tree planting programs have proven effective ways to increase the urban tree canopy and citizen involvement.

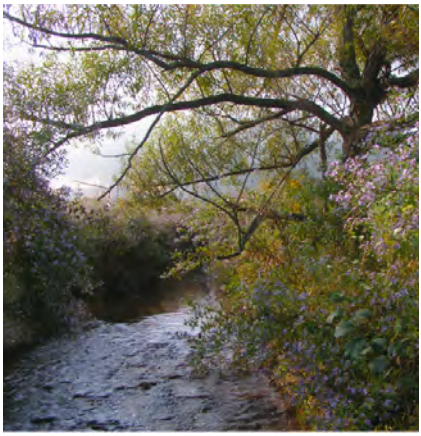
Urban stream restoration

Many urban streams and creeks have been neglected over the centuries, especially in older post-industrial cities. Development has heavily impacted streams: many have been buried in underground pipes, and urban land uses contribute harmful impacts to the stream system, which becomes eroded and channelized.

Urban stream restoration projects transform these damaged and neglected places into healthy, resilient, and functional natural systems. These restoration projects also create a community asset, as they often occur as a part of a larger parks and open space plan or community development initiative. Restored urban streams provide a valuable asset to surrounding neighborhoods, increase property values, and can stimulate economic development and redevelopment.

Riparian buffers

Riparian buffers are vegetated areas on either side of a river, stream, or creek. These corridors of plants enhance watershed health by moderating water quantities and improving water quality.



Riparian buffers intercept, absorb, and infiltrate surface runoff. This replenishes the groundwater table, which ensures a more constant flow of water in the adjacent stream channel. This also moderates the peak runoff rates during rain events, which reduces erosion and sedimentation of the stream channel.

Riparian buffer plantings remove pollutants, contaminants, and sediments before surface water enters the stream. They also also mitigate the unnaturally high water temperatures that are common in urbanized areas.

Green Infrastructure Toolkit

Community Spaces

Cities, organizations, neighborhoods and community volunteers can transform vacant urban parcels into green spaces that increase the aesthetic, community and ecological values of the landscape. Cleveland's *Reimagining Cleveland Pattern Book** demonstrates several low cost ways to create neighborhood assets from vacant and underutilized properties.

Examples of community spaces include:

- Pocket park
- Informal recreation
- Meadow/native habitat
- Outdoor classroom
- Community garden

Design concepts for vacant land in *Reimagining Cleveland.*

* *Reimagining Cleveland Pattern Book* is accessible here: http://www.neighborhood-progress.org/uploaded_pics/patternbookFINAL_lo-res_file_1241529170.pdf

Pocket park

Scuffletown Park, Richmond, VA

Overview

Pocket parks are small green spaces in neighborhoods that provide a safe area for residents to gather for play, quiet outdoor space or social interaction. Often too small for physical activities, pocket parks provide greenery, a place to sit outdoors, and sometimes a children's playground. They may be created around a monument, historic marker or art project.

How to

- A municipality may identify land to develop and maintain as a pocket park.
- A neighborhood group may initiate the formation of a pocket park as a citizens' project, often soliciting sponsorship from the city or other associations and volunteers for development and maintenance.
- Grants are often available to support these projects.

Benefits

- Improved aesthetic and ecological value of land
- Can stimulate social interaction and community building

Resources

- Enrichmond: http://www.enrichmond.org
- How-to-guide: http://www.kibi.org/pp_how-to

Informal recreation

Pickup soccer game, Maine

Overview

Vacant lots can be planted with low maintenance turf grass to provide space for informal recreation such as soccer, frisbee or neighborhood gatherings. Limited maintenance (mowing) could be provided by the city or neighborhood volunteers.

How to

- Community members work with landowner(s) to arrange interim use.
- Community members seek support from neighborhood, city, or grant programs for initial planting resources and ongoing maintenance.

Benefits

- Creates opportunity for outdoor recreation and community interaction
- Encourages exercise and fitness activities

Meadow/native habitat

Urban Meadow, Brooklyn, NY

Overview

Vacant parcels can be planted as meadows: low-maintenance plantings that bring verdant change and seasonal blooms during the spring, summer and fall.

How to

- Community members work with landowner(s) to arrange interim use.
- Community members seek support from neighborhood, city, or grant programs for initial planting resources and ongoing maintenance.

Benefits

- Neighbrohood beautification
- Stormwater infiltration
- Native habitat for plant and animal species
- Educational and social opportunities for the community

Resources

- Brooklyn Urban Meadow: http://urbanmeadowbrooklyn.blogspot.com/
- Virginia Department of Natural Resources: http://www.dcr.virginia.gov/natural_heritage/index.shtml

Outdoor classroom

Tremont School, OH

Overview

Outdoor classrooms can be created on vacant parcels close to schools to provide an extension of the classroom outdoors for a variety of environmental learning opportunities. Some outdoor classrooms may just consist of gardens, while others may include structures such as benches and pavilions.

How to

- Schools and landowners can work together to coordinate use of the vacant parcel.
- A school or parents organization may solicit volunteers, resources and sponsorships from local building supply and service businesses.

Benefits

- Hands-on education opportunities
- Increasing familiarity with native species of plants and flowers
- Alternative learning environment

Community garden

Tricycle Gardens, Bainbridge and 9th Street, Richmond, VA

Overview

Community gardens are plots of land cared for and cultivated by members of the community. The land, often owned in trust by local government or non-profit organizations, is typically open for the public involvement. Community gardens often provide fresh produce and plants as well as satisfying labor, neighborhood improvement, sense of community and connection to the environment.

How to

- Community members can work with landowners to plan a garden.
- Non-profit organizations, such as Tricycle Gardens in Richmond, often work with communities to form groups and develop resources to start and maintain community gardens.

Benefits

- Provide a catalyst for neighborhood and community development
- Stimulate social interaction, encourage self-reliance, beautify neighborhoods
- Produce nutritious food, reduce family food budgets, and conserve resources
- Create opportunities for recreation, exercise, therapy and education

Resources

- Tricycle Gardens: http://tricyclegardens.org/gardens/community-gardens/
- American Community Gardening Association: http://www.communitygarden.org/

Green Infrastructure Toolkit

Community Stewardship

Changing industry and settlement patterns have led to an increase in vacant and underutilized properties in urban areas across the U.S. To confront the challenges to quality of life, property value and safety created by growing vacancies, many cities have developed neighborhood stabilization strategies directed at making vacant properties productive and safe assets for communities. Innovative policies and programs provide support, resources and/or guidance for organizations and community members to become stewards of vacant properties.

Examples of some of those policies and programs include:

- Green space grant programs
- Land banking
- Mow-to-own
- Adopt-a-block

Green space grant programs

Many cities have partnered with local corporations and organizations to sponsor grants and support programs for neighborhood volunteers. Indianapolis' *Keep Indianapolis Beautiful* program offers Greenspace grants to neighborhoods willing to transform blighted areas into community assets, from pocket parks to community gardens.

Resources

- Keep Indianapolis Beautiful: http://www.kibi.org/greenspace

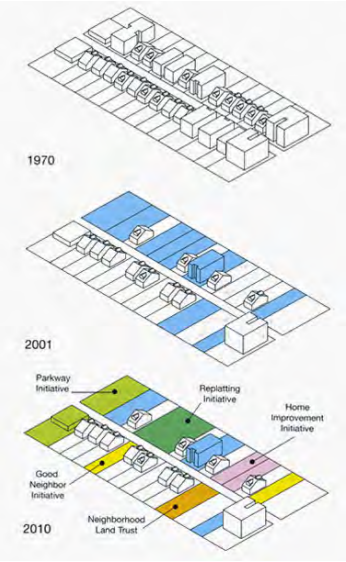
Land banking

A growing number of communities have created a dedicated public authority, known as a land bank, to streamline property reuse activities, assemble developable parcels, and manage the redevelopment process to serve the community's goals.

A land bank generally involves public acquisition of abandoned property; the land is then transferred to a nonprofit third party for redevelopment. Land banks attempt to unlock the potential value of properties and sites, with the goal of returning them to productive use.

Resources

- Housing Policy.org: http://www.housingpolicy.org/toolbox/strategy/policies/abandoned_properties.html?tierid=155#lb
- Detroit: http://kirwaninstitute.org/research/projects/vacpropreform/index.php



Detroit land banking diagram. Source, *Shrinking Cities*.

Mow-to-own

Vacant lots can be absorbed into residential neighborhoods by encouraging adjacent property owners to acquire and maintain these sites as an expansion of their own properties.

Cleveland's proposed Mow-to-Own program enables residents to earn the ownership of a neighboring or nearby property (from a landbank) in exchange for providing good maintenance of these properties according to city-established standards.

http://www.cudc.kent.edu/shrink/Images/reimagining_final_screen-res.pdf

Adopt-a-block

The Adopt-a-Block program created in Indianapolis provides a support structure, resources, and tools for neighbors who work together to keep a block clean and maintained in the city. A block leader coordinates the volunteer effort, and the city provides training, tools, trees and other plants to support the neighborhood's efforts.

http://www.kibi.org/adopt-a-block

Additional resources and references:

http://www.epa.gov/owow/NPS/lid/ - U.S. EPA website for Low Impact Development and Green Infrastructure. Numerous resources, references, and information are compiled at this extensive website.

"Catching the Rain: A Great Lakes Guide to Natural Stormwater Management." American Rivers 2004.

http://baltimorecity.gov/Government/AgenciesDepartments/RecreationandParks/TreeBaltimore.aspx

Davis, Lynn. "Urban forestry: Engineering cities into natural systems," Research Magazine, (Winter 2004). http://www.research.vt.edu/resmag/2004resmag/forestry.html.

Georgia Forestry Commission. "Tree Benefits: Environmental benefits of trees." http://www.gfc.state.ga.us/CommunityForests/TreeBenefits.cfm.

"Why Shade Streets? The Unexpected Benefits." Center for Urban Forest Research, (2006). http://www.fs.fed.us/psw/programs/cufr/products/cufr_673_WhyShadeStreets_10-06.pdf.

Akbari, H., M. Pomerantz, H. Taha. Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. 2001. Solar Energy, Vol. 70, No. 3.

Georgia Forestry Commission. "Tree Benefits: Environmental benefits of trees." http://www.gfc.state.ga.us/CommunityForests/TreeBenefits.cfm.

Georgia Forestry Commission. "Tree Benefits: Environmental benefits of trees." http://www.gfc.state.ga.us/CommunityForests/TreeBenefits.cfm.

"A Citizen's Streambank Restoration Handbook." Firehock, Karen and Doherty, Jacqueline. A publication of the Save Our Streams Program: Izaak Walton League of America, Inc. 1995.

"A Stream Corridor Protection Strategy for Local Governments." Institute for Environmental Negotiation, Department of Urban and Environmental Planning of the School of Architecture at the University of Virginia, 2002.

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