Sustainable Community Design

Introduction to Principles and Practices for Conservation Design

"Municipal Tool Kit"

Prepared by: Brenda Kelley, Bathurst Sustainable Development, January 2009

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This "Municipal Toolkit" is a collection of publically available information and best available examples of Sustainable Community Design (SCD) concepts from various highly respected sources. It is our hope that this information will be useful to planners, developers, homeowners, contractors and Municipalities.

It was prepared by Bathurst Sustainable Development with the kind assistance of the Province of NB, the City of Bathurst and the NB Department of Environment, Planning Branch.

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Bathurst Sustainable Development is a non profit community environmental organization working on issues pertaining to sustainable development. You can visit us at the following two locations:

Bathurst Sustainable Development Environmental Resource Center

Open Saturdays from 8:30am -12:30pm.!
Located inside the Bathurst City Farmer's Market on Main Street, Bathurst, NB

Bathurst Sustainable Development Climate Change Action Center

Open Weekdays! Located at 237 Main Street, Bathurst, NB!

On behalf of Bathurst Sustainable Development we wish to thank the Province of New Brunswick, the City of Bathurst and all contributing sources for their support of this initiative.

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What is Sustainable Community Design?

Introduction

Conservation design is a density neutral design system that takes into account the natural landscape and ecology of a development site and facilitates development while maintaining the most valuable natural features and functions of the site. *(Conservation Design Resource Manual 2003)*

Density neutral means that designers plan development so that there is no overall loss of buildable units despite the conservation goals achieved on the site. *(Conservation Design Resource Manual 2003)*

Needs for housing and development in the future for Canada will respond to the Baby boomer generation who retire and do not want to maintain huge properties but do want to live close to nature, and for younger generations that require work and living spaces under one roof. *(Source: CMHC Research highlight: Housing the Boom, bust and echo generations, March 2002).*

In the United States it is known as the popular concept of conservation design for subdivisions. Through the implementation of a new concept for Canada that is called Sustainable Community Design (SCD) for subdivisions, local governments, communities, developers, and homeowners all can contribute to the protection of the environment, biodiversity and improving quality of life by observing these four principles:

- **Develop Flexible Lot Design Standards**
- **Protect and Create Natural Landscape and Drainage Systems**
- **Reduce Impervious Surface Areas**
- **Implement Sustainable Stormwater Management Techniques**

The goal of this toolkit is to provide general information about some of the conservation design principles and practices, and to provide some of the necessary language to enable communities to implement conservation design at varying levels.

In general Sustainable Community/ Conservation Design (SCD) follows these basic principles, benefits and or objectives:

- Generally 50% of the land to be developed would be protected and not developed.
- Prospective purchasers of housing may be willing to pay higher if their property or sub-division includes a protected environment.
- SCD building is often less costly than conventional building for developers.
- In SCD, density is increased by including a mix of housing styles: condos, townhouses, smaller homes and apartments on smaller lots along with more compact and mixed uses within the subdivision.
- Focus is on building less roads and allowing more open green space.
- Significant biological features such as mature forests, individual mature trees, marshes, wetlands, critical habitat, pools, ponds and riparian zones are preserved and enhanced as recreational and ecological desired features.
- Mature trees left intact can increase the economic value to a property by several thousands of dollars.
- Ensuring that all stormwater and waste stays on the site instead of being released into the environment.

- Designing to take advantage as much as possible of renewable energy systems such as solar, wind, and geothermal.

The following principles have been identified as essential in the Conservation Design process:

1. Willingness by the community and developer(s) to implement a new concept.
2. Developers and local governments working together with the people from the area where the subdivision is being built.
3. Interest to incorporate actions to respond to climate change, reduce GHG, and adopting smart growth principles.
4. Openness to change / amend local regulations or by-laws to facilitate the implementation of the concept.

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Sustainable Development and Climate Change

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The principles of true sustainable development tell us that we must live within the Earth's caring capacity and that we must protect the eco systems which are our life support systems. In order to be sustainable, it is our responsibility to insure that we manage our economies and communities in such a way that these eco systems remain intact, able to function properly and in good health for future generations. We see all too often how easily our activities can contaminate ground water, soils and the air that we breathe and so we must reverse this trend.

The world is in a major global transition to a "green shift", moving towards a world that releases far fewer carbon emissions, and functions with smaller "ecological footprints" and "ecological impacts" from human activities. Home buyers are now looking for places to live and housing that allows them to reduce their impact on the earth and have fewer toxins both inside and outside their home. They are also seeking a wider variety of housing options that are very energy efficient, incorporate green building design and building materials, use renewable energy, allow them to reduce, reuse and recycle, allow them to live "car free" or with reduced transportation distances, be able to access active and sustainable transportation options, enjoy the outdoors and have a high quality of life.

We hope that this collection of information on sustainable community design is beneficial to you and to your community!

Brenda Kelley, Bathurst Sustainable Development

What are the Benefits of Conservation Design?

The benefits of conservation design fall roughly into three categories, quality of life benefits, environmental and economic benefits.

Communities that choose to implement conservation design may see a variety of benefits, including reduced flooding, improved water quality, enhanced biodiversity, higher property values, higher property tax revenues, and greater community cohesion.

Quality of Life Benefits of Conservation Design

- Addresses citizens concerns able their impact to and living with the natural environment.
- Creates a variety of formal and informal public spaces within developments for social, recreational and quality of life benefits within the neighbourhood.
- Offers a variety of recreational spaces and activities which may include group activities such as picnics or soccer games, biking or walking in natural areas, or observing the plants and wildlife that thrive in preserved habitats which can make a noticeable difference in the quality of daily life.
- Homes in these types of developments will be increasingly valuable as homebuyers increasingly demand access to nature and efficiency with the residences they purchase.

Quality of Life Indicators

In December 2004, Infrastructure Canada, with the principal objective of soliciting Canadians' opinions about their issues and priorities for community life, and coordinated by Infrastructure Canada (the Cities Secretariat) on behalf of an interdepartmental group, contracted the Strategic Counsel to provide a report on the findings of a national survey on Canadians' views of the quality of life in their communities.

The most surprising finding was how strong the consensus was, across regions, community sizes and demographic groups, as to the characteristics of the ideal community - an important starting point for long term policy development. The ideal town or city has high quality education, a thriving economy, green spaces, good active and sustainable transportation options and services and affordable housing. Other characteristics, such as recreation facilities, an arts community, highly educated people and cultural diversity were viewed as secondary, but important, characteristics.

Four areas surfaced as being of most concern to Canadians:

In order, these are:

- the environment,
- the local economy,
- community services and
- infrastructure, including public transit.

Environment and Biodiversity Benefits

Thoughtfully implemented conservation design practices are beneficial to the natural environment in a number of ways.

- Protected water quality
- Reduced flooding
- Protected habitat and biodiversity
- Protected and recharged aquifers
- Reduction in carbon outputs and greenhouse gas emissions

Economic Benefits

The economic benefits of conservation design are can be summarized as:

- More areas of preserved open space,
- Lower construction, maintenance and reduced infrastructure costs,
- An increase in real estate value appreciation, and tax base.

The difference in comparable costs can be quite impressive:

Average Conventional Development Costs	$2000 per acre (varies according to location)
Average SCD Development Costs	$800 per acre (varies according to location)
Average Carbon Savings	53 tons per acre of natural space preserved

Source: Sustainable Planning Workshop, Bathurst, NB, 2007

Thirteen specific site design practices are presented to implement these principles. They are discussed throughout this tool kit.

A. Develop Flexible Lot Design Standards

1. Lot Size, Density, and Suggested Open Space
2. Arranging the Development Site
3. Building Setbacks

Flexible lot design standards can lead to attractive, comfortable developments while simultaneously optimizing the protection of natural systems and conserving natural areas. Eliminate minimum lot size requirements; rather, regulate overall density of development. (NIPC 2004)

Community Benefits

- Minimizes stormwater runoff.
- Preserves natural resources and features.
- Produces a broader range of marketable housing.
- Reduces long-term maintenance and development costs, since infrastructure (roads, sewer, streetlights, water, etc.) is reduced.
- More compact layouts result in shorter sewer and water connections and arterial roads.
- Reduces the public sector's long-term infrastructure maintenance costs.
- May increases the community real estate tax base.

Homeowner Benefits

- Increases property values.
- Enhances access to recreational opportunities, as more natural areas are created.
- Reduces dependency on automotive transportation by allowing mixed use and compact development.
- Reduces landscape maintenance needs.

Developer Benefits

- Enhances marketability of homes and enhances design flexibility.
- Lowers development costs.
- Grouping homes can result in reduced construction costs associated with developments.
- In general, construction cost savings of 25% or more have been realized when grouping large lot (1 acre or more) developments. These cost savings are not as great when smaller, half-acre lots are grouped, where a cost savings of about 10% has been realized (CWP 1995).
- In 1992, CH2MHill found that as the distance between individual dwelling unit's decreases, the total cost of subdivision infrastructure declines proportionally (CWP 1995).

Lot Size, Density, and Open Space

The basic principle underlying the practice of conservation design is the protection of natural and cultural resources through design flexibility. This flexibility involves the reduction of lot sizes in a development in exchange for setting aside the remainder of the property as significant amounts of natural, open space land. (NIPC, 2003)

Arranging the Development Site

Maintain critical natural areas by designing the site with sensitivity and group buildable lots together to maximize the area of undisturbed land. (NIPC, 2003)

Randall Arendt, a North American expert in conservation design, outlines the following four step process for arranging the development site (Arendt 1996).

1. **Identify all Potential Conservation Areas.** This will include all inherently unbuildable areas (floodplains, wetlands, steep slopes) and also buildable areas that are sensitive environmentally (natural areas, stream and wetland buffer areas, woodlands, etc.), significant historically and culturally, or important for conservation for some other reason. The developer will be responsible for identifying the conservation areas; a community resource inventory or comprehensive plan can be a valuable tool in monitoring the protection of conservation areas.

2. **Locate the House (or other building) Sites.** At this point, only the specific sites for buildings to be constructed should be located. To maximize the revenue potential of the sites, the developer will take care to locate the sites to maximize views and access to natural areas and other amenities.

3. **Design the Street and Trail Systems.** Determine how to most efficiently lay out the street system to access every home. Similarly, homes should have easy access to walkways and trail systems within the development.

4. **Draw in the Lot Lines.** This is the final step and should be almost trivial once the building sites and street system have been identified.

For a more in depth discussion of Arendt's suggested design process, refer to Conservation Design for Subdivisions, pages 41-48. (NIPC, 2003)

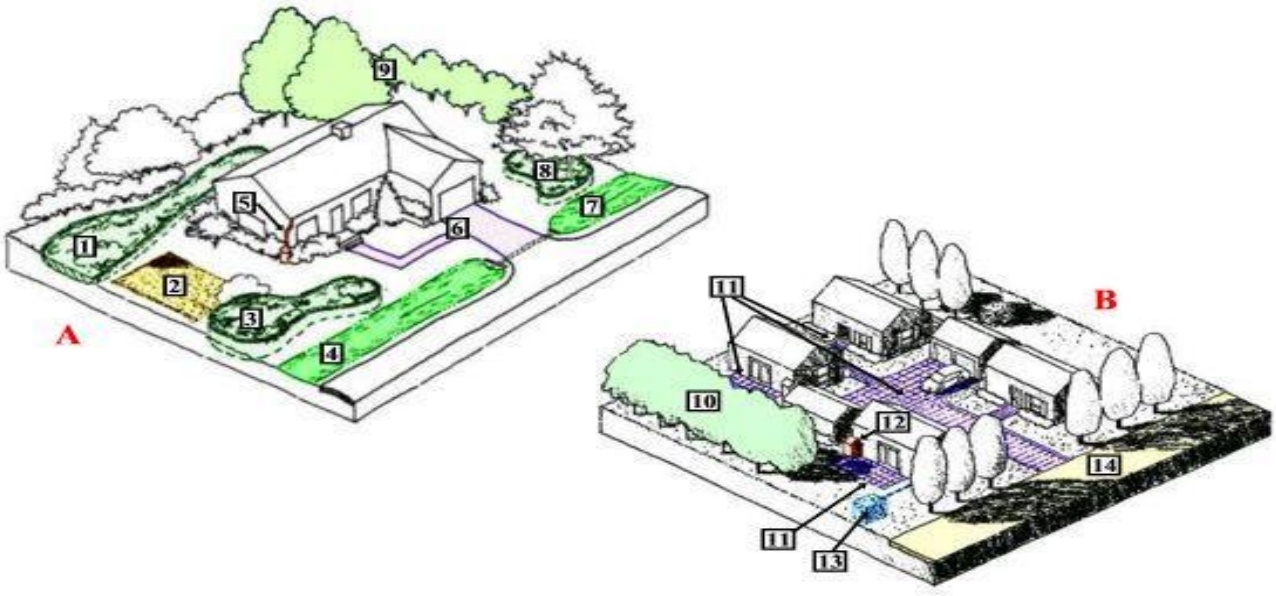
Example 1

The figures below, (Teska Associates, Inc., 2000) show example configurations that can be used to arrange the same number of housing units on a development site, with the resulting differences in building massing and natural areas.

Conventional Layout on Development Site
Teska Associates, Inc. – 2000

Conservation Design Layout on Development Site
Teska Associates, Inc. – 2000

Example 2



Sketch A was adapted from Prince George's County, MD, LID IMP Guidance Document, 2002. Sketch B was modified from Start at the Source as provided by Bay Area Stormwater Management Agencies Association and illustrator Patrick Dawe.

Legend

A

1. Bioretention / Rain Garden, Low Density Residential
2. Soil Amendments, Low Density Residential
3. Bioretention / Rain Garden, Low Density Residential
4. Grassed Swale, Low Density Residential
5. Disconnectivity (Rain Barrel), Low Density Residential
6. Permeable Pavers, Low Density Residential
7. Grassed Swale, Low Density Residential
8. Bioretention / Rain Garden, Low Density Residential
9. Conservation, Low Density Residential

B

10. Conservation, High Density Residential
11. Permeable Pavers, High Density Residential
12. Disconnectivity (Rain Barrel), High Density Residential
13. Disconnectivity (Dry Well), High Density Residential
14. Minimizing Imperviousness (Reduced street width), High Density Residential

Suggestions:

- Landscape with a rain garden to provide on-lot detention, filtering of rainwater, and groundwater recharge.
- Disconnect the gutters and downspouts from roofs and direct the flow to a rain garden.
- Retain rooftop runoff in a rain barrel for later on-lot use in lawn and garden watering.
- Combine the rain gardens with grassed swales to replace a curb-and-gutter system.
- Use permeable pavers for walkways and parking areas.
- Combine the rain gardens with grassed swales to replace a curb-and-gutter system.
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Source: Rain Garden Design Templates, Low Impact Development Center
http://www.lowimpactdevelopment.org/raingarden_design/lid_residential.htm

Example 3: Dieppe, New Brunswick

The idea of managing residential growth in such a way that it reduces its environmental impact actually makes cities more "liveable", more socially inclusive and makes it more energy efficient to maintain buildings.

The City of Dieppe, in New Brunswick, Canada, in partnership with a developer, the community and others has begun to design and develop a Sustainable Community Design Subdivision. "Le Village en haut de Ruisseau (LeV)' as it is named, is a proposed subdivision designed for a 10 hectare site located on the outskirts of the city. Over 50% of the land in the subdivision is to be preserved as natural areas. At the same time, there will be more residential units available than if the subdivision had been designed using the conventional method.

For more detailed information visit: Ville de Dieppe - (506) 877-7900,
http://www.dieppe.ca/dieppe_dev_en.cfm

Conventional Design

Conservation Design

Sample of a Proposed Conservation Design Option

http://www.dieppe.ca/dieppe_dev_en.cfm

Example 4: Terrace in the Woods, NY

Benefits: Smaller lots with higher density, preserved green spaces, forests, mature trees and open space, higher biodiversity, less road ways, strong buffers between houses to reduce noise.

Low Impact Development (LID) Center
http://www.lid-stormwater.net/general_residential.htm

Setbacks

Eliminate setback requirements for the interior of development sites while maintaining expectations on the perimeter. (NIPC, 2003)

Conventional ordinances generally require large setback distances between homes and adjacent homes, streets, and lot lines. In order to meet conventional requirements, lots must be of substantial size, where the house is located at the center with generous spaces on all sides. (NIPC, 2003)

Conservation design discourages this approach to configuring homes and lots. Rather than having large front, back and side yards for individual homes, conservation design calls for smaller yards in exchange for larger expanses of contiguous natural areas. To accomplish this, most setback requirements must be substantially reduced or eliminated. (NIPC, 2003)

B. Protect and Create Natural Landscapes and Drainage Systems

Facilitating conservation design and fostering stewardship of natural areas and natural communities is critical to achieving regional biodiversity goals. (NIPC, 2003)

4. Natural Area Protection and Conservation
5. Natural Landscape Sensitivity
6. Natural Landscaping
7. Open Space Management

Biodiversity

Implementing the principles of conservation design can potentially increase biodiversity and thus have a positive effect. Conservation design promotes the creation, retention, and management of open space. This open space creates a habitat for many different ecosystems with wide varieties of animal and plant species. By preserving open space, biodiversity is also preserved (NIPC, 2003).

Community Benefits

- Reduces flooding and stormwater management costs.
- Buffers provide temporary storage of floodwaters in headwater streams, which reduces the height of a flood crest storm surge and the subsequent cost damages to downstream communities (CWP 1995).
- Reduces long-term maintenance costs.
- Unlike storm sewers, curbs, gutters, and sewer inlets, swales and filter strips theoretically never need to incur replacement costs (except in cases of extreme erosion), but rather require periodic maintenance consisting of sediment or debris removal and general cleaning (NIPC 1997a).
- Filter strips may reduce maintenance costs for components of downstream drainage systems because they remove sediment and other pollutants (NIPC 1997a).
- Swale maintenance costs can be reduced if upstream sources of sediment—particularly from construction activities—are well controlled, and if local ordinances are enforced prohibiting homeowners from dumping materials into swales (NIPC 1997a).
- Natural landscaping can serve as a buffer to existing preserved natural areas, thereby increasing the size of the natural area. This provides a continuous natural ecosystem setting and enhances the "connection to nature" that is important to communities (The Countryside Program 1998).
- Allows connections to existing natural areas, open space, greenways, and trails.
- Reduces soil erosion.
- Reduces need for fertilizer and pesticides.
- Conserves local including rural, areas of biodiversity.
- Preserves rare, threatened, and endangered species.
- Increases opportunity for passive recreational and educational activities.
- Improves air and water quality, and controls urban heat.

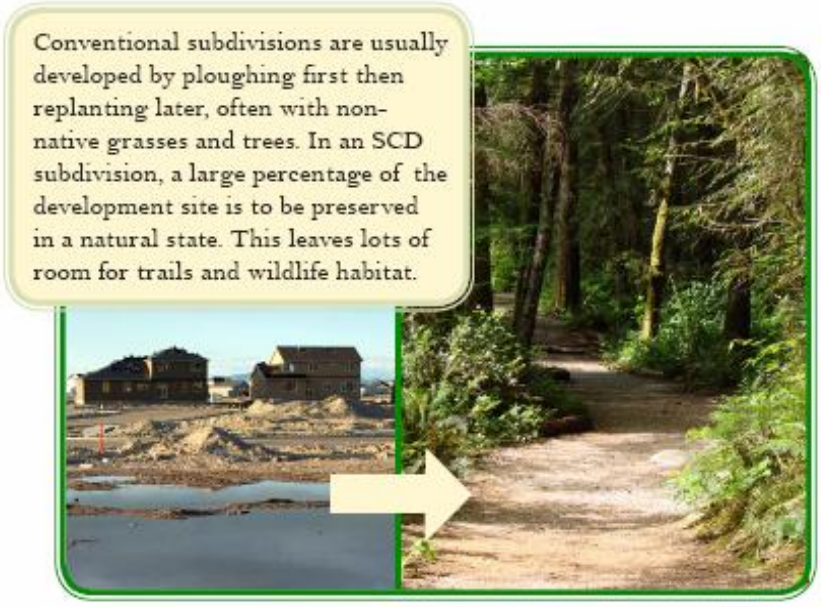
Homeowner Benefits

- Can increase property values and decrease maintenance costs.

- Turf grasses require fertilizers, water, pesticides and other measures annually to keep lawns in quality condition (The Countryside Program 1998).
- Native landscapes require weed control and minimal watering.
- Smaller yards that have natural landscaping require less maintenance.
- Enhances aesthetics.
- Maintains productive land uses.
- Natural area protection can conserve highly productive agricultural land.

Developer Benefits

- Reduces landscaping and other installation costs.
- Installation and maintenance costs are lower for natural (native) landscaping compared with common turf grasses. (Pizzo & Associates 2001).
- Enhances marketing potential and developer reputation for innovative development.
- The marketability of a development can be enhanced by the lower maintenance aspects associated with native landscaping and smaller lawns.
- A 1995 Newsweek survey found that two-income families prefer smaller lawns in order to reduce their lawn maintenance activities (CWP 1998)



Royal District Planning Commission, Sussex NB, (506) 432- 7530 www.royaldpc.com

Protect Valuable, Mature Trees with Tree Wells and Protective Barriers

University of Wisconsin-Extension

By walking the lot prior to excavation, you can identify and protect valuable mature trees and areas with high conservation value which will add economic and ecological value to your lot. Contractors are encouraged mark off and allow no excavation in these areas and to place protective barriers around the base of mature tree to protect underground root system from damage during excavation.

- As a rule of thumb, the protective barriers for mature trees on a construction site should be erected as far from the base of the tree trunk as the widest part of the overhead tree canopy.
- For a mature Blue Spruce tree for example, the large major roots could extend as much as 6 feet from the base of the tree.

Avoided stormwater-construction costs attributed to trees, as measured by the American Forests' CITY green model.

Urban Area	Amount that trees save in one-time stormwater-construction costs
Houston, Texas	$1.33 billion
Atlanta, Georgia	$2.36 billion
Vancouver, Washington/ Portland-Eugene, Oregon	$20.2 billion
Washington D.C. Metro Area	$4.74 billion
New Orleans, Louisiana	$0.74 billion
San Antonio, Texas	$1.35 billion
San Diego, California	$0.16 billion
Puget Sound Metro Area, Washington	$5.90 billion
Detroit, Michigan	$0.38 billion
Chesapeake Bay Region	$1.08 billion

Source: American Forests 2000-2006

ECONorthwest: The Economics of Low Impact Development

Protecting Buffers and Riparian Zones

Natural buffers and riparian zones are critical for protecting sensitive natural areas. They both provide the following benefits:

- Slows water runoff and reduces downstream flooding.
- Removes nutrients and pesticides in runoff.
- Removes sediment and pathogens in runoff.
- Reduces noise and odour.
- Serves as a source of food, nesting cover, and shelter for wildlife.
- Stabilizes stream banks and reduce water temperature in stream.

Local by-laws should be updated to substantially restrict development on or near natural areas, and require or encourage protection and restoration of undeveloped buffers around these areas.

- Areas to evaluate for protection include streams, lakes, and all types of wetlands, floodplains, steep slopes, wildlife habitats, woodlands, farmland, sensitive aquifers, watersheds and their recharge areas.
- Certain sensitive areas such as flood zones, wetlands, and threatened and endangered species habitats may be protected by federal and provincial laws, but each community must decide the extent to which it will protect additional natural areas that are not already legally protected for the future sustainability of their community.

Please help us to protect riparian zone (shoreline) areas along rivers, streams, brooks and coastal zones! Let's keep the water clean!

Poor shoreline protection and maintenance

Good shoreline protection and maintenance

Please Do Not Use Pesticides

University of Wisconsin-Extension

C. Reduce Impervious Surface Areas

8. Roadway Design
9. Parking Lot Design
10. Vegetated Swales
11. Walkways
12. Driveway Design
13. Roof Runoff Management

Impervious cover (also called impervious surface) includes roads, parking lots, sidewalks, swimming pools, roof tops, garages, patios, and any other surfaces through which water cannot pass. (NIPC, 2003)

- Enact flexible standards for road length, width, right-of-way, and design.
- Require the minimum amount of paved surface area while maintaining safe and sufficient support of travel lanes, on-street parking, and emergency and support vehicle access. (NIPC, 2003)
- Shorten road lengths by grouping developed areas and minimizing paved surfaces.
- Protect scenic views and vistas.

Community Benefits

- Decreases demand for stormwater runoff management.
- Reduces municipal maintenance and energy costs.
- Reduced residential street widths and lengths reduce the associated long-term operation and maintenance costs of local infrastructure (CWP 1998). These costs include 1) road repair and replacement, 2) utility repair and replacement, 3) snow removal, 4) inspections, and 5) street sweeping.
- Improves water quality and quantity.

Homeowner Benefits

- Increases interaction with neighbours
- Increases biodiversity in nearby wetlands and water bodies, since impervious areas are reduced.
- Reduces residential street widths tends to slow drivers down, creating safer roads.
- A 1998 study by Peter Swift illustrates that as street width widens, accidents per mile per year increases exponentially, and that the safest residential street width is 24 feet (Swift 1998).

Developer Benefits

- Decreases development costs.
- For each increment of impervious cover that is reduced, developers gain a proportional reduction in infrastructure construction costs (CWP 1995).
- The cost of a curb-and-gutter/storm drain pipe system can often be about 2 to 3 times more expensive than an engineered swale (CWP 1998).
- Roadside swales with culverts at road and driveway crossings are generally less costly to construct than curb-and-gutter storm sewers. (NIPC 1997a).
- Reducing the width of a 300 foot long residential street from 28 feet to 18 feet would reduce overall imperviousness by 35% and construction costs (CWP 1998).
- Eliminating just one parking space is about $1,100 (in 1990 dollars).
- Lower costs for storm drains, Best Management Practices (BMPs), and associated maintenance (CWP 1995)

Recommended Pavement Widths

Residential Collector	Follow local standards
Local Streets	No parking expected 16-18 feet
	Restricted parking 22-24 feet
	Normal residential parking 24-26 feet

Source: (NIPC, 2003)

Parking Lot Design

Enact flexible standards for parking lot design in multi-family housing developments, commercial, and business areas. Require stormwater treatment for parking lot runoff using bioretention areas, filter strips, and/or other practices that can be integrated into required landscaping areas and traffic islands. (NIPC, 2003)

There are several techniques that communities can use to reduce the volume and increase the quality of stormwater generated at parking lots. These include:

- Reducing minimum parking requirements to allow smaller lots to be built.
- Allowing developers to use pervious materials for spill over parking.
- Designing drainage and landscape systems that filter & infiltrate runoff.
- Reduce parking lot size.
- Reducing the size of individual parking stalls.
- Include designated spaces for compact cars, motorcycles and bicycles.
- Reduce parking demand through improved pedestrian and public transportation access.
- Existing landscaped areas in parking lots should be used to provide stormwater filtering or infiltration. (NIPC, 2003)

Grass Filter Strips

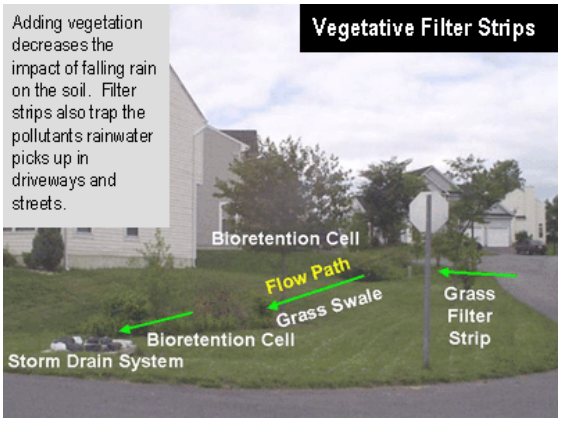
Grassed filter strips (also known as vegetated filter strips, filter strips, and grassed filters) are vegetated areas that are intended to treat sheet flow from adjacent impervious areas.

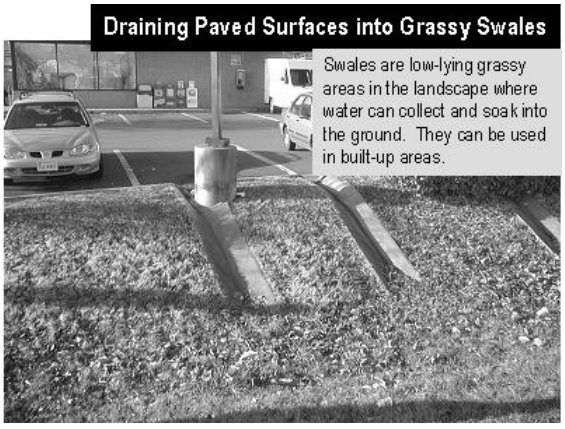
- Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and providing some infiltration into underlying soils.
- Filter strips can provide relatively high pollutant removal.
- Filter strips are best suited to treating runoff from roads and highways, roof downspouts, and small parking lots.
- Typically, filter strips are used to treat very small drainage areas. (NIPC, 2003)

Vegetated Swales

The term "swale" (a.k.a., grassed channel, dry swale, wet swale, biofilter) refers to a series of vegetated, open channel practices that are designed specifically to treat and attenuate stormwater runoff for a specified water quality volume. As stormwater runoff flows through the channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Maintenance of grassed channels mostly involves maintenance of the grass or wetland plant cover. Swales may be used in the street right-of-way and throughout the site. (NIPC, 2003)

Examples of Permeable Surfaces and Vegetative Filter Strips





http://www.epa.gov/owow/nps/nps_edu/urbanx4.html U.S Environmental Protection Agency

- Most jurisdictions require that curb and gutter systems be installed along residential streets to convey stormwater runoff. (NIPC, 2003)
- Curb and gutter systems, however, provide no stormwater treatment and quickly discharge stormwater directly into streams. By contrast, open vegetated swales that could provide better treatment are usually discouraged or prohibited. (Better Site Design, CWP)
- Unlike curb and gutter systems, which move stormwater with virtually no treatment, open vegetated swales remove pollutants by allowing infiltration and filtering to occur. (Better Site Design, CWP)
- Open swales also encourage groundwater recharge, and can reduce the volume of stormwater runoff generated from a site. (Better Site Design, CWP).
- Compared to roadside ditches, vegetated swales have a wider bottom, gentler slopes, and denser vegetation. They are designed to detain stormwater flows for ten to twenty minutes to allow sediment and heavy particles to filter out. Vegetated swales are relatively easy to construct and maintain. If applied under the right conditions, and installed properly, grass channels experience few of the nuisance problems associated with roadside ditches. . (NIPC, 2003)
- It should be noted that the feasibility of using swales at a development site is determined by a number of factors, including drainage area, slope, length, housing density, and street type. In general, open channel

systems are most appropriate for smaller drainage areas, mildly sloping topography, and housing density less than four dwelling units per acre. (NIPC, 2003)

Walkways

For conservation design, the preferred approach is to mandate 'walkways' within developments. These walkways can take various forms, from traditional sidewalks to rustic trails, depending on the nature of the development (Countryside Program, 3C).

- Establish flexible design standards for walkways.
- Materials also may be varied; for an informal walkway system, materials such as gravel, mulch, wood chips, or grass clippings can effectively replace asphalt or concrete.
- A trail system can be designed to take advantage of contiguous open space on other development sites, connecting through multiple sites for a communitywide trail network, where ownership arrangements and easements permit (Countryside Program, 3C).
- Municipalities should ensure that work crews and winter snow piling activities do not block local trails and connector walking lanes.

Driveway Design

Update bylaws to eliminate length and width requirements for driveways and to permit alternative driveway surfaces and shared driveways that connect two or more homes together.

Benefits

- Driveway lengths and widths are naturally shortened and narrowed in conservation design.
- Homes are located closer together and closer to roads and streets.
- Shared residential driveways can serve 2-5 housing units.
- While permeable paving blocks are only sometimes appropriate for parking areas and public roadways, they are nearly always appropriate for driveways.
- Allow the use of permeable pavers, gravel, or other pervious surfaces for driveways in conservation subdivisions.

Pedestrian Access Lanes

Pedestrians are at risk of being injured if they have to walk "through" a parking lot to get to a building.

Commercial and public building design and development should be required to incorporate designated pedestrian access lanes from the street or roadway to one of the main entrances of the buildings.

Parking lots are almost always designed specifically for cars. Signage, traffic flows and entrances are designed to create ease of access for cars but their design often lacks safe pedestrian access lanes.

Pedestrians are at risk of injury in parking lots if:

- They are elderly and sometimes move slowly.
- They have young children with them.
- They are visually or hearing impaired.
- The pavement is covered in ice.
- The parking lot was designed only for vehicle traffic.
- There is no designated pedestrian lane from the street to the door of the building.
- There is no pedestrian crossing signage.
- Curbs are not blended.
- Pedestrian lanes and walkways are obstructed with snow and or debris.

Pedestrian Access Lanes Features

- Municipalities and building owners need to ensure that pedestrians can travel safely.
- Ensure visible and appropriate signage is in place to let motorists know that the pedestrian has priority.
- Placing a speed bump before a pedestrian crossing helps with traffic calming.
- Use textured surface covers for pedestrian lanes.
- Incorporate blended curbs for safe access from varying grades and elevations.
- Ensure audible crosswalk signals and written brail is available at all pedestrian crossings.
- Highlighting steps and crossing lanes with bright yellow paint assists with visibility of the crossing.
- Ensure that timing for crossing signals allow enough time for seniors and physically challenged citizens to cross safely.

Audible Pedestrian Signals

- People with vision loss rely on the parallel traffic to determine when it's safe to cross at a controlled intersection.
- When they arrive at the corner, they listen to the traffic and when the parallel traffic starts going, they cross in the same direction.
- Certain intersections are very complex and it's very difficult to determine when it's safe to cross. That is when an audible pedestrian signal is required to better and safely determine when it is safe to cross. (CNIB).

D. Implementing Sustainable Stormwater Management Techniques

Sustainable stormwater management techniques can decrease flooding, improve water quality, decrease erosion and sedimentation, and improve groundwater recharge.

- Stormwater runoff has been traditionally treated as a by-product of development to be disposed of as quickly and efficiently as possible. The result often has been increased flooding, degradation of water quality, soil erosion and sedimentation, and reduced groundwater recharge.
- Developments with improved stormwater management facilities can be more marketable because they provide aesthetic features such as rain gardens, wet detention basins, and natural drainage areas that attract wildlife.
- Can Increase marketability - developments with improved stormwater management facilities can be more marketable because they provide aesthetic features such as rain gardens, wet detention basins, and natural drainage areas that attract wildlife.
- Stormwater management benefits cross the various principles and practices and site specific cases.
- Require or encourage alternative roof runoff management techniques.
- Encourage green roof designs and manage rooftop runoff on site through rain gardens, bioretention ponds, rain water collection etc...
- Redirecting rooftop runoff is a significant measure for reducing downstream impacts and can decrease annual runoff volumes by as much as 50% for medium and low density land uses.
- It also can significantly reduce the annual pollutant load and is aesthetically and socially beneficial.

Dry Wells

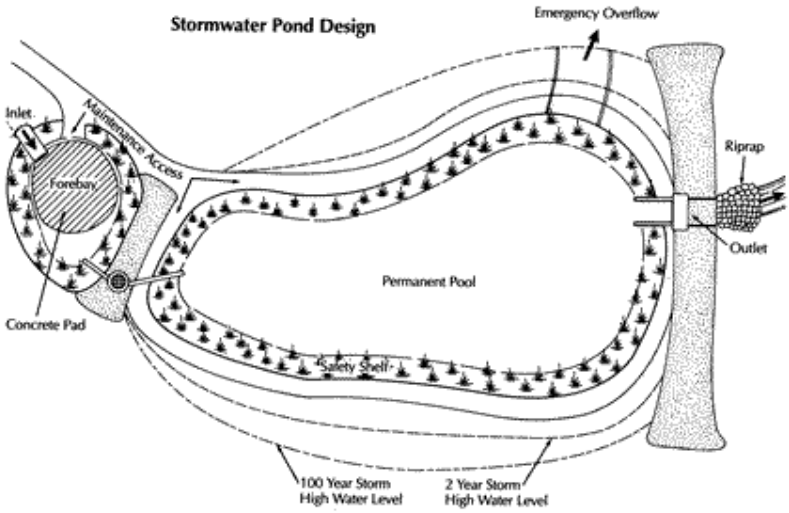
The practice of dry well is when rooftop runoff is directed to underground rock-filled trenches or pits known as dry wells. French drains or Dutch drains also can be used for this purpose. Deep dry wells often have a long trench with a perforated pipe within the gravel bed to distribute flow throughout the length of the trench to the dry well pit.

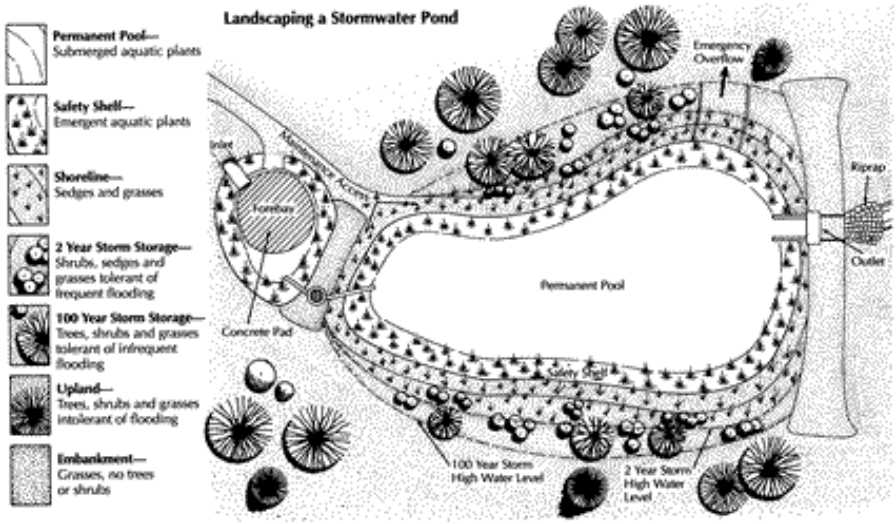
- Runoff can be diverted to a pervious area or to a treatment area using site grading, channels, and berms.
- Treatment options can include **grassed swales, bioretention**, or **filter strips**. Alternatively, rooftop runoff can simply be diverted to pervious lawn areas, as opposed to flowing directly to the street, and thus the storm drain system.
- Practices that store rooftop runoff, such as cisterns and rain barrels, are the simplest in design of all rooftop runoff treatment systems. Some of these practices are available commercially and can be applied in a wide variety of site conditions (*Center for Watershed Protection*, www.cwp.org).
- Locate infiltration areas sufficiently far from house foundations to prevent undermining the foundation or seepage into basements. These practices should be separated at least ten feet from the house to prevent these problems.

Vegetated/ Green Roof Covers

Green roofs or vegetated roof and extensive roof gardens, involve blanketing roofs with a veneer of living vegetation. These systems can reduce roof runoff as well as provide an aesthetic benefit to homeowners and communities.

Storm Water Ponds





Courtesy of: http://clean-water.uwex.edu/pubs/clipart/mhy.4.htm

Savings attributed to installing Low Impact Development stormwater controls in residential developments

Location	Description	LID Cost Savings[a]
Meadow on the Hylebos Residential Subdivision Pierce County, WA	9-acre development reduced street width, added swale drainage system, rain gardens, and a sloped bio-terrace to slowly release stormwater to a creek. Stormwater pond reduced by 2/3, compared to conventional plan. (Zickler 2004)	LID cost 9% less than conventional
Somerset Community Residential Subdivision Prince George's Co., MD	80-acre development included rain gardens on each lot and a swale drainage system. Eliminated a stormwater pond and gained six extra lots. (NAHB Research Center Inc. 2003)	$916,382 $4,604 per lot
Pembroke Woods Residential Subdivision Frederick County, MD	43-acre, 70-lot development reduced street width, eliminated sidewalks, curb and gutter, and 2 stormwater ponds, and added swale drainage system, natural buffers, and filter strips. (Clar 2004; Lehner et al. 2001)	$420,000 $6,000 per lot[b]
Madera Community Residential Subdivision Gainesville, FL	44-acre, 80-lot development used natural drainage depressions in forested areas for infiltration instead of new stormwater ponds. (PATH 2005)	$40,000 $500 per lot[b]
Prairie Crossing Residential Subdivision Grayslake, IL	667-acre, 362-lot development clustered houses reducing infrastructure needs, and eliminated the need for a conventional stormwater system by building a natural drainage system using swales, constructed wetlands, and a central lake. (Lehner et al. 2001; Conservation Research Institute 2005)	$1,375,000-$2,700,000 $3,798-$7,458 per lot[b]
SEA Street Retrofit Residential street retrofit Seattle, WA	1-block retrofit narrowed street width, installed swales and rain gardens. (Tilley 2003)	$40,000
Gap Creek Residential Subdivision Sherwood, AK	130-acre, 72-lot development reduced street width, and preserved natural topography and drainage networks. (U.S. EPA 2005; Lehner et al. 2001; NAHB Research Center Inc. 2003)	$200,021 $4,819 per lot
Poplar Street Apartments Residential complex Aberdeen, NC	270-unit apartment complex eliminated curb and gutter stormwater system, replacing it with bioretention areas and swales. (U.S. EPA 2005)	$175,000
Kensington Estates* Residential Subdivision Pierce County, WA	24-acre, 103-lot hypothetical development reduced street width, used porous pavement, vegetated depressions on each lot, reduced stormwater pond size. (CH2MHill 2001; U.S. EPA 2005)	$86,800 $843 per lot[b]
Garden Valley* Residential Subdivision Pierce County, WA	10-acre, 34-lot hypothetical development reduced street width, used porous paving techniques, added swales between lots, and a central infiltration depression. (CH2MHill 2001)	$60,000 $1,765 per lot[b]
Circle C Ranch Residential Subdivision Austin, TX	Development employed filter strips and bioretention strips to slow and filter runoff before it reached a natural stream. (EPA 2005)	$185,000 $1,250 per lot

Savings attributed to installing Low Impact Development or Conservation Design stormwater controls in residential developments cont...

Location	Description	LID Cost Savings[a]
Woodland Reserve* Residential Development Lexana, KS	Reduced land clearing, reduced impervious surfaces, and added native plantings. (Beezhold 2006)	$118,420
The Trails* Multi-Family Residential Lexana, KS	Reduced land clearing, reduced impervious surfaces, and added native plantings. (Beezhold 2006)	$89,043
Medium Density Residential* Stafford County, VA	45-acre, 108-lot clustered development, reduced curb and gutter, storm sewer, paving, and stormwater pond size. (Center for Watershed Protection 1998b)	$300,547 $2,783 per lot[b]
Low Density Residential* Wicomico County, MD	24-acre, 8-lot development eliminated curb and gutter, reduced paving, storm drain, and reforestation needs. Eliminated stormwater pond and replaced with bioretention and bioswales. (Center for Watershed Protection 1998b)	$17,123 $2,140 per lot[b]

Source: ECONorthwest, with data from listed sources.
Notes: * indicates hypothetical or modeled project, not actually constructed.
[a] Dollar amounts as reported at the time of study.
[b] Per-lot cost savings calculated by ECONorthwest.

Gallons of Stormwater Managed per $1,000 Invested

Stormwater Control	Gallons per $1,000 Invested
Conventional Storage Tanks	2,400
Greenstreet	14,800
Street Trees	13,170
Greenroof	810
Rain Barrel	9,000

Source: Plumb and Seggos 2007

ECONorthwest: The Economics of Low Impact Development

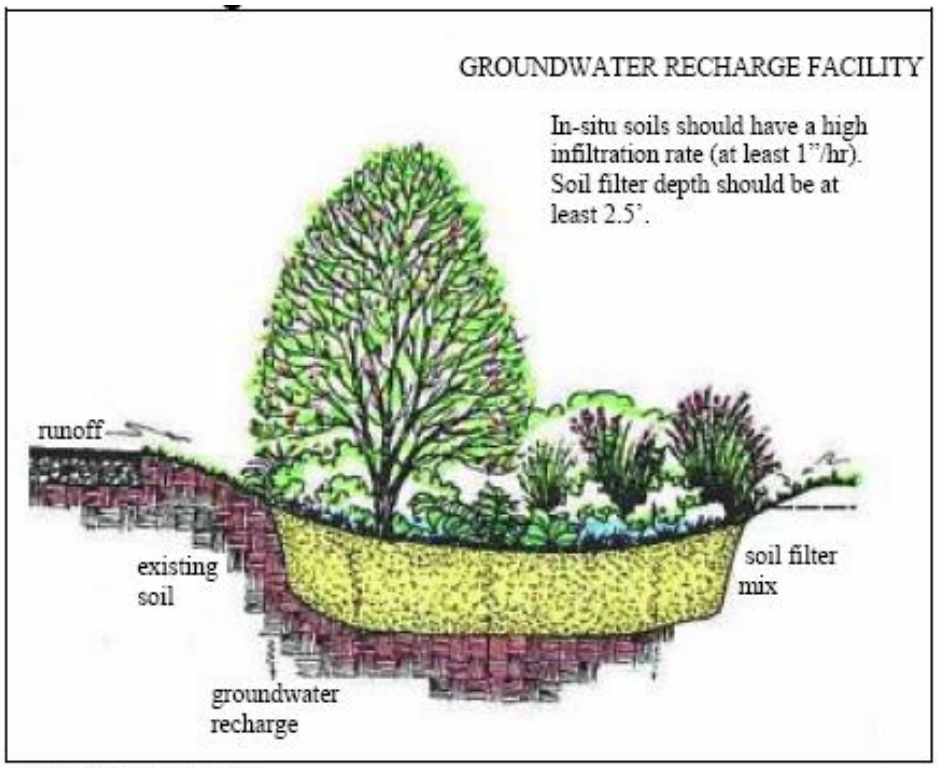
Cost savings attributed to installing LID stormwater controls in commercial developments.

Location	Description	LID Cost Savings[a]
Parking Lot Retrofit Largo, MD	One-half acre of impervious surface. Stormwater directed to central bioretention island. (U.S. EPA 2005)	$10,500-$15,000
Old Farm Shopping Center* Frederick, MD	9.3-acre site redesigned to reduce impervious surfaces, added bioretention islands, filter strips, and infiltration trenches. (Zielinski 2000)	$36,230 $3,986 per acre[b]
270 Corporate Office Park* Germantown, MD	12.8-acre site redesigned to eliminate pipe and pond stormwater system, reduce impervious surface, added bioretention islands, swales, and grid pavers. (Zielinski 2000)	$27,900 $2,180 per acre[b]
OMSI Parking Lot Portland, OR	6-acre parking lot incorporated bioswales into the design, and reduced piping and catch basin infrastructure. (Liptan and Brown 1996)	$78,000 $13,000 per acre[b]
Light Industrial Parking Lot* Portland, OR	2-acre site incorporated bioswales into the design, and reduced piping and catch basin infrastructure. (Liptan and Brown 1996)	$11,247 $5,623 per acre[b]
Point West Shopping Center* Lexana, KS	Reduced curb and gutter, reduced storm sewer and inlets, reduced grading, and reduced land cost used porous pavers, added bioretention cells, and native plantings. (Beezhold 2006)	$168,898
Office Warehouse* Lexana, KS	Reduced impervious surfaces, reduced storm sewer and catch basins, reduced land cost, added bioswales and native plantings. (Beezhold 2006)	$317,483
Retail Shopping Center*	9-acre shopping development reduced parking lot area, added porous pavers, clustered retail spaces, added infiltration trench, bioretention and a sand filter, reduced curb and gutter and stormwater system, and eliminated infiltration basin. (Center for Watershed Protection 1998b)	$36,182 $4,020 per acre[b]
Commercial Office Park*	13-acre development reduced impervious surfaces, reduced stormwater ponds and added bioretention and swales. (Center for Watershed Protection 1998b)	$160,468 $12,344 per acre[b]
Tellabs Corporate Campus Naperville, IL	55-acre site developed into office space minimized site grading and preserved natural topography, eliminated storm sewer pipe and added bioswales. (Conservation Research Institute 2005)	$564,473 $10,263 per acre[b]
Vancouver Island Technology Park Redevelopment Saanich, British Columbia	Constructed wetlands, grassy swales and open channels, rather than piping to control stormwater. Also used amended soils, native plantings, shallow stormwater ponds within forested areas, and permeable surfaces on parking lots. (Tilley 2003)	$530,000

Source: ECONorthwest, with data from listed sources.
Notes: * indicates hypothetical or modeled project, not actually constructed.
[a] Dollar amounts as reported at the time of study.
[b] Per-acre cost savings calculated by ECONorthwest.

Bioretention Ponds

Definition: *An engineered process to manage stormwater runoff, using the chemical, biological and physical properties afforded by a natural, terrestrial-based community of plants, microbes and soil.*



Source: PGDER.

References:
Prince George's County Bioretention Manual, Maryland

Images courtesy Prince George's County, Maryland

Bioretention as a Best Management practice

- The concept of bioretention has the advantage of being on site, minimizing the distance between the source of runoff (e.g. parking lots, roof tops) and the site of control (e.g. rain garden), unlike end-of-pipe storm water management practices.
- Besides controlling water quantity, bioretention facilities can improve the quality of stormwater runoff prior to discharge to streams or recharging of ground water.
- Bioretention provides two important functions: water quantity and flood control and improve water quality through removal of pollutants and nutrients associated with runoff.

What is a Rain Garden?

http://www.raingardennetwork.com/rgphotosE5.htm

A Rain Garden is a garden that takes advantage of rainfall and stormwater runoff. The design of a rainwater garden and the plants selected are designed to withstand extremes of both moisture and higher than normal concentrations of nutrients which are often found in stormwater runoff.

Rain gardens are placed close to the source of the runoff and help slowdown the stormwater as it runs downhill giving more time for it to be filtered and loose some of its erosive power.

http://www.lowimpactdevelopment.org/raingarden_design/whatisaraingarden.htm

- On the surface, rain garden looks like a conventional garden. It may support habitat for birds and butterflies and it may be a formal landscape feature. Many riparian zone plant species are well suited to rain gardens.
- Most rain gardens are planted with perennials, woody shrubs or trees.

The garden is actually a small bioretention cell in which stormwater is cleaned and reduced in volume once it enters the rain garden. Nutrient and sediment levels in the stormwater are reduced by the action of the plants and growing soil.

- Multiple rain gardens over an area will have a positive cumulative effect on both the volume and quality of stormwater runoff.
- There are two basic types of rain gardens- under-drained and self-contained. Both types of rain gardens improve stormwater quality, reduce runoff volumes and generally facilitate infiltration. Which type of garden is selected to be built is decided by the volume of water to be treated, existing soil conditions, available space, and budget for the project.
- In some cases where infiltration is not desired, the underdrain system can move excess water into a conventional storm sewer pipe system such as in areas where the bottom of the garden has less than 4' of clearance to the seasonal mean high water table.
- Rain gardens are designed to be drained within four hours after a 1" rain event.
- Under-drained rain gardens are designed to drain within 2 hours of the storm event
- Porous planting media and underdrains carry cleaned rainwater away from the garden.
- Plants used need to be able to withstand both the extremes of flooding and drought.
- Rain gardens with no underdrain hold moisture longer.
- Plants should be able to tolerate inundation for a more extended period of time.
- Soils are amended with a very porous planting media, minimally to a depth of 8" and ideally to a depth of 2'- 3'.
- Plants on the upper edges of the garden will need to be ones that require less water than the plants in the lower areas.
- A liner may or may not be used, depending on the local conditions.
- Start with healthy and smaller, rather than larger, plants.

Building a rain garden (or a couple of rain gardens) in your own yard is probably the easiest and most cost efficient thing you can do to reduce your contribution to stormwater pollution. By capturing rainwater from your roof, driveway and sidewalks and diverting it into a great looking rain garden where it can slowly soak into the ground, filter contaminants and keep quantities of clean water from going down the sewer system you'll have a great looking garden that puts water in its place.

- Rain gardens can absorb runoff more efficiently - as much as 30% - 40% more than a standard lawn. By capturing rainwater in a rain garden, holding it and then slowly releasing it into the soil the rush of a large storm can be slowed and cleaned – quickly, neatly and naturally.
- Because rain gardens are dug 4" to 8" deep, and in some cases 1' - 2' deep, they hold larger quantities of rainwater making their overall construction more cost efficient then other green alternatives.
- Rain gardens also need less technical experience to install and can be installed without permits or heavy equipment.

Rain gardens are one very good option that helps to lower the impact of impervious surfaces and polluted runoff because they are low-tech, inexpensive, sustainable and beautiful. *(The Rain Garden Network http://www.raingardennetwork.com).*

Rain Water Harvesting

Many Municipalities and homeowners are facing shortages of fresh water for drinking water. As the impacts of an ever warming world continue to be felt, impacts from climate change on our fresh water resources will require that we "think outside the box' and look for alternative sources of both non potable and potable water supplies both for human needs and for agricultural use.

Rain Water harvesting and the use of both above ground and below ground rain water collectors and cisterns, is an ancient water system and was the first type of municipal water collection and supply used in the world.

- Archaeological evidence supports the capture of rain water as far back as 4000 years ago and cisterns built as early as 2000 BC are still standing in Israel and Jordan.
- Ancient underground cisterns are still being discovered today that contain pure fresh water that has not been exposed to light or air pollutants for thousands of years.

Today, rainwater harvesting is popular in many parts of the world and is quickly becoming a necessity due to reductions in global fresh water resources.

- A rainwater harvesting system functions in many ways, but mainly to catch rainwater from the roof and gutters, transport it through the downspouts and piping, remove debris and clean and store it for its intended use.
- A rainwater collection and storage system can be as simple as capturing rain in a barrel for gardening or complex enough to require the expertise of an architect, engineer, rainwater specialist and filtration and water treatment specialist.

Rainwater and snowmelt are the primary sources for all fresh water on the planet. The practice of collecting runoff from rainfall events can be classified into two broad categories: **land-based and roof-based.**

- Land-based rainwater harvesting occurs when runoff from land surfaces is collected in dikes, ponds, tanks and reservoirs.
- Roof-based rainwater harvesting occurs when rainwater runoff is collected from roof surfaces.
- Roof-based rainwater harvesting results in a much cleaner source of water and provides water that can be used both for landscape watering and for indoor purposes.
- There are many examples of rainwater harvesting systems being used in residential, commercial and industrial applications (TWDB, 2005).
- Public facilities, such as schools and community centers have started harvesting rainwater to conserve water supplies.
- The Cities of Austin, Portland, Oregon, and the State of Washington have developed guidelines for designing and installing rainwater harvesting systems and are encouraging the use of rainwater as a supplemental source of water for residential and other applications.
- Tucson, Arizona, has instituted requirements for rainwater harvesting in its land use code to provide supplemental water for on-site irrigation as well as for floodplain and erosion control.
- Several Canadian universities have also installed rain water collection systems on the roof of buildings for their washrooms and non drinking uses.

There are numerous potential benefits and advantages from rainwater harvesting (Krishna, 2003). Rainwater harvesting systems can:

- provide a source of free water;
- provide water if there is no other source of water;
- augment or replace limited quantities of groundwater;
- provide good-quality water if groundwater quality is unacceptable;
- provide water if tap charges are too high for water supply connection;
- reduce storm water runoff and reduce non-point source pollution;
- reduce erosion in urban environments;
- provide water that is naturally soft (no need for water softeners);
- provide water that is pH neutral/slightly acidic;
- provide water that is sodium-free, important for those on low-sodium diets;
- provide good quality water for landscape irrigation;
- provide water for non-potable indoor uses;
- provide safe water for human consumption, after appropriate treatment;
- help utilities in reducing peak demands in the summer;
- help utilities in delaying the expansion of water treatment plants;
- provide water for cooling and air-conditioning plants;
- reduce the demands on groundwater;
- provide water for fire protection; and
- save money for the consumer in utility bills.
- Use of rainwater can be valuable for the hotel industry, helping them reduce their use of municipal water supplies and the amount of detergents used for their daily laundry.

There is a significant untapped potential to generate additional water supplies through rainwater harvesting, particularly in urban and suburban areas. Governments could consider expanding their role in promoting rainwater harvesting by:

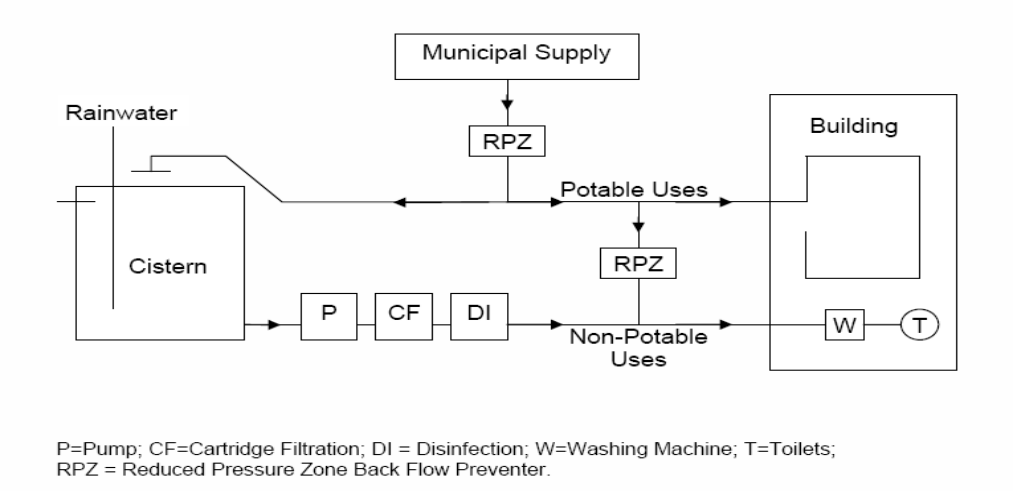
- Directing new government facilities with 10,000 square feet or greater in roof area (and smaller facilities, when feasible) to incorporate rain water collection into the building design.

- Harvested rainwater at these locations may be used for restroom facilities, landscape watering and cleaning.

- Developing incentive programs to encourage the incorporation of rainwater harvesting systems into the design and construction of new and existing residential, commercial, and industrial facilities.

- Provide funding or matching grants for rainwater harvesting demonstration projects.

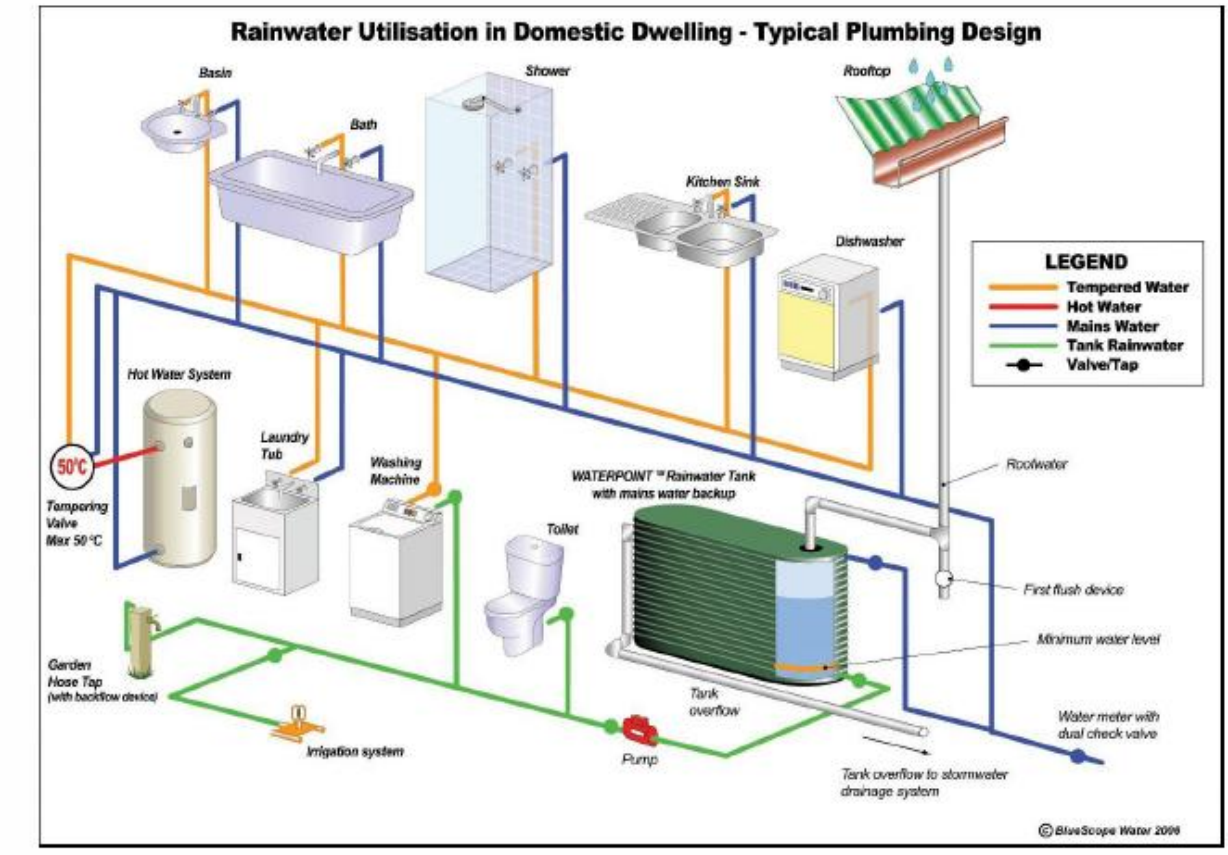
Municipal Rain Water Collection Systems



P=Pump; CF=Cartridge Filtration; DI = Disinfection; W=Washing Machine; T=Toilets;
RPZ = Reduced Pressure Zone Back Flow Preventer.

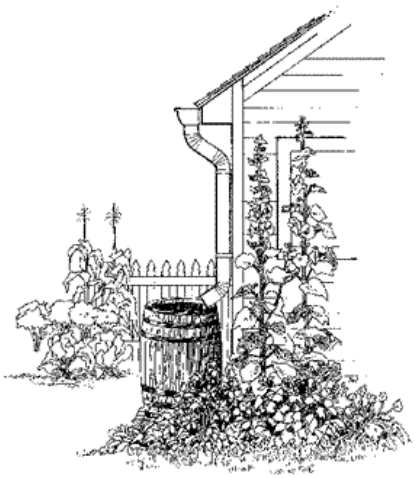
A schematic showing the conjunctive use of public water systems for potable uses, and rainwater for non-potable uses (washing machines and toilets). Texas Water Development Board : http://www.twdb.state.tx.us/iwt/rainwater.asp

Residential Rain Water Collection System



An example of a dual plumbing system used in Australia,
Texas Water Development Board : http://www.twdb.state.tx.us/iwt/rainwater.asp

Examples of Backyard Rain Water Collectors for Outdoor Water Use



Bathurst Sustainable Development Rain Barrel Project

Rainwater is a renewable, sustainable and a high quality water source for your outdoor water use at your home, cottage, park and gardens. You can establish a series of rain barrels interconnected with over flow tubes to capture more rain water. The barrels can also be elevated to allow for gravity feeding of the water from the rain barrel location to your garden area. Bathurst Sustainable Development provides information and training to homeowners on how to make and use rain barrels.

Community Garden Rain Water Collector
Victoria Park Community Garden, Bathurst, NB

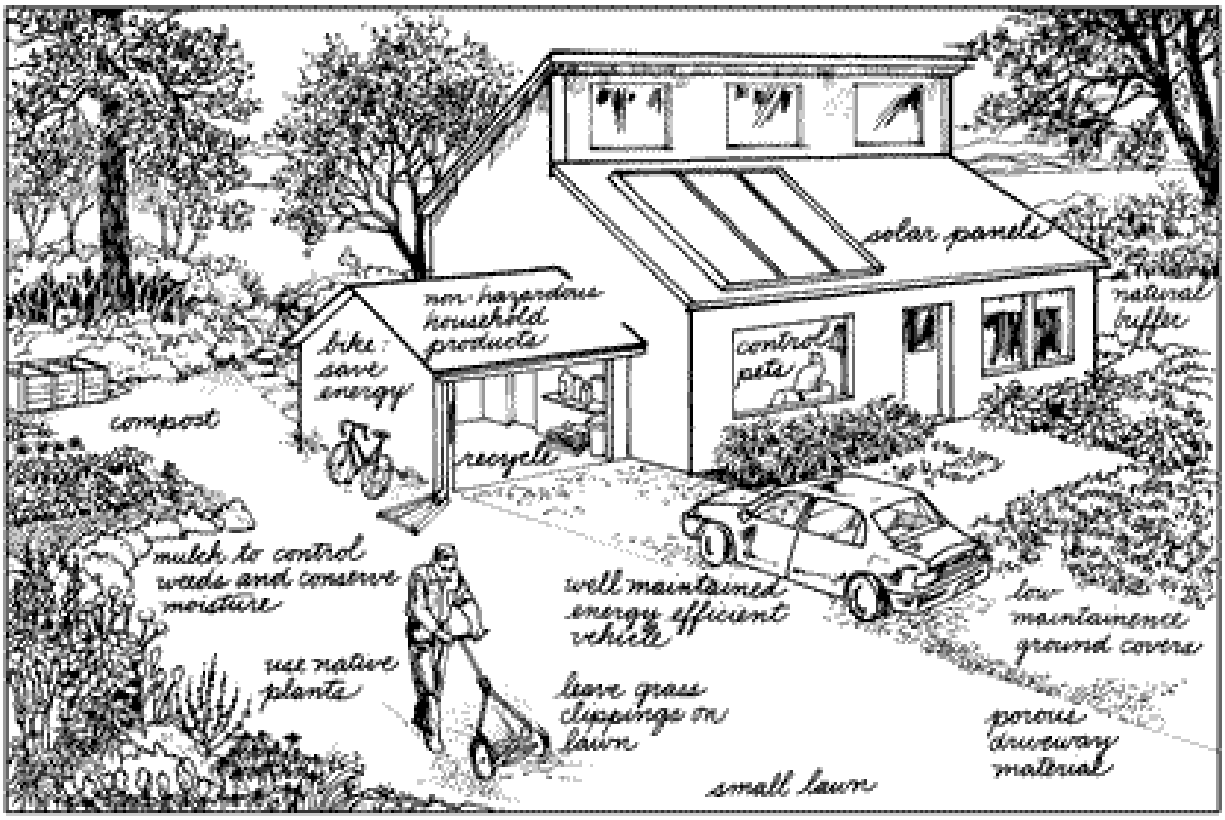
Bathurst Sustainable Development and Bathurst Community Gardens Program

This 1000 litre above ground cistern/ tote is part of a newly constructed rain water collection system for our community garden. It has been built with the kind support of the Royal Bank Blue Water Program, Xstrata Zinc Inc. and the City of Bathurst. Its purpose is to supply daily rain water to be used to irrigate plants and wash off garden tools in the community garden located in Victoria Park.

- **All parks and community gardens could construct rain water systems as a source of water for irrigation of plants and trees instead of using potable Municipal drinking water supplies.**

- **Please cover your rain barrels and collectors with either a cover or a screen to prevent small animals from getting injured and also to prevent misquotes from laying their eggs.**

"I Spy" Sustainable Living and Conservation Design Features



This home and owner are practicing sustainable conservation in the following ways:

House as south roof orientation to allow for solar panels
Porous driveway materials
Natural plants for landscaping
High level of biodiversity
Maintaining natural buffers
No toxic cleaning products used indoors
Windows allow solar passive heating
Garden provides family with locally grown food
Natural cooling in summer from shade
Building materials are all non hazardous

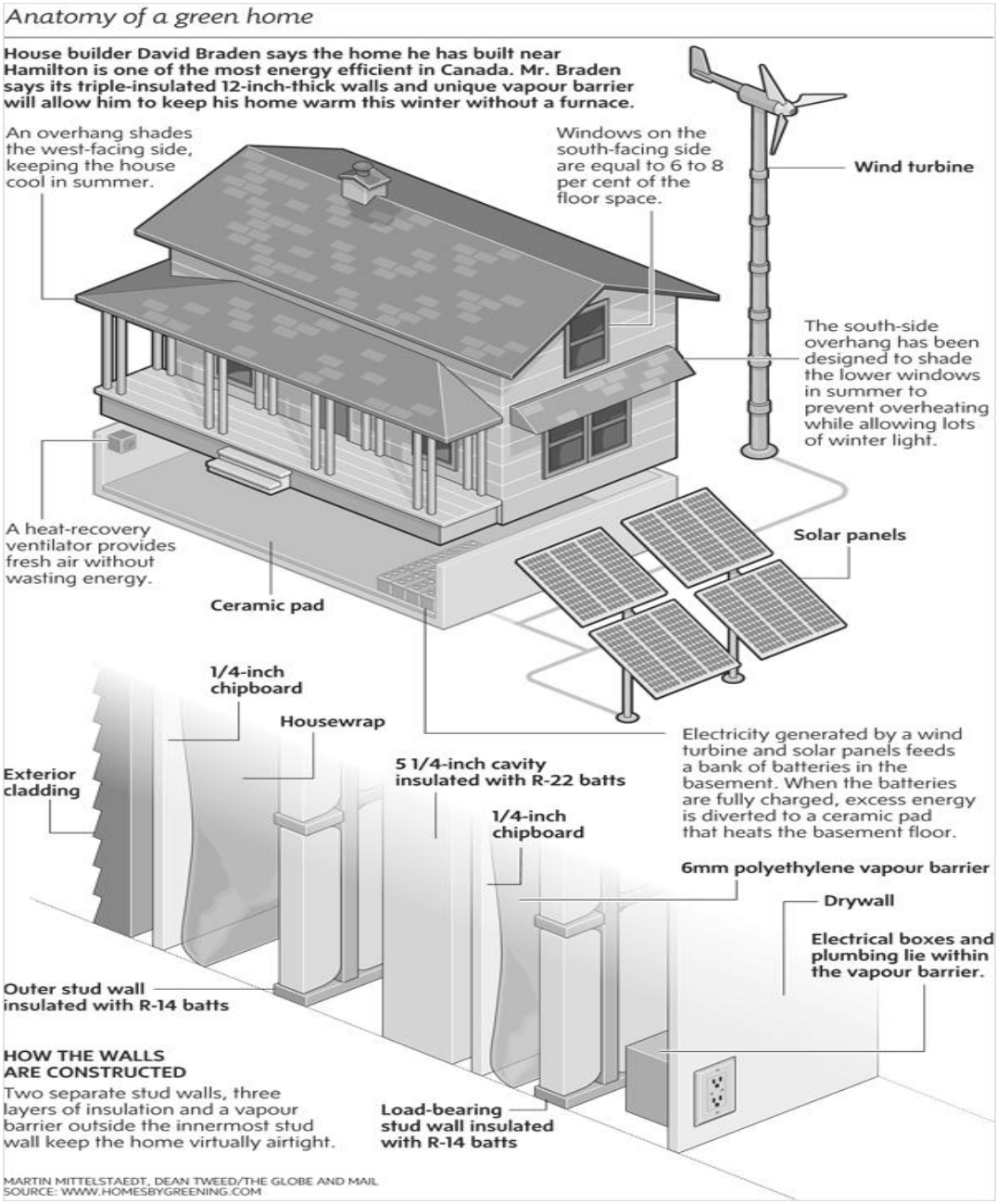
Participating in Composting
Energy Efficient Vehicle
Bike for alternative transportation
Mulches grass and leaf clippings
No pesticides being used outdoors
Mature trees and small Lawn
Using a push lawn mower
Pet waste is being controlled
Low maintenance ground covers
Roof is covered in solar shingles

Benefits:

Less exposure to toxins indoor and outdoor
Lower energy costs and GHG Emissions
Property has a much higher biodiversity value
Rain water is able to recharge aquifers underground
Composting replenishes soil nutrients

Property has lower ecological footprint
Mature Trees help capture carbon
Improved indoor air quality
Lower transportation emissions
Less water is wasted

Elements of Green Home Construction



From the Globe and Mail Newspaper, 2008

Zoning By-Laws and Planning

- Ensure that conservation design is encouraged under the Municipal by-laws and plans.
- Zoning by-laws and Municipal Plans must be reviewed and updated to allow conservation design.
- Update the zoning by-laws and Municipal plans to create a level 'playing field,' where conservation design enjoys regulatory support equivalent to conventional development.
- The goal is for the conservation design option to be selected over the standard subdivision option.

Examples of how to include conservation design and examples of actual by-laws and their language are available from the "Northeasten Illinois Planning Commission" and "Chicago Wilderness Conservation Design Resource Manual Language and Guidelines for Updating Local Ordinances: *A planning tool from the Northeastern Illinois Planning Commission and Chicago Wilderness*, March 2003".

Whatever decision is made regarding conservation zoning, some combination of the conservation design practices is appropriate for all types of development. All of the practices should be encouraged or required where appropriate. As each community reviews its by-laws and Municipal Plans, many conservation design practices could be enacted for all development, regardless of zoning classification.

Maintenance of Conservation Design Sites

- Once a conservation design development is built, the open space and natural drainage systems in place need to be maintained. Conservation design developments use a variety of solutions to accomplish this.
- The most common solution in subdivisions for example is establishing home owner's association fees, used to hire a contractor to maintain the open space and native landscaping.
- Developments could also partner with forest preserves, park districts and land trusts.
- The goal is to establish a long-term arrangement to care for the open space. It can take years before the native plants are established so maintenance is very important to the success of the open space.
- On a smaller scale, such as with commercial spaces, usually Conservation design techniques including native landscaping are less expensive and require less frequent maintenance. In one study the annual maintenance cost of open space with natural landscaping was $75 per acre compared to a typical lawn maintenance that was about $225 per acre. In the middle is passive recreation (trails, bike paths) with a cost of about $200 per acre (NIPC, 2003).

Adopt a Spot Program: Establishing an "Adopt a Spot" neighbourhood program or in partnership with local community groups is another option for maintenance.

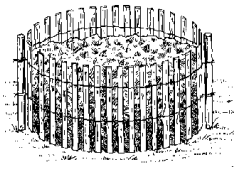
Waste Reduction

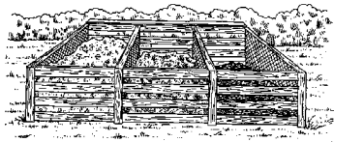
Composting uses natures own recycling system. Weeds and leaves, grass clippings, vegetable peels, and various other organic wastes are turned into humus. That's an essential soil conditioner richer than anything we can buy. Why throw away the raw material which generates something so valuable?

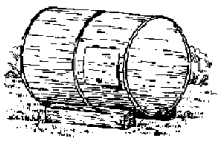
Multi-unit, commercial and intuitional developments can either have large scale commercial composters for municipal pick up in communities with a full composting program, individual facility bins such as an **Earth Tub™** or a community backyard composting program for tenants. Tenant with yards and garden plots can then manage and use the compost to enrich the soil around trees and in garden beds.

Composting has other benefits as well.

- ✓ Up to 30% of the garbage we throw out each week can go in the compost pile.
- ✓ Cutting domestic waste generation means a longer life for landfill sites and better environmental management for the entire community.
- ✓ It gradually releases a variety of nutrients just when they're required by the growing plants.
- ✓ Plenty of compost added to the soil will also act like a sponge, soaking up water when it rains and releasing it in dry spells.
- ✓ It improves the structure of both sand and clay soils, protecting them against drought and erosion.







All apartment buildings, school and institutional buildings should have onsite recycling and composting containers or municipal sorting bins nearby.

Apartment tenants throw out an astonishing 81 per cent of all materials that could be recycled (CBC 2007).

Landlords can set up composting bins outside and recycling sorting areas either outside or inside in common areas and should work in partnership with their tenants, local solid waste commissions, Municipalities and environmental organizations on developing the program, facilities and types of composting bin options.

Earth Tub™ Green Mountain Technologies: http://www.compostingtechnology.com/

Edible Landscaping and Urban Agriculture

Edible Landscapes refer to producing food in urban areas and through landscape design. Either on your own lot, in a nearby community garden or in cooperation with your local government and community organizations replacing asphalt and turf grass with varieties trees, bushes, vines, plants, and flowers that produce sources of fruits and vegetables not only helps provide fresh sources of food but also increase our own sustainability, self sufficiency, assists with cooling and increases biodiversity in urban centers.

- Replacing conventional landscaping (turf grass) with natural landscaping reduces greenhouses gases by requiring 90% less maintenance (Illinois Green Government Coordinating Council).

Research shows that there are many benefits to "edible landscaping" or "urban agriculture" including that many cities are actively engaged in urban agriculture.

Growing one's own food has physical, social, economic and health benefits not only for the gardeners but it also has spinoff benefits for the entire neighborhood.

- Research shows that housing resale prices are often higher when they are either near a community garden or green spaces or when the property has mature and well maintained edible landscaping on the property.
- Edible landscaping and community gardens also help to reduce the costs associated with food.
- Instead of planting conventional grass and or laying turf, plant edible landscaping species of plants, trees and shrubs.
- Edible landscapes can be just as attractive, yet produce fruits and vegetables for home use...
- The production of locally grown food supplies helps reduce both the cost of food and shortages of fresh food products for many families while increasing biodiversity and habitat areas.

Small Lot Size or Patio? Think up!

Food crops also growing vertically and organically!



For a Complete Edible Landscaping Plant List visit: The National Gardening Association- Edible Landscape Resource Guide, http://www.kidsgardening.com/Dig/digdetail.taf?Type=Art&id=2147

Bathurst Community Garden Program, *www.bathurstsustainabledevelopment.com*

Urban Farming: *http://www.urbanfarming.org-* Vertical Gardening

Climate Change

Climate Change is the most critical threat to our ability to continue to support all life on this planet. The massive release of carbon dioxide into our atmosphere created by the burning of fossil fuels is adversely affecting our planets surfaces, such as snow/ ice levels, melting of permafrost, water levels, ocean temperatures, habitats, increased coastal flooding, coastal erosion, loss of food supplies for species and **the** destruction of both wetlands and agricultural lands. In addition to the structural changes of surface covers, the warming of the planet is also increasing risk to human health and entire communities through loss of homes and lively hoods in addition to the increase in exposure to air quality contaminates.

As the earth's oceans continue to warm, coupled with the gorging of melting glaciers the reduction in sea ice is increasing the impact on the Atlantic Ocean as well as resulting in a slowing of the North Atlantic current. Warmer ocean temperatures contribute to increased intensity of global storms causing risk and damage to coastal communities resulting in huge financial cost from property and infrastructure damage.

As the world now begins its journey to transfer from fossil fuel dependency through a global energy revolution to a low carbon or carbon neutral world, the economic opportunities to take advantage of this energy revolution are vast and improvements in the protection of our life support systems will be the greatest benefit from our efforts.

For more information on Climate change, for ideas on how you can help, for a list of our upcoming our events and activities, to volunteer or to schedule a presentation contact Bathurst Sustainable Development at **www.bathurstsustainabledevelopment.com** or visit us at our Climate Change Action center at 237 Main Street, Bathurst, NB Telephone (506) 548-2106 or **rosewood@nbnet.nb.ca.**

NB Climate Change Action Plan

The New Brunswick Climate Change Action Plan is an important step to address the many broad and interrelated aspects of climate change in this province. It is an ambitious plan that outlines our collective vision for reducing provincial greenhouse gas emissions and managing our adaptation to climate change impacts through a series of targets and policy actions as well as engagement of stakeholders and the public. In these ways, this plan charts our path to sustainability in a changing climate.

New Brunswick-led initiatives will result in greenhouse gas emission reductions of 5.5 megatonnes (millions of tonnes, Mt) annually in 2012. The plan includes actions in the following areas: Renewable Energy and Energy Efficiency; Transportation; Waste Reduction and Diversion; Industrial Sources; Government Leading by Example; Adaptation; and Partnerships and Communication.

With the assistance of federal initiatives, this plan will result in a reduction of New Brunswick's greenhouse gas emissions to 1990 levels in 2012 and position our province to realize further reductions of 10% below 1990 levels by 2020. Encouraging sustainable community design, energy efficiency and renewable energy in all current and future housing developments will help New Brunswick and Canada reach their GHG emissions reduction targets.

The full action plan is available at: *http://www.gnb.ca/0009/0369/0015/0002-e.asp*. For more information about climate change you can contact either the **New Brunswick Climate Change Secretariat, at the Department of Environment**, www.gnb.ca, and keyword: environment, or visit **Bathurst Sustainable Development** *at* ***www.bathurstsustainabledevelopment.com*.**

Energy Consumption

The effects on energy consumption by implementing conservation design can have beneficial results. Conservation design strategies such as maximizing natural areas and minimizing paved areas can lead to a reduction in the overall indoor temperature, lowering cooling costs in the summer.

- Conservation design often results in the preservation of mature trees which, in addition to lowering temperatures in the summer, can act as windbreaks that reduce heating costs in winter.
- The use of sustainable stormwater techniques can reduce stormwater amounts that enter the sewer system which saves energy used for pumping and treating the additional water.
- Conservation design tends to encourage the clustering of dwellings, which has a number of energy benefits. For one, necessary infrastructure is reduced, indirectly reducing the energy consumed in the production of the materials used in that infrastructure, as well as the fuel expended in its construction.
- With clustering, fewer street lamps are required, and the energy necessary to light the community should be reduced.
- Energy normally lost traversing longer lengths of electrical wire, or fuel wasted driving longer distances within a subdivision, can be saved by clustering dwellings together, shortening distances and increasing efficiency (NIPC, 2003).
- Those who build and want to live in conservation design developments tend to be adherents to green design and methods of construction. Often beginning with materials created with less energy than conventional materials, wise green design can yield significant reductions in personal and community energy consumption over the long term.

Efficiency New Brunswick

Efficiency New Brunswick offers sound advice and practical solutions to help New Brunswick citizens use energy more efficiently, make better energy choices, manage energy expenses and lessen the impact of energy use on the environment.

For example: A new program will offer financial incentives to builders of energy-efficient, multi-unit, residential buildings. Efficiency NB's new Multi-Unit Residential Buildings (MURBs) program offers incentives to help with the cost of improved energy efficiency. Whether you want to make your existing home more energy efficient, build an energy efficient new home, build or retrofit a commercial building for improved energy efficiency or build a new multi-unit residential building that is energy efficient, Efficiency NB can help you with advice and financial incentives.

Currently grants and loans exist for energy efficiency improvements for both new and existing residential, commercial and institutional, as well as industrial properties.

Visit either **Bathurst Sustainable Development** *at* ***www.bathurstsustainabledevelopment.com*** or **Efficiency NB** at ***www.efficiencynb.ca*** to obtain information on all Provincial energy efficiency grants and loans, as well as links to information on the additional rebates available through the federal eco-ENERGY program.

Active and Sustainable Transportation

City of Bathurst Bike Rack Program (2008) - Downtown Waterfront
Photo: Bathurst Sustainable Development

Bathurst Sustainable Development and the City of Bathurst are partnering to implement the **Bathurst Bike Rack Program** as part of the City of Bathurst Sustainable Transportation Action Plan (STAP). The high quality racks, placed along transportation, employment and shopping corridors, encourage citizens to cycle more often and also provide the capacity for citizens to participate in cycling by providing safe and secure bicycle parking facilities.

Urban Sprawl

The costs of sprawl and infrastructure are having serious consequences on the limited financial resources, social, environmental and economic well being of Municipalities and its citizens.

- Sprawl increases the burden of road repairs to taxpayers throughout the region.
- Sprawl contributes to tax increases by requiring taxpayers to essentially create additional new roads, schools, and public safety services in rural areas.
- Sprawl burdens taxpayers now and in the future with the cost of aging infrastructure in urban areas.
- Sprawl increases over all transportation and cost of living for citizens living in the community.
- Vast tracts of habitat are lost from the ever expanding roadways.

Huge investments in road expansion projects could be transferred or shared to make real improvements in sustainable modes of transportation including an improved transit service and enhanced active transportation network.

Benefits of Sustainable Transportation

- Ensuring links between land use and transportation are made will require new ways of retrofitting, designing, and building communities.
- Promoting more sustainable forms of development will significantly increase the quality of life in the communities as well as the environment through better air quality and reduced GHG emissions.
- Governments at all levels should support the implementation of public transit; walking and cycling networks;
- Improved and more efficient sustainable transportation services assist in the revitalization of urban neighbourhoods.
- Incorporating such items as public transit, bike racks, bike storage lockers, bus shelters, bike lanes and trails into a subdivision design not only improves quality of life for the residents but also reduces transportation costs, traffic noise and congestion.
- Statistics Canada studies show that youth are particularly attracted to living in communities where public transit is available.
- Access to affordable sustainable transportation options such as cycling and public transit allow citizens to have a greater participation in active living, greater inclusion and ensures social justice and equality.
- Access to affordable sustainable transportation provides security concerning independent living.
- Access to affordable transportation options allows greater participation in the workforce, community events and provides stimulus to local economies by keeping household transportation costs lower which allows citizens to divert their monthly savings to consumer purchases such as healthier food choices or supporting local events.



Check List for a Green Community

Source: US EPA

A Green Community Strives To:

Environment

- Comply with all Environmental Regulations
- Practice Waste Minimization and Pollution Prevention
- Conserve Natural Resources through Sustainable Land Use

Economic

- Promote Diverse, Locally-Owned and Operated Sustainable Businesses (Profitable, Non- Polluting, Socially Responsible)
- Provide Adequate Affordable Housing
- Promote Mixed-Use Residential Areas which Provide for Open Space
- Promote Economic Equity

Social

- Involve Citizens from ALL Sectors of the Community through Open, Inclusive Public Outreach Efforts
- Ensure that Public Actions Are Sustainable, while Incorporating Local Values and Historical and Cultural Considerations
- Create and Maintain Safe, Clean Neighborhoods and Recreational Facilities for ALL
- Provide Adequate and Efficient Infrastructure (water, sewer, etc.) that Minimizes Human Health and Environmental Harm
- Provide Transportation Systems that Accommodate Broad Public Access, Bike and Pedestrian Paths
- Ensure Equitable and Effective Educational and Health-Care Systems

Regulations and Approvals

The following is a sample of legislation or policies that may affect your proposed development and Departments that you may need to contact to obtain authorization or relevant permits.

This list is not intended to be all inclusive.

Clean Water Act – Depending on the location, activity or development along coastal shorelines, Rivers, streams, lakes and brooks you may be required to submit your plan to the NB Department of Environment for review. It will determine what applications and environmental permits are required. No watercourse or wetland may be disturbed without a Watercourse and Wetland Alteration Permit. http://www.gnb.ca/0062/acts/acts-e.asp

"A Coastal Areas Protection Policy for New Brunswick"; 2003, NB Department of Environment, http://www.gnb.ca/0009/0010-e.asp

Quarriable Substances Act – The Department of Natural Resources' Minerals Division must issue a Quarry Permit authorizing any excavation of materials 300 meters above or 300 meters below the ordinary high water mark. An application is required. http://www.gnb.ca/0062/regs/q-1-1reg.htm

Fish & Wildlife Act; Endangered Species Act; Wetlands Policy – All applications may be forwarded to DNR's Fish & Wildlife Branch for their review to ensure they do no conflict with these Acts or Policies, http://laws.justice.gc.ca/en/F-14/index.html

Clean Environment Act – Depending on the nature of the work and/or the location, the NB Department of Environment may review and approve activities under certain regulations (e.g., Water Quality Regulation, Environmental Impact Regulation). An application and written approval, in the form of a Certificate of Determination and/or a Certificate of Approval, may be required. http://www.gnb.ca/0062/acts/acts-e.asp

Fisheries Act – The Habitat Management Division of Fisheries and Oceans Canada must approve any activity that may alter, disrupt or destroy fish habitat. http://laws.justice.gc.ca/en/F-14/index.html

Canadian Environmental Protection Act – Environment Canada must review and approve any activity involving the disposal of any materials below the ordinary high water mark under the Ocean Disposal Permit Regulation. After screening projects under the *Canadian Environmental* Assessment *Act*, an Ocean Disposal Permit may be issued. An application is required. http://www.ec.gc.ca/CEPARegistry/the_act/

Community Planning Act: Check with your local municipality or District Planning Commission to determine wh permits are required. http://www.gnb.ca/0062/acts/acts-e.asp

Definitions

Best Management Practices ("BMP"): Practices applicable to construction sites, parking lots, and new developments that reduce the toxicity contained in, and the volume of, water that runs into storm drains, treatment facilities, and waterways.

Bioretention: Retention of stormwater through the use of vegetated depressions engineered to collect, store, and infiltrate runoff.

Buffer: A buffer preserves, provides access to, or otherwise serves as necessary adjunct to natural areas by protecting streams, lakes, wetlands, soil, air, and habitat. Buffers include, but are not limited to, areas of predominantly deeply rooted native vegetated land adjacent to channels, wetlands, or lakes for the purpose of stabilizing banks, reducing contaminants including sediments in storm water that flows to such areas.

Impervious Surface: Any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall.

Land Use Buffer: Land area used to separate or visibly shield and/or screen one use from another.

Natural Feature: An existing component of the landscape maintained as a part of the natural environment and having ecological value in contributing beneficially to air quality, erosion control, groundwater recharge, noise abatement, visual amenities, the natural diversity of plant and animal species, human recreation, reduction of climatic stress, and energy costs.

Setback: The required distance between a building and a lot line, street right-of-way, pavement, stream or riverbank, wetland or other delineated site feature.

Wetland: Wetlands are land that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, under normal conditions, a prevalence of vegetation adapted for life in saturated soil conditions (known as hydrophytic vegetation). A wetland is identified based upon the three attributes: 1) hydrology, 2) soils, and 3) vegetation as mandated by the current government wetland determination methodology.

Wetlands Buffer: An area of undisturbed natural vegetation located adjacent to the perimeter of the wetlands

Land Trust: A non-profit, tax-exempt entity whose primary purpose includes the preservation of open space, natural land, rural land, or agricultural land, and which is permitted to hold conservation easements.

Riparian Buffer: A naturally vegetated area located adjacent to streams and rivers that is intended to stabilize banks and limit erosion.

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Resources: **Canada Mortgage and Housing Corporation** (CMHC) is an excellent Canadian source of information concerning SCD. Bathurst Sustainable Development has many of their fact sheets and information brochures at both our Environmental Resource Center and at our Climate Change Action Center in Bathurst or you can visit the CMHC website.

University of Wisconsin Clip Art

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