



Photo courtesy of USDA NRCS.

SECTION II:

Site-Level Protection and Mitigation Measures

Where and how communities grow—directly and indirectly—affects water quality. As discussed in Section I, conventional postwar development patterns have had adverse effects on U.S. waterways. To help ensure the health of our watersheds, it is important to manage where growth occurs from a regional perspective. It is equally important to discuss how development should take place on targeted sites to reduce potential negative effects—the subject of this section.

In addition to regional water impacts caused by low-density, dispersed development, a number of site-level practices are detrimental to water resources. Setback and minimum lot size requirements maximize the amount of impervious surfaces around and between homes. Parking standards for shopping and office centers (as required either by localities or lenders) result in the vast parking lots that often characterize strip-shopping development. Zoning that separates uses (e.g.,

residential, commercial, office) often makes walking between destinations impractical, requiring use of vehicles that release emissions and toxic particulates that find their way to waterways through air deposition or polluted stormwater runoff. Some density restrictions forbid the construction of multi-story buildings or accessory units that could accommodate more units on less land.

Smart growth techniques provide a range of options for communities that seek a different approach to growth. Beyond the regional planning and coordination discussed in Section I, communities have also used smart growth approaches to improve site-level development. They have encouraged the development of existing impervious surfaces, in the form of infill development and brownfield and greyfield redevelopment. They have adopted a mixed-use, compact approach to site development that uses less land, and makes walking and other modes of environmentally

friendly transportation feasible again. Communities have found that design considerations can not only improve the aesthetic quality of developments, but also their environmental quality. Finally, some communities are finding that smart growth techniques can actually provide greater flexibility for innovative developers. With this flexibility, developers are creating new construction and design that make sound economic and environmental sense, but are difficult or impossible to achieve under current laws.

EPA and other organizations, such as the Center for Watershed Protection, have written extensively about numerous BMPs and low-impact development techniques that reduce site- or development-specific stormwater runoff and associated pollutants.⁸⁵ When used in combination with regional techniques, these site-level techniques can prevent, treat, and store runoff and associated pollutants at the site. Many of these practices incorporate some elements of low-impact development techniques, such as rain gardens, bioretention areas, and grass swales; many go further to incorporate smart growth principles, such as changing site design practices. Incorporating these techniques will not only help localities meet their water quality goals, but will also help create more interesting and livable communities. As with many development decisions, implementing these approaches could require communities to balance site-level impacts with regional benefits to achieve water quality improvements.

State and local governments can support improved site-level protection and mitigation measures through the policies discussed in the next four subsections: site planning, site-level technologies, ordinances and codes, and education. For the most part, policies described in this subsection support Smart Growth Principle #5: Foster distinctive, attractive communities with a strong sense of place. As in the previous section, issues to consider and practice tips are provided for many of the policies discussed.

SITE PLANNING

Local governments can direct development to specific areas within their communities. In addition, they can help plan for how that development occurs. This subsection focuses on planning approaches that help ensure development that is consistent with a community's smart growth and water quality goals.

For example, stormwater runoff varies substantially depending on a site's land use and design. Smart growth approaches can help communities prevent and manage their stormwater runoff and its effect on water quality and quantity. Overall site design considerations can have a dramatic impact on reducing stormwater runoff and associated pollutants.

In addition, critical ecological characteristics, such as steep slopes and permeable soil, also must be addressed when considering optimal site design to ensure that the design meets ecological and regional planning goals. Design and development practices that take into

account the site's natural features can benefit water quality and support water quality improvements in the local watershed. Site design features, such as drainage and vegetation patterns, can increase onsite filtration of pollutants and minimize the impacts of site runoff on water quantity and quality.

Policy 47. Consider cumulative site-level development-related impacts

In most jurisdictions, only site-level impacts are considered in proposals for new developments. A more accurate assessment of development impacts, however, would consider the impacts from the current proposal as well as those of future planned and probable developments. Throughout time, the impacts from increased development across a region can have a compounding effect on regional water sources.

For example, limiting impervious cover at the site does not take into account the transportation-related infrastructure, such as roads and parking lots, or the retail venues that generally go along with development. Ten 100-acre sites that have 10 percent impervious cover will not simply translate into 1,000 acres with 10 percent impervious cover; the net increase in impervious cover will be much greater.

A better understanding of the cumulative water quality impacts of site-level regulation is necessary to ensure healthy regional water quality. Such an assessment would consider direct and indirect impacts, as well as short-term and long-term effects, resulting from current and proposed development. Having this cumulative information would allow local governments to better plan site-level development activities. For example, instead of limiting impervious cover at the site, they might wish to limit the total impervious cover within their jurisdiction.

Practice Tip: North Carolina's Department of Environment and Natural Resources developed a guidance document on cumulative and secondary impact assessment on aquatic and terrestrial wildlife resources and water quality. This document is intended to help local governments calculate the secondary and cumulative water impacts associated with public projects. The recommendations feature information on forested buffers, stream and wetland resources, infrastructure locations, floodplains, impervious surfaces and stormwater treatment, and erosion and sediment control. In addition, the guidance manual supports the development of model codes to further guide future construction.⁸⁶ These recommendations apply to new public developments and existing ones undergoing significant modifications or expansion.

Policy 48. Provide incentives to encourage specific development practices

A number of tools are available to communities to encourage development practices that serve smart growth and water quality goals. In addition to regulations mandating certain types of development, incentives can help shape development practices through voluntary changes. Incentives such as density bonuses, streamlined permitting, and decreased fees are all ways to reward development that incorporates features that improve water quality and enhance smart growth goals.

For example, a density bonus allows a developer to construct a building at a size and scale beyond that allowed by conventional zoning, thereby offering more opportunity for profit on the same amount of land. It is typically provided to developers as a reward or incentive when they provide a public amenity, such as parks, plazas, or affordable housing; stormwater benefits could also be included in the list of eligible public amenities. Municipalities also can offer decreased development fees for developments that include features to minimize impacts on waterbodies. Such features could include the use of pervious materials or landscaping that reduce runoff and treat water onsite. Bonuses or reduced fees can also be provided to developers who agree to replace older water and sewer infrastructure serving the project.

This type of approach yields multiple stormwater benefits. More projects are likely to incorporate features that mitigate runoff, and the increased density allows more development to occur on less land, leading to more efficient use of existing roads, sidewalks, and water and sewer systems.

Local governments can create incentives to encourage landscaped setbacks and sidewalk medians. These features not only reduce runoff, but also improve the community's character.



Photo courtesy of Local Government Commission.

Practice Tip: The city of Portland, Oregon, was the first in the nation to offer significant private sector incentives, in the form of density bonuses for developments that incorporate green roofs, to reduce runoff. In 2001, with a large concentration of new development along the Willamette River, the city approved the Floor Area Ratio bonus option for developments that include the use of landscaped rooftops to retain and filter rainwater. The program offers a sliding scale of density bonuses based on the size and relative scale of the green roof; developers can earn as much as three square feet of additional floor area for each square foot of green roof area.⁸⁷

Policy 49. Minimize stormwater runoff through construction site design

Construction activities are a major source of polluted runoff, especially sediments. Rainfall during the site development process leads to erosion from areas of bare soil left after vegetation is cleared and the site is leveled. Designing construction sites with sediment and erosion control in mind can minimize water quality impacts during construction.

A key characteristic of smart growth communities is accommodating more residences, business, transportation, and retail uses on less land. During actual construction, using less land yields additional economic and environmental benefits for the simple reason that less land is required for the development; consequently, less soil is disturbed during construction, decreasing soil erosion and the costs for mitigating it. Further, the need for and expense of soil and erosion techniques, such as silt fences, are based on the number of acres disturbed. Building on fewer acres will save the developer money on soil and erosion technology. For example, a 1-acre site requires far less silt fencing than a 10-acre site, which calls for the same fence to be installed around its perimeter. If 10 residences are built on both sites, the per unit cost of erosion mitigation drops dramatically on the smaller site, demonstrating the cost savings that can be reaped through development of more compact sites.

Photo courtesy of USDA NRCS.



Sediment in the street in Des Moines, Iowa, after a rain. Measures were not taken to protect the soil from erosion during development.

Policy 50. Use conservation site design

Conventional site design typically divides available land into equal lots. In conservation design, lot division instead responds to the site's natural features, preserving large sections as open space and dividing the remaining land into smaller-sized lots for construction.

In its simplest form, conservation design (also known as cluster development) is development of a particular parcel in a manner that respects the site's natural and cultural features. Conservation design is usually applied to new residential developments in rural or suburban settings, where specific features—such as mature woodlands or existing trout streams—are preserved through a careful arrangement of new buildings and roads. These assets and other designated open spaces are often set aside for permanent conservation; building design and infrastructure concurrently take maximum advantage of these features (either as views or recreational sites).

WANT MORE INFORMATION?

The Minnesota Land Trust, with the University of Minnesota, developed a conservation design portfolio that highlights creative development options. It can be viewed at: www.mnland.org/programs-consplanning.html.

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The homes at the Fields of St. Croix are clustered in blocks allowing 60 percent of the site to remain as permanent open space.

Available data demonstrate that conservation design in greenfield areas and in centrally located, compact, mixed-use developments has fewer environmental impacts because less land is required to accommodate the same number of units and commercial space than in low-density, dispersed developments. Conservation design benefits water quality by ensuring that large portions of new developments remain as permeable surfaces, with their ecological features intact. For example, open space preserved on the site can reduce runoff and allow infiltration of water to underground aquifers. Compact development techniques, such as clustering homes and buildings, reduce impervious surfaces.

Communities can encourage conservation design through open space zoning provisions that require developers to cluster density (e.g., residential units) on a site away from environmentally sensitive areas. Conservation easements could then be used to preserve the retained open space. Open space zoning is supplemental to conventional zoning and can be applied as an overlay district.⁸⁸

Issues to Consider: Conservation subdivisions have become a popular tool to preserve open space. However, they should be used with care as they could lead to further separation of uses and increased dependence on automobiles. In some cases, conservation subdivisions can spur leapfrog development. In the context of a larger vision for the community, conservation subdivisions can play a vital role, but they should be avoided as a piecemeal tool or solution.

Practice Tip: The Jackson Meadow development in Minnesota incorporates typical conservation design principles. Located on a 145-acre parcel of high ground in open meadows and wooded hills overlooking the St. Croix River Valley, Jackson Meadow uses a cluster-housing model, preserving more than 70 percent of the site as open space. Housing and street patterns reflect existing models in the nearby town of Marine, and the development is organized topographically with neighborhoods oriented toward a central green. In lieu of typical suburban streets, each neighborhood block shares a pedestrian way located between the fronts of houses. The site is connected to Marine through a series of walkways and pedestrian corridors linked to the central green. Each pedestrian way connects directly to more than 5 miles of walking and cross-country skiing trails. From these trails, residents of Jackson Meadow are within a 10-minute walk of the local elementary school and Marine's downtown village center. This new neighborhood highlights the importance of walking, sustainability, and diversity, and designating the best land as open space for community interaction and recreation.⁸⁹

Policy 51. Minimize stormwater runoff through traditional and non-traditional BMPs

While BMPs are accepted practices to reduce stormwater runoff, numerous opportunities exist within the BMP framework to employ “non-traditional” smart growth practices to reduce stormwater runoff and associated pollutants.

Communities can expand the concept of BMPs by incorporating “non-traditional” approaches into their environmental management practice to reduce stormwater runoff to its lowest possible levels. These approaches might include using compact site design, preserving open space, incorporating street trees into a site design, requiring planters within plazas, or improving comprehensive planning. Such strategies not only reduce runoff but also foster distinctive, attractive communities. This type of multi-objective approach is central to smart growth.

Practice Tip: The state of Maryland has developed the Maryland Stormwater Design Manual, which includes both design standards and environmental incentives. The manual aims for better stormwater management by relying less on standard BMPs for all development projects and more on an approach that mimics existing hydrology through site design policies. The goal is to protect the state’s waters from adverse impacts of stormwater runoff, provide design guidance on the most effective structural and non-structural BMPs for development sites, and generally improve stormwater management practices on development sites in the state.⁹⁰

Policy 52. Designate smart growth site design as a BMP

EPA provides a menu of onsite BMPs to reduce stormwater runoff.⁹¹ As discussed in the previous policy, a number of non-traditional BMPs help reduce runoff, decrease associated pollutants, and enhance the look and feel of a neighborhood. Designating a smart growth site design deserves special mention in an expanded policy toolbox because of its potential to minimize development-related water quality impacts.

WANT MORE INFORMATION?

The Center for Watershed Protection maintains a Web site with information and resources for people involved in stormwater management. The site is located at: <www.stormwatercenter.net>.

To designate a site design, regulators should identify and define criteria for numerous design principles, including density levels, the number of uses the site accommodates, percentage of open space—including plazas, social gathering areas, or other public amenities—and the range of transportation and housing choices available. Individually and collectively, these design features reduce overall land consumption and impervious surface compared to more conventional development designs.⁹² Designating smart growth site design as a BMP is an option at the state or municipal level, providing another tool for developers to use to reduce stormwater runoff and associated pollutants.

At the state level, smart growth site design could be designated as a BMP where land use controls are explicitly stated, such as within the state's general permit, any stormwater management guidelines, or model stormwater ordinances. In addition, although general permits in most states do not include specific suggestions on how localities can manage their stormwater runoff, they do include sections that require minimum control measures. States could include a section on reviewing or considering site designs within the permit approval process, recognizing the importance of site design in managing stormwater runoff.

At the municipality level, several opportunities are available for specifying smart growth site design as a BMP. A municipality can adopt a stormwater ordinance that includes smart growth or modify existing ordinances to ensure that they allow developers to use a smart growth site design as a BMP or to receive some other type of water quality credit. In addition, municipalities can designate a smart growth site design BMP as part of their public facilities manual, which provides a blueprint for developers on how to implement ordinances and other local requirements. By defining and establishing specifications for a smart growth site design within this manual, the municipality supports developers with the information they need to design and build smart growth communities.

Policy 53. Allow green building points for infrastructure repair

Green buildings are growing more popular as localities realize the benefits of buildings that use less energy, contain better materials, and treat stormwater on the site. In older cities and suburbs, however, site constraints such as the existence of legacy pollutants, sewer and water pipes that are failing or in disrepair, and expensive land often limit or prevent a developer's ability to follow standard green building practices for infiltrating stormwater on the site. A certified green building program could award points

for infrastructure repair. These infrastructure repairs can encourage additional development activity in areas needing revitalization.

For older cities, water and sewer pipes in disrepair can be a significant water quality issue. During heavy rains, overtaxed sewer lines back up into homes and streets with stormwater and sewerage. Leaky water pipes mean that cities pay for water that seeps into the ground rather than being delivered to customers. A city with a green building scorecard could add a category for developers who want to replace or repair the failing water and sewer infrastructure serving, or proximate to, their projects. These “innovation points” would have to be tied to the project and be awarded based on repair of an identifiable source of water problems.

WANT MORE INFORMATION?

The Green Building Council sponsors the Leadership in Energy and Environment Design (LEED) scorecard, which is a popular tool for localities that want to reward developers who follow green building designs. Information on LEED standards can be found at: <www.usgbc.org/LEED/LEED_main.asp>.

Policy 54. Allow offsite mitigation

Current approaches to stormwater management generally require onsite practices, such as detention ponds. These approaches might not always be practical, however, in higher-density areas or in compact, mixed-use communities. Another approach to ensuring that stormwater is effectively managed is to allow offsite mitigation.

Offsite mitigation allows a developer to treat stormwater runoff at another location, specified by the local government, in lieu of treating runoff at the development site. Localities must approve the project in advance and ensure that it conforms to existing building and zoning regulations and provides for long-term site maintenance. Offsite mitigation provides an opportunity to strategically locate mitigation facilities where they can better address existing or potential water quality issues.⁹³ For example, Nashville, Tennessee’s stormwater ordinance states, “if it is unfeasible to implement onsite stormwater BMPs, then the development could design a system that controls quality for an equivalent portion of runoff entering from the watershed above.”⁹⁴

In return for offsite mitigation, jurisdictions may increase allowable densities in downtown and designated areas, for example, and then assume responsibility for maintaining water quality in that particular area. This strategy allows developers to build communities that integrate residential, commercial, and transportation uses—and the resultant runoff flow—into the community and offset their water impacts elsewhere, thereby ensuring overall regional water quality.

WANT MORE INFORMATION?

More information about the CWP's Roundtable series, smart site practices, and better site design techniques, is available at: <www.cwp.org/smartsites.pdf>.

Arlington County, Virginia, decided in the mid-1980s to encourage high-density development around transit stops in order to maintain the neighborhood feel of surrounding lower-density communities.



Photo courtesy of U.S. EPA.

Policy 55. Adopt model development principles

Sometimes development strategies that preserve open space and minimize impervious cover are practiced in some municipalities but not others nearby, undermining efforts to improve overall regional water quality. Communities or organizations can support more widespread adoption of improved development by adopting model development strategies that minimize impact on water resources.

Existing planning and zoning regulations prescribe many of the features of conventional development, such as large surface parking lots and dispersed, low-density developments that adversely affect water quality. Using alternative development design often requires time to obtain a zoning or other regulatory exemption—a time-consuming and costly process. As a practical matter, widespread implementation of development strategies that preserve open space and minimize impervious cover requires fundamental changes in the framework that determines how and where land is developed. Such fundamental change requires a comprehensive community approach that identifies key priorities and coalesces in a shared vision of the type of future growth that is desirable. Clear policy guidance, in the form of model development principles, could be drafted and adopted by local jurisdictions to help the community achieve its goals.

In 1996, the Center for Watershed Protection (CWP) began a project that provides an example of how to carry out this process. Recognizing the link between site design and watershed health, the CWP initiated a “Site Planning Roundtable” to encourage better design at the site level. In the first phase of this national-level project, a roundtable group consisting of planners, engineers, developers, attorneys, fire officials, environmentalists, and transportation and public-works officials from nationally recognized organizations came together to develop and endorse a set of national model land development principles. Meant to promote economically viable and environmentally sensitive site planning, these principles include the following⁹⁵:

- Shorter, narrower streets
- Smaller parking lots
- Increased stormwater treatment practices
- More community open space
- Increased vegetated buffers
- Enhanced native vegetation
- Limited clearing and grading

Starting with these principles, numerous communities have since conducted their own site planning roundtables, in which local stakeholders review the CWP template and adapt it to include the principles that make sense for their own communities. These roundtables aim to provide communities with a technical and economic framework to rethink their zoning and subdivision ordinances, planning processes, and individual site development decisions. By strategically helping communities revise their planning and zoning ordinances and incorporate model development principles, such projects provide local governments with the tools to promote more environmentally sensitive development across the entire region.

Practice Tip: The Frederick, Maryland, roundtable project adapted design principles developed at the national level for local application. The Frederick County Site Planning Roundtable was initiated partly as a result of conversations between the county’s planning and zoning staff and CWP staff. Employees of CWP had observed that the county was rapidly developing using conventional practices because many of the county’s codes actually prohibited more innovative development strategies that would reduce impervious cover. Using a consensus-building process, the project identified local codes and ordinances that prohibited or impeded better site designs. Roundtable members representing a wide range of professional backgrounds were invited to participate in a nine-month process to review the county’s existing subdivision and zoning codes. The roundtable reviewed the model development principles to identify which modifications were needed for application to Frederick County and summarized its findings in *Recommended Model Development Principles for Frederick County, Maryland*.

WANT MORE INFORMATION?

Frederick County summarized its findings in *Recommended Model Development Principles for Frederick County, Maryland*, available at: www.cwp.org/Frederick.pdf.

Policy 56. Allow developers to pool stormwater management efforts

Traditionally builders or developers are responsible for stormwater management efforts only on their particular sites. Smart growth suggests another approach—allowing developers to work together and pool resources and strategies for joint stormwater management efforts. Such joint efforts can yield better environmental results and can also achieve cost savings. Moreover, allowing developers to pool stormwater management efforts can provide more flexibility for the developers working in space-limited areas, such as infill sites. To encourage urban revitalization efforts, infill development, and other development scenarios that might be space-limited, communities could implement more flexible regulations for site-level mitigation that would permit developers to work together and pool resources for handling stormwater.

Practice Tip: San Diego, California, has introduced flexible regulations to allow the developers of multiple properties within infill development areas to pool their resources for handling stormwater. Rather than requiring each property to implement BMPs, the new rules allow developers to contribute to larger basin-wide controls that serve a cluster of redeveloped properties. This method is called the “localized equivalent area drainage” method. The city believes treatment systems with a larger capacity serving a cluster of properties can remove the same amount of pollutants as individual devices, such as filters placed where water enters storm drains. By pooling resources, the city estimates that developers will save up to \$40,000 per acre.⁹⁶

SITE-LEVEL STRATEGIES AND TECHNOLOGIES

The previous subsection focused on site planning approaches that communities can implement to ensure development consistent with their smart growth and water quality goals. This subsection describes strategies and techniques for the site design process of a particular development. These strategies can help communities achieve their goals based on how they want their neighborhoods to look, act, and connect with other neighborhoods and still meet water quality objectives.

Policy 57. Maximize use of existing impervious cover

Redevelopment of previously developed sites provides water quality benefits by reducing the need to accommodate growth on undisturbed, open land. These benefits increase when the redevelopment of a site maximizes the use of already impervious cover by modifying it to serve multiple uses.

It is well known that the amount of impervious cover in a watershed directly affects the volume of runoff, contributing to higher pollutant loads, more frequent flooding, and the degradation of stream channels. As discussed previously, redevelopment of brownfield or greyfield properties can decrease runoff. The logic behind this phenomenon is simple: a parking lot that was previously 100 percent impervious cover will have close to 100 percent runoff. Changing the use of that land by adding houses, apartments, retail, or pocket parks will not increase runoff, but will, in most cases, decrease it. In addition to brownfield and greyfield opportunities, many communities might have smaller sites of existing impervious cover that could accommodate redevelopment activity. These more common opportunities include vacant and abandoned buildings, land that held property that has since been torn down, under-

utilized retail areas such as declining strip malls, or out-of-business gas stations. Identifying and marketing these properties as potential places for redevelopment will not only help revitalize neighborhoods, but will reduce the need to accommodate growth on undisturbed land.

In addition, many impervious surface areas can be redesigned to capture runoff or otherwise made to serve more than one use. By assessing and taking advantage of such possibilities, communities can reduce runoff from impervious surfaces, such as parking lots and rooftops. For example, rooftops that previously contributed to runoff volume could be redesigned to capture and direct water to landscaping uses. Plazas that serve as gathering places for lunchtime workers might, for example, serve double duty as overflow parking lots for evening or weekend area visitors. Underground parking, shared parking, and multi-purpose parking lots (including those that serve as sites for markets or recreational facilities in off-hours) all serve to eliminate the redundancy of facilities and reduce the need for construction of additional impervious surfaces.

Policy 58. Design open space areas to minimize stormwater runoff

Incorporating small areas of open space, such as plazas or pocket parks, within compact developments can serve a number of critical functions: as a gathering place for residents, as a focal point for the development, as a tool to encourage privacy and division of spaces, and as an environmental resource. With some strategic design modifications, these valuable open space resources can often be used to reduce stormwater runoff and still serve to create more attractive, distinctive communities.

Many redevelopment and infill projects use open spaces, courtyards, and plazas to provide a community focal point, encourage community interaction, and offer opportunities for recreation. Often they consist of large areas of impervious surface, such as great swaths of concrete or large circulating fountains. Others are comprised of landscaping features that support infiltration and water retention. Communities can reduce overall imperviousness by encouraging developers to expand their use of landscaping and alternative covers—such as pavers, bioretention areas, or planting boxes—that allow for water infiltration. These materials can often support the same functions as their impervious counterparts and also serve to store, filter, or treat rainfall to reduce the impact of runoff on water resources.

Lawns can be modified to capture and treat runoff.



Photo courtesy of USDA NRCS.

Practice Tip: The Buckman Heights residential development in Portland, Oregon, captures and filters rooftop runoff through a centralized courtyard featuring two gardens of native and ornamental plants. A third vegetated channel is located adjacent to the parking lot. The soil and plants in these gardens act as a natural filter and reduce stormwater runoff. In addition, narrower driveways and the use of a back-up dry well reduce the amount of runoff generated. These combined efforts allowed the site to be built without connection to the stormwater system and ensured that the development will not contribute to the city's stormwater treatment needs.⁹⁷

Policy 59. Preserve and enhance green areas in existing neighborhoods

In many cases, vegetated areas remain in existing neighborhoods, community parks, abandoned properties, or natural areas such as non-recreational streams or lakes. Such areas make positive contributions to a community's water quality through infiltration or reduced imperviousness, but they are often fragile assets, small and fragmented, and strongly influenced by adjacent uses. Often they are susceptible to compaction, dumping, and invasive plant species from adjacent developed sites.

Careful management of fragile or damaged green areas will encourage revegetation and soil restoration and contribute to more attractive communities with a strong sense of place. In approaching these publicly owned or abandoned sites, communities are advised to consider the type of vegetation most likely to improve water quality. For example, grass-covered sites are less likely to filter water and mitigate runoff from neighboring sites than those with native vegetation. Lawn grass is generally compacted during its installation and remains so during maintenance (e.g., continual mowing). Communities must balance the need for water quality improvements with the specific requirements called for by the site and its surrounding residents and uses. In addition, thoughtful planning and zoning for developed uses in the vicinity of these sites can also help to mitigate impacts upon these resources and ensure that they provide important community and water quality benefits far into the future.

Conservation easements, donations of public land-to-land trusts, and innovative partnerships for the care of land (such as between a nearby association or school and the local jurisdiction) are among possible long-term solutions for financing and maintaining these sites. By whatever mechanism they are managed, attractive and well-maintained green spaces can serve as community assets, spurring more investment and redevelopment of the surrounding areas.

Practice Tip: The 26th Street Gateway in Philadelphia, Pennsylvania, was previously a post-industrial wasteland of neglected spaces, crumbling asphalt, and short-dumping sites. In 1989, the organization Philadelphia Green joined with public and private organizations (including the Pennsylvania Department of Transportation and Philadelphia’s Department of Streets) to rehabilitate the stretch of roadway. Natural areas were preserved, and native vegetation was planted. Now this 1-mile stretch of land covering 25 acres is a meadow of native trees, grasses, and wildflowers.⁹⁸

Policy 60. Use green practices to manage rooftop runoff

Rooftops are by necessity built with impervious materials such as asphalt, metal, shingles, and other tiled materials. They can still provide an effective means of reducing runoff from sites, however, particularly in higher-density areas, if practices such as rooftop gardens and other green infrastructure practices are used.

Rooftop runoff can be managed through the storage, reuse, and redirection of runoff for stormwater management and other environmental benefits. Green roofs, in which some or all rainwater is absorbed and redirected to other uses (such as rooftop gardens), can be used to reduce the volume of rooftop runoff. Gutter systems can be designed to direct runoff from roofs into rain barrels, which subsequently provide a “grey water” resource for landscaping and thereby reduce water demand. Runoff volume can also be reduced through improvements in the design of rooftops and site layout, so that the reduced flow from less sloped roofs is directed onto pervious surfaces instead of into stormwater systems.

Such techniques are useful in lower-density development, yet they also have particular significance in higher-density, compact developments where marginal per unit decreases in runoff become significant when multiplied by the greater number of units located onsite. These cumulative effects might be great enough that they eliminate the need for detention ponds or other mitigation efforts that might otherwise interrupt the flow and feel of a compact community. In addition, such mitigation efforts can help communities avoid hotspot effects. Further, any effort to reduce the pressure on an overtaxed stormwater infrastructure means that more growth must be accommodated in existing neighborhoods, so that open land on the urban fringe can be preserved.

WANT MORE INFORMATION?

Increasingly, cities, private industry, and residents are installing environmentally friendly roofs. A wide variety of case studies, information, and technical resources are available at: www.greenroofs.com and www.cleanrivers-pdx.org/clean_rivers/ecorooft.htm.

Rooftop runoff can be directed to backyard ponds.

Photo courtesy of USDA NRCS.



Issues to Consider: Specially trained architects must be employed to design systems that do not overwhelm the structural capacity of the roof, and to ensure that the appropriate types of vegetation are used in a manner that is both cost-effective and protects the rooftop’s sustainability and its stormwater management capabilities.⁹⁹

Practice Tip: Completed in the spring of 2001, Chicago’s City Hall rooftop garden covers approximately 20,300 square feet and contains a variety of grass, shrub, vine, tree, and other plant species. The roof’s water storage slows down and reduces direct discharge into storm sewers, resulting in less pressure on the sewer system and improved water quality. The green roof is cost-effective, generating direct energy savings through a combination of shading, evapotranspiration effects, and insulation.¹⁰⁰

Policy 61. Use low impact development techniques

Low-impact development (LID) techniques are those that mimic the predevelopment site hydrology to store, infiltrate, evaporate, and detain runoff. They are a natural complement to smart growth approaches that seek to reduce runoff through an improved approach to regional development and site design. Although smart growth approaches applied at the site level reduce the volume of runoff, the use of LID techniques adds to the potential gains by mitigating the effects and pollution levels of the site’s stormwater runoff.

LID techniques are usually associated with new development sites, such as subdivisions, parking lots, or other large uses with a high level of imperviousness, and where the hydrological and topographical aspects of the site can easily be determined. Some aspects of the LID approach, however, are equally applicable to and potentially beneficial for infill development. For example, vegetated buffers can be located next to sensitive areas such as streams to slow the movement of runoff and filter sediment and pollutants. Level spreaders are site features that convert concentrated runoff (such as that from a pipe that carries runoff from a number of impervious surfaces) to sheet flow that can be more evenly dispersed across a slope, thereby causing less erosion than a single, high-volume stream.¹⁰¹

Jordan Cove, a low impact development in Waterford, Connecticut, uses rain gardens between houses.



The potential for using LID techniques for urban infill areas is increasing. Ongoing research is being conducted to evaluate the impact of LID techniques in urban settings, as compared to their

traditional application in rural and suburban contexts. More research is needed to better understand the quality and quantity of runoff under various redevelopment approaches and the potential economic savings to be gained by using LID to capture stormwater flow before it enters a system that is at or over capacity.

Issues to Consider: Communities must resolve the question of how to pay for LID features on a site. Given that reduced and/or improved stormwater runoff can mitigate the need for treatment cost and system expansion, it might be appropriate to offset the costs borne by private developers who incorporate LID through some financial incentive, such as reduced fees. It might also be determined that the aspects of LID that serve to reduce conventional site development costs—such as clearing and grading—might be sufficient to offset any higher costs for constructing features such as those discussed above. Further, the long-term cost savings (in terms of turf and pavement maintenance and replacement) that are generated by LID features could convince private developers that the additional investment in stormwater mitigation site technology is worthwhile.

Practice Tip: In the Puget Sound area of Washington State, King County officials have merged their LID program with the community's larger smart growth initiative to develop comprehensive planning and implementation for stormwater management. The Puget Sound Action Team, comprised of community leaders, local governments, tribes, and businesses, oversees water quality protection in the sound by setting up work plans and implementation goals for involved groups. Projects to date include a LID CD-ROM with materials from the LID in Puget Sound Conference, and an Alternative Futures project with the public to test alternate land use scenarios with hydrologic and habitat models.¹⁰²

WANT MORE INFORMATION?

The Low Impact Development Center offers a range of technical information, resources, and tools at: <www.lowimpactdevelopment.org>.

Policy 62. Construct narrow, walkable, well-connected streets

Many development sites today are connected by wide streets made of large quantities of impervious surface. The increased street width is not needed in all instances and can make unpleasant, inconvenient, and at times unsafe places to walk. Impervious surface can be reduced and walking can be encouraged if site design incorporates narrower, walkable, well-connected streets for both vehicles and pedestrians to use. As a result, runoff can be reduced and air and water quality improved through the reduced need for vehicular transportation.

Communities can express their preference for reduced runoff from narrower streets that are better connected and use less impervious surfaces through design guidelines. Site design guidelines might also call for alleys or rear lanes that serve multiple functions, such as utility and service areas, thus better maximizing the use of existing impervious surfaces. Some counties and metropolitan planning organizations have clarified their objectives for street design in formal street design guidelines. Others have stated a maximum level of impervious surface for a particular parcel or watershed, and then give developers and designers flexibility to meet runoff reduction requirements using a variety of techniques, including open space, narrow roads, parking structure design, and reduced building footprint. North Carolina's Department of Transportation, for example, approved street design guidelines to make it easier for local governments to implement traditional neighborhood street networks in new developments. The guidelines specify street width and require bicycle and pedestrian facilities, which support improved water quality as well.¹⁰³

Issues to Consider: One critical component of a community's transportation system is effective emergency response; fire, ambulance, and police officials need to respond to calls quickly. To meet this need, roads are built to accommodate large fire trucks with large intersections for faster turns. In some instances, communities have abandoned plans for smart growth road and transportation improvements, such as multi-use streets or engineering techniques to calm traffic, after fire chiefs testify against the plans based on faster response times. Some emergency response officials have pointed out, however, that the wider streets and turns actually produce more safety problems than they solve, since they allow for higher speeds for all traffic. Others note that residential street designs, such as cul-de-sacs and limited access points for private communities, also impede effective response times. To achieve safer street networks, local governments should consult emergency responders during the design phase of a road improvement project, rather than at the end of the process. They should identify street and traffic solutions that work well for everyone.

Photo courtesy of U.S. EPA.



Downtown Annapolis, Maryland, demonstrates that narrow streets can still provide on-street parking, which serves as a buffer for pedestrians.

Practice Tip: The city of Columbus, Ohio, has developed a stormwater ordinance that supports the reduction of impervious surface—including narrower street widths that conform to the standards found in the Traditional Neighborhood Development code—to lessen the impacts from runoff. Other strategies include a reduction in commercial parking and the preservation of open space, including agricultural lands and riparian areas.¹⁰⁴

ORDINANCES AND CODES

Ordinances and codes are means by which a community can express its goals and objectives for development. Ordinances and codes help shape the type and placement of development in a community and manage its natural resources. As such, they can be used to promote standards to better manage how and where development takes place.

Policy 63. Adopt stormwater ordinances

Local governments are currently not required to have stormwater ordinances in place. Adopting such an ordinance, however, is advisable because it lets communities effectively enforce development and mitigation guidelines that protect water quality by reducing the quantity or improving the quality of stormwater runoff.

Stormwater ordinances give local governments the legal authority to shape development and better protect water quality. The adoption of enforceable stormwater ordinances is critical to implementing new and innovative ways to prevent or control stormwater runoff. Such ordinances can require developments to conduct regular maintenance activities. For example, local governments can set surface runoff limits for post-construction stormwater runoff volumes and identify allowable nonstructural and structural stormwater practices. The ordinances can also include language regarding onsite stormwater requirements, and whether offsite treatment is an option.

State and regional governments can support communities by developing model ordinances that can be customized to a locality's conditions and preferences. The model ordinance developed by the Twin Cities Metropolitan Council in Minnesota, for example, includes design standards for stormwater ponds, BMPs for protecting water quality, and shoreline regulations.¹⁰⁵

WANT MORE INFORMATION?

The Center for Watershed Protection maintains a Web site containing model stormwater ordinances at: <www.stormwatercenter.net>.

WANT MORE INFORMATION?

EPA offers a range of tools and examples of stormwater ordinances on its Web site at: <www.epa.gov/owow/nps/ordinance/stormwater.htm>.

Issues to Consider: Stormwater ordinances are most effective when they clearly identify the entity responsible for long-term maintenance and build in a requirement for regular inspection visits. Ordinances might call for the use of BMPs; they should also provide supporting information, such as maintenance agreements and inspection checklists, to ensure that they result in the desired water quality impacts and perform efficiently during the long term. In addition, ordinances must be comprehensive enough to ensure that regional water benefits are achieved, but specific enough to reflect the needs of particular areas. Older urbanized areas, for example, will face different stormwater issues than new developments.

Practice Tip: Grand Traverse County, Michigan's Stormwater and Sediment and Erosion Control Ordinance is an example of an ordinance specifying operation and maintenance provisions for stormwater, erosion, and sediment control. The ordinance specifies actions property owners must take, including certification that construction has been completed in accordance with the approved soil erosion and stormwater runoff control plan, inspection procedures, and other compliance and enforcement actions regarding stormwater, sediment, and erosion control.¹⁰⁶

Policy 64. Adopt ordinances for source water protection

Under the Safe Drinking Water Act (SDWA), all states are required to complete assessments of their public water systems that delineate areas that feed groundwater and surface water supplies, and identify potential pollution risks. Additionally, to further ensure water quality, a limited number of communities have ordinances in place to protect source water. Communities should consider developing ordinances that protect source waters, such as aquifers and watersheds, by adopting ordinances that protect the most critical recharge or contribution areas, nearest to wells and intakes.

The purpose of source water protection is to prevent pollution from reaching the groundwater, lakes, rivers, and streams that serve as local communities' drinking-water sources. Ordinances can be developed to protect water sources and help safeguard community health by reducing the risk of contamination of water supplies. Wellhead protection zones and aquifer protection areas are two examples of source water protection ordinances that help protect groundwater sources. Water supply watershed districts and lake watershed overlay districts are examples of local management tools that provide protection to surface water supplies by restricting land uses around a reservoir used for drinking water. In all cases, communities can develop

an ordinance that applies to a specified area surrounding the water source in question. Such ordinances are most effective when they provide clear guidance on the allowable uses, water quality measures required during construction or in existing developments, and other practices to help protect and ensure the quality of the community's drinking-water sources.

Issues to Consider: Source water planning should be conducted on a scale that ensures protection of the entire recharge zone for that particular water source. It is unlikely that communities will be able to protect, or perhaps even define, entire recharge zones, as these zones can be very large and could include substantial areas outside of a community's jurisdictional boundaries. For surface waters, communities might wish to create overlay zoning districts that have boundaries large enough to protect the source water resource, tributaries, and the contributing streams.

For groundwater protection, communities can consult with the U.S. Geological Survey (USGS) to ensure that their overlay zoning district encompasses the entire area that recharges an aquifer. In addition, communities could contact the state agency responsible for source water assessment. Many states have completed a comprehensive effort to delineate and characterize critical wellhead protection and surface water contribution areas for every public water system.

In addition, an ordinance should include specific information on the allowable and prohibited land uses within the source water protection zone. For example, many source water protection ordinances limit or forbid the storage of hazardous materials and place restrictions on the location of businesses that use these materials within the district. An ordinance should include procedures for the review of proposed projects within a source water protection district to verify that the project is consistent with the ultimate goal of the ordinance. These procedures might include requiring applicants to submit geotechnical and hydrological analyses to determine the potential impacts to water quality, and the submission of spill control plans for businesses performing potentially contaminating activities. Finally, the ordinance should include language explaining the mechanisms for enforcement of the ordinance, including the civil and criminal penalties that could apply for failure to obey. Local governments might wish to review state statutes and regulations governing municipal land use and talk with public health authorities, to assure consistency and avert concerns regarding state preemption.

WANT MORE INFORMATION?

A new EPA source water protection rule, Long Term 2 Enhanced Surface Water Treatment, allows treatment credit for watershed protection actions. Details are available at: www.epa.gov/ogwdw/lt2/index.html.

WANT MORE INFORMATION?

EPA's Office of Water has numerous resources on planning and implementing source water protection programs, including financial assistance, case studies, and model ordinances available, at: www.epa.gov/safe-water/protect/sources.html.

Practice Tip: The New York City Watershed Agreement provides a dramatic example of communities taking steps to protect their source water. In 1997, EPA and New York City, along with more than 70 towns and eight counties, signed an agreement to support an enhanced watershed protection program for the New York City drinking-water supply. Through the multi-year, \$1.4 billion agreement funded by the city, a multi-faceted approach is being implemented, including the purchase of 80,000 acres within the watershed to protect drinking-water sources. This plan allows the city to avoid the construction of filtration facilities estimated to cost between \$6 billion and \$8 billion.

This agreement created a blueprint for protecting the watershed during the next 10 to 15 years and established a land use pattern intended to protect the future of the city's water supply. The city has clearly demonstrated a commitment to the protection of the watershed through the provision of green infrastructure in established villages, economic development aid to bolster a healthy rural economy and working landscape, and support for various planning studies.¹⁰⁷ These efforts serve to correct existing water quality problems, prevent development in important ecological areas, promote pollution prevention, and create and strengthen organizations and local governments in their ability to manage growth and protect water quality.

Policy 65. Adopt water-saving landscaping ordinances

In addition to its many environmental benefits, smart growth fosters the development of distinctive, attractive communities with a strong sense of place. Landscaping ordinances adopted at the local level can serve this function and provide water quality benefits when they encourage the use of water-saving landscaping or xeriscaping™.

Communities can foster distinctive places and achieve water quality benefits by adopting ordinances that call for the use of native species, especially perennials, in landscaping. Such plants can reduce water use because they are well adapted to the climate and therefore require less water and maintenance. An ordinance might encourage the expanded use of xeriscaping—an approach to landscaping that relies on the use of plants and landscaping techniques that explicitly reduce water use. This type of landscaping approach tends to provide more permeable surfaces than conventional landscaping, thus further reducing stormwater runoff.

Issues to Consider: Some planned communities use neighborhood covenants to regulate the type of landscaping in their community to ensure consistency in

appearance. In extreme cases, they might ban xeriscaping and prescribe the use of a specific, water-thirsty type of groundcover, such as Kentucky bluegrass. One community is seeking to remove these bans by opposing a proposed law that would forbid new subdivisions in Denver, Colorado, from requiring landscaping and banning the use of xeriscapes. Denver officials want more homeowners to consider landscaping techniques that feature plants that require less water, but sometimes are viewed as unappealing by neighbors.¹⁰⁸

Practice Tip: Florida's water management district rules require that all local governments consider adopting a xeriscape ordinance as a water conservation measure. The Florida DEP prepared a model landscape ordinance that minimizes irrigation and uses landscaping to protect water quality. The ordinance would apply to all new construction and sites undergoing renovation that require a local building permit.¹⁰⁹

Policy 66. Adopt tree ordinances

Tree ordinances are among the many ways localities can foster distinctive, attractive communities that also achieve water quality benefits. By encouraging communities to plant more trees, tree ordinances help achieve these dual goals.

The stormwater benefits that trees provide are often not fully recognized. Trees intercept and slow the fall of rainwater, helping the soil to absorb more water for gradual release into water sources. This cycle prevents flooding, filters out toxins and impurities from the water, releases water into the atmosphere, and reduces stress on the stormwater system. Based on these various benefits, developers and residents should be encouraged to plant and maintain trees.

Tree ordinances are most effective when they specify the goals of a community's tree program, its methods of enforcement, and evaluation procedures. In addition, they should provide clear guidelines and rules on how to plant and manage new and existing trees on new development sites and along public streets. For example, street tree ordinances can explain the practice of planting and removing trees within the public right-of-way. They might also specify planting requirements for parking lots, thereby mitigating the effects of their imperviousness. Smart growth projects and developments can be designed to maximize the preservation and use of trees to help improve the quality of a community's water resources.

Volunteer programs, such as AmeriCorps, can assist in implementing a community's tree ordinance.

Photo courtesy of USDA NRCS.



WANT MORE INFORMATION?

American Forests developed a software package called "CITYgreen," which can help establish a baseline tree canopy and estimate the dollar value of the services provided to a community by its tree cover. Garland, Texas, used CITYgreen to measure the cost savings associated with its tree canopy and learned that its trees provide 19 million cubic feet in avoided stormwater storage space, saving the city an estimated \$2.8 million annually in construction costs for a stormwater facility. This tool is available at: <www.americanforests.org/graytogreen/stormwater>.

Issues to Consider: Different trees have different absorption rates, growing condition needs, growth rates, and lifespans. Policymakers should consult an expert to determine which trees will provide the most water quality benefits for the community. In addition, planners should ensure that the trees' future needs are met by ensuring that tree planters are large enough to support tree growth in the coming years.

Policy 67. Implement ordinances and standards to better manage development along waterways

Waterbodies are particularly sensitive to the uses that surround them. Polluted runoff, construction sediment, and the elimination of natural features that filter water can have a dramatic effect on the quantity and quality of water resources. Communities can develop and implement riparian standards and buffer ordinances to protect zones along and around waterbodies. Furthermore, by preserving and maintaining the land surrounding waterbodies, the community's character can be enhanced.

Riparian standards can help minimize the impact development has on riparian zone functions by better directing and managing development. To be effective, standards should consider the particular characteristics of the riparian zone and waterbody being protected. For example, a small spring-fed creek will have different requirements for protection and accommodate different nearby uses than will a man-made lake. Riparian areas have high ecological value, and standards designed to protect them are critical to ensure that future development does not pose further threats.

Buffer ordinances, which protect water quality and aquatic habitat, regulate activity in the strips of native vegetation along streams and other water resources. These areas provide wildlife habitat, protect water quality, and serve as natural boundaries between local waterways and existing development. Buffers help protect water resources from the impacts of development by filtering pollutants, sediment, and nutrients from runoff. Other benefits of buffers include flood control, stream bank stabilization, stream temperature control, and room for lateral movement of the stream channel. Ordinances can specify the size and management of the stream buffer.

Issues to Consider: To provide the functions necessary to protect water resources from the impacts of development, buffer ordinances should require that buffer boundaries be clearly marked on local planning maps. In addition, language should restrict vegetation and soil disturbance during maintenance, tables should illustrate buffer width adjustment by percent slope and type of stream, and direction should be provided on allowable uses and public education.

Practice Tip: The state of Maine created a Mandatory Shoreland Zoning Law that requires municipalities to protect shoreland areas by zoning land within 250 feet of coastal waters, lakes, and rivers, and within 75 feet of second-order perennial streams. These zoning ordinances provide guidance on the types of activities that can occur by establishing zones for resource protection, general development, residential, and other uses, and by specifying building size and setbacks for those areas in which development will occur. In addition, Maine's revised Natural Resources Protection Act (NRPA) regulates development activity within 75 feet of any mapped stream. To receive an NRPA permit, applicants must demonstrate that the proposed activity will not cause unreasonable erosion of soil or sediment or prevent naturally occurring erosion; unreasonably interfere with the natural flow of any surface or subsurface waters; lower water quality; or cause or increase flooding. Together, these two legislative acts create standards for improved management of Maine's oceans, lakes, and streams.¹¹⁰

WANT MORE INFORMATION?

EPA maintains a database of model ordinances to protect local water resources. It is accessible at: www.epa.gov/owow/nps/ordinance/buffers.htm.

Policy 68. Reduce lot sizes through zoning and setback requirements

Much of the low-density, dispersed development apparent today is the result of zoning requirements and building codes that specify how and where growth can occur. As discussed throughout this document, communities can improve the quality of their water resources through efforts that direct development to targeted areas and encourage more compact development that consumes less land for growth. Revised zoning and setback requirements are one way to achieve these goals.

Density bonuses encourage more growth on less land, reducing the total level of imperviousness for a community—just like guidelines that permit buildings to be constructed with smaller setbacks or less parking. Zoning codes, subdivision standards, and setback requirements all directly impact the amount of land that will be consumed by specifying minimum lot size. Communities can provide more choices to residents—and achieve water quality benefits—by revising zoning codes and subdivision standards. This action will allow development on smaller lots and lower the requirements for the distance that a building must be set back from its lot line. For example, instead of requiring a minimum of a quarter-acre for residential lots, as many current codes do, new codes could allow development on smaller lots or more units to be built on a quarter-acre parcel. Reduced setback requirements for front, side, and rear yards allow homes and commercial buildings to be built closer together and leads to shorter driveway and roadway lengths to reduce total imperviousness.

Shared driveways are another mechanism to reduce lot size while not compromising on living space.



Photo courtesy of the NEMO program and the University of Connecticut.

WANT MORE INFORMATION?

A forthcoming revision to *Parking Alternatives: Making Way for Urban Infill and Brownfields Redevelopment* expands on how localities can balance parking with broader community goals with more case studies and new proven techniques.

This summer 2004 publication, *Parking Spaces/Community Places: Finding the Balance through Smart Growth Solutions*, will be available at: <www.epa.gov/smartgrowth/publications.htm>.

The current version can be accessed at: <www.smartgrowth.org/pdf/PRKGDE04.pdf>.

Market Common, a mixed-use development in Arlington, Virginia, has reduced parking requirements because of its proximity to transit and surrounding neighborhoods.

Policy 69. Minimize parking requirements

Parking lots are a highly visible and significant share of a community's impervious surface cover; they are sizable contributors to stormwater runoff. The size and design of parking lots are currently dictated by a combination of zoning and building regulations implemented by localities, building features required by lenders, and the conventional practices of builders and developers. Communities can directly encourage smaller and more structured parking that reduces imperviousness through revised parking requirements and other supportive policies, and indirectly through education of developers and lenders.

A revised approach to parking can result in a number of water quality benefits. First, smaller parking lots and structured parking can significantly reduce the extent of imperviousness on a building site. This approach reduces the total footprint of a development, allowing more of the site to remain undeveloped or capable of absorbing additional, compact growth. Consequently, pressure to develop undisturbed land for new development is lessened, and more pervious surface is retained. In addition, a smaller parking footprint reduces the area on which pollutants can be deposited and stormwater collected, thereby reducing polluted runoff.

Also, allowing on-street parking can reduce the need for parking lots and improve walkability by helping to calm passing traffic. Montgomery County, Maryland, encourages structured parking by charging a special parking assessment on new development near the Bethesda Metro station; the money collected supports the construction and maintenance of public, multi-story parking lots in the area. The county's approach to privately constructed parking lots for offices is designed to support the use of transit, thus reducing overall parking need. The county also provides carpool and vanpool spaces in specific facilities to encourage ridesharing and tries to minimize the use of land devoted to parking by encouraging the mixed-use development of sites.¹¹¹ Other policies, such as market pricing for parking, providing only a limited amount of parking, eliminating parking subsidies, and using shared parking, can also encourage the use of transit, ride sharing, bicycling, and walking, and help reduce the demand and need for parking. Finally, communities can require that a percentage of spaces used for overflow parking be constructed with pervious or otherwise porous materials.

Finally, communities can encourage private-sector partners, such as developers and lenders, to adopt reduced onsite parking by ensuring that public transit systems are responsive to the transportation needs of potential building users. Communities can also provide information to developers and lenders on the extent to which public transit



Photo courtesy of U.S. EPA.

can reduce the need for parking. Although this practice can deviate from the conventional approach by lenders and developers, thorough and well-substantiated information can encourage them to reduce the amount of onsite parking provided in both residential and commercial developments.

Practice Tip: Olympia, Washington, conducted a study of the stormwater volume benefits associated with reduced impervious surfaces in new development, redevelopment, and parking lots. The city found that reducing commercial parking acreage by 20 percent could lower the impervious surface on the site by 11 percent. The city then surveyed commercial establishments to determine whether they perceived that they would be able to reduce parking by 20 percent without affecting business. In spite of the fact that business owners did not think they had excess parking, Olympia determined that the typical occupancy rate in parking lots was only 46 to 67 percent—a level clearly supportive of a 20 percent reduction. Eighteen of 31 representative sites had less than 75 percent occupancy rates during the busiest peak hours surveyed.¹¹²

EDUCATION

Encouraging developers and communities to consider changes in how and where growth occurs requires widespread education on smart growth alternatives and their benefits. Through outreach, training, and information sharing on new development approaches and innovative site-level construction techniques, state and local governments and water quality practitioners can help encourage smart growth practices that improve water resources.

Policy 70. Provide resources to educate developers and local staff on LID techniques

Low impact development (LID) techniques are a natural and valuable complement to a smart growth approach to achieve water quality benefits. Because they represent a significant deviation from the standard approach to development, communities can encourage their wider use by making resources available to educate developers, local staff, and others on LID techniques.

A number of resources are available to communities to support their efforts to educate staff and private-sector citizens. EPA provided support to the Low Impact Development Center to create a number of tools for communities. For example, the LID Integrated Management Practices Standards and Specifications tool helps public-works agencies design and implement their own LID standards. Another tool, the

WANT MORE INFORMATION?

The Low Impact Development Center provides various community tools at: <www.lowimpactdevelopment.org/EPA03.htm>.

LID Planning Process for Urban Areas, includes guidance for urban planners and landscape architects on how to incorporate LID into master plans. The LID Training Program for Linear Transportation is an interactive training program for federal, state, and local transportation agencies. Finally, the LID Sustainable School Project includes materials to help schools implement and monitor their own LID approaches as a learning tool.

Communities can achieve significant pollution prevention benefits by combining the techniques of smart growth and LID. Improved education will ensure that both approaches are used in a complementary manner to achieve the maximum possible benefits for water quality.

Practice Tip: Cherry Creek Watershed Partners in Colorado is providing resources to educate developers and staff by hiring a “Phosphorus Broker” as a way to promote better development approaches surrounding Cherry Creek. The Phosphorus Broker will identify LID techniques (such as constructed wetlands, riparian buffers, and onsite stormwater retention techniques), encourage developers to adopt these approaches, facilitate approval in the regulatory process, coordinate outreach and education on the benefits of these approaches, and promote wider implementation of these practices. This strategy serves as a contrast to the common approach in which local regulatory compliance is assessed only after construction begins.¹¹³

Policy 71. Create a statewide educational program for local experts

Statewide programs to educate local experts about new practices and techniques can build valuable support for local water quality efforts. Such programs also can serve as a way for water professionals to network and share ideas. Well-educated resident experts can help guide and support local decisionmakers on development options that will have a significant water quality impact. These educational programs can also be used to encourage more general smart growth practices and create a deeper understanding among water experts on the relationship between growth, development, and water.

Photo courtesy of the NEMO program and the University of Connecticut.



NEMO continues its education program for its national network of water quality and land use experts.

Practice Tip: The state of Indiana’s Planning with POWER program is based on education and outreach.¹¹⁴ In Indiana, all extension agents (university-based community leaders) are voting members of local zoning commissions, and are therefore in a strong position to educate other commissioners about the impacts of development on water quality. Through this program, extension agents essentially create a technical advisory committee on natural resources and water quality, comprised of local representatives from the Natural Resources Conservation Service, the Indiana Soil Conservation District, and the Indiana Department of Environmental Management. The teams hold monthly meetings and bring technical resources into the planning and zoning process.

Policy 72. Notify homebuyers of future water availability and cost

Individuals are often not fully aware of the impacts that their personal actions have on their local watershed. For example, the cumulative purchases by homebuyers of large-lot homes have a direct and significant effect on the community’s overall demand for water.

Although it is not currently a common practice, local authorities, realtors, and lenders could help raise homeowner consciousness concerning water issues by educating potential homebuyers on the probability of future water limitations. Rural communities are increasingly trying to educate potential homebuyers on the realities of rural living. For example, the Planning Department in Ottawa County, Michigan, a predominately agricultural community, created a “scratch and sniff” brochure that provides future homeowners a strong whiff of how their community smells.¹¹⁵ The point was simple: we are a farming community and want to stay a farming community.

Information on state water supply projections, local growth and population estimates, and anticipated policy changes (such as higher rates for excess water use), for example, could be also provided to future homebuyers. As a result, they would be better equipped to assess the likelihood that affordable water will be available in the future, which should be an important consideration when purchasing a home. Such knowledge of future water supply issues might encourage buyers to reconsider the personal and public financial impacts of large lots and the environmental effects that could result.

WANT MORE INFORMATION?

Extension agents are university-based community educators. Originally based in land grant colleges and universities, the extension program has since been expanded to include wide-ranging programs such as growth and development, water resources, and disaster mitigation. Information on Sea Grant programs can be found at: www.sga.seagrant.org and information on the Land Grant programs is available at: www.reeusda.gov/1700/statepartners/usa.htm.

Policy 73. Educate citizens and businesses to help protect water resources

Small efforts can have a lasting impact on water quality if many participate. Oftentimes, those interested in helping maintain or improve the quality of the water are at a loss about how to contribute to the effort. When informed about behaviors that are detrimental to the environment, many individuals and businesses are likely to want to learn what they can do to help. Creating programs, educational opportunities, and incentives for behaviors that improve water quality can make a major difference in preventing additional degradation.

Schools and local civic organizations can co-sponsor special programs on how to contribute to cleaner water. Educational opportunities can be created through formal workshops or training seminars, or informal means such as fact sheets and Web-based resources. Incentives can be offered to encourage desired behavior. For example, tree seedlings could be given to children who walk to school for a week instead of riding in a car. Special community-wide events can be organized by local governments to highlight and demonstrate the impacts of individual behavior. For example, a local government could designate a “no fertilizers” month, in which homeowners and commercial buildings agree not to use fertilizers on lawns or plants. The resulting water quality impacts could then be measured and presented to the community as evidence of their successful contributions.

Efforts to educate the public about how smart growth can improve water quality, encourage more individuals to get further involved with community planning projects, and demonstrate how water-efficient technologies and designs that impact water quality are likely to result in improved behavior. Small changes in behavior will eventually translate into higher water quality on a regional basis. With a greater understanding of their individual impacts on development, communities and residents are likely to express greater support for smart growth initiatives.

Photo courtesy of USDA NRCS.



Tree seedlings given to children who walk to school for a week is an excellent opportunity to educate the next generation about their environmental decisions and to enhance the beauty of their school.

Practice Tip: Portland, Oregon, implements several programs to educate individuals and businesses about their role in water quality. Programs include initiatives to disconnect rain gutters from the storm sewer system (instead directing rainfall to absorbent flowerbeds and surfaces), promote native landscaping practices, and support community-based and K-12 projects that involve hands-on activities such as tree planting and monitoring projects on school grounds to educate children about stormwater management.¹¹⁶

Policy 74. Train teachers on smart growth issues

Due to the increased development of environmental education programs (such as “reduce, reuse, recycle”) during the last few decades, many children are increasingly aware of and sensitive to environmental concerns. Few, however, have an understanding of how their communities are created and shaped, and the impacts that they, as residents, have on the environment. Municipal officials and water management districts can work with local schools to incorporate smart growth issues into their curricula.

Teachers can be supported to educate their students on these connections through programs that provide them with greater capacity and resources on the issues of watershed protection, land use and development, and the principles of smart growth. As these ideas are incorporated into school curricula, children will have access to knowledge that will enable them and their families to better protect water resources.

Practice Tip: The Southwest Florida Water Management District created Project WET (Water Education for Teachers) to help build capacity in local teachers on environmental issues. The Project WET Curriculum and Activity Guide is a collection of more than 90 innovative, interdisciplinary activities that are hands-on, easy to use, and fun. These curriculum guides are available to teachers through free workshops that prepare them to educate children in K-12 about their local watershed and how to make informed decisions about water resources. The district’s *Growth and Development* newsletter for high-school students provides information on how growth and development can impact natural resources. The district also provides mini-grants for classroom projects on watersheds, water quality, and alternative sources of water and conservation.¹¹⁷

WANT MORE INFORMATION?

The Trust for Public Land's publication, *Economic Benefits of Open Space*, comprehensively details the stunning economic benefits of open space. It is available at: www.tpl.org/tier3_cdl.cfm?content_item_id=1145&folder_id=727.

Policy 75. Encourage information-sharing among developers concerning smart growth designs that protect water resources

Communities supportive of smart growth approaches have realized there is a market segment demanding neighborhoods with vitality and diversity—with stores, parks, and businesses within walking distance of their homes. Often one barrier to building better communities is the lack of awareness from the development community. Some developers have recognized this growing market segment, in part because developments with smart growth characteristics command a market premium, yet some developers are still unaware of how to address the permitting, construction, and design issues that many smart growth developments face.

To address this barrier, more developers with a working knowledge of smart growth approaches are needed. Information-sharing among developers, through venues such as the National Association of Home Builders, about their experiences with smart growth can be a step toward meeting these needs. Because developers have intimate knowledge of the development process, they can provide valuable information on how to implement many of the ideas discussed in this section. Developers can therefore be strong advocates for techniques that protect water quality, save them money, and build better neighborhoods.

Practice Tip: The Builders for the Bay project is a unique partnership between the development and environmental communities. The Center for Watershed Protection, the Alliance for the Chesapeake Bay, and the National Association of Home Builders have agreed to hold local roundtables in the Chesapeake Bay watershed to help local jurisdictions incorporate more environmentally sensitive site designs into existing subdivision codes and ordinances. Currently, many localities require a special exception process for developers to utilize these techniques. Adoption of the regulations developed through these roundtables would provide more flexibility in the development process, help preserve natural areas, reduce stormwater runoff, and achieve cost savings. Roundtable participants include local government planning and zoning departments, watershed organizations, developers, landowners, and other community stakeholders.¹¹⁸

- ⁸⁵National Stormwater Best Management Practices Database. <www.bmpdatabase.org>. Also, Center for Watershed Protection. The Stormwater Manager's Resource Center. <www.stormwatercenter.net>.
- ⁸⁶North Carolina Wildlife Resources Commission. August 2002. *Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality*. <216.27.49.98/pg07_wildlifespeciescon/pg7c3_impacts.pdf>.
- ⁸⁷The Green Roof Infrastructure Monitor. 2001. "Portland Provides Incentives for Green Roof Implementation." *The Green Roof Infrastructure Monitor*. 3:1. <www.greenroofs.ca/grhcc/GRIM-Spring2001.pdf>.
- ⁸⁸Florida Departments of Community Affairs and Environmental Protection. November 2002. *Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices*. <www.dca.state.fl.us/fdcp/DCp/publications/springsmanual.pdf>.
- ⁸⁹Jackson Meadow. Home page. <www.jacksonmeadow.com>.
- ⁹⁰Maryland Department of the Environment. *Maryland Stormwater Design Manual, Volumes I & II* (Effective October 2000). <www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp>.
- ⁹¹U.S. EPA, Office of Water. "National Menu of Best Management Practices for Storm Water Phase II." National Pollutant Discharge Elimination System (NPDES). <cfpub.epa.gov/npdes/stormwater/menuofbmps/menu.cfm>.
- ⁹²U.S. EPA. Development, Community, and Environment Division. June 2003. *Minimizing the Impacts of Development on Water Quality* [Draft].
- ⁹³Maupin, Miranda and Teresa Wagner. 2003. "Regional Facility vs. On-site Development Regulations: Increasing Flexibility and Effectiveness in Development Regulation Implementation." Presented at the National Conference on Urban Stormwater: Enhancing Programs at the Local Level. Chicago, Illinois. February 17-20, 2003. U.S. EPA, Office of Wetlands, Oceans, and Watersheds. <www.epa.gov/owow/nps/natlstormwater03/22Maupin.pdf>.
- ⁹⁴Metropolitan Government of Nashville and Davidson County. Metro Stormwater Management Manual. <www.nashville.gov/stormwater/non_discharge_policy_directive.htm>.
- ⁹⁵Brown, Whitney. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Ellicott City, MD: Center for Watershed Protection. <www.cwp.org>.
- ⁹⁶U.S. EPA. Development, Community, and Environment Division. February 2003. *Using Smart Growth Policies to Help Meet Phase II Storm Water Requirements* [Draft]. Also see City of San Diego. Appendix G: LEAD Method As Proposed by the City of San Diego. <www.sdcounty.ca.gov/dpw/docs/AppendixGLeadMethod.pdf>.
- ⁹⁷Portland Development Commission. 1999. Building for the Future: Sustainable Development in Portland. <www.fish.ci.portland.or.us/pdf/pdc1.pdf>.
- ⁹⁸Pennsylvania Horticultural Society. February 1999. Impact 2000 - Public Landscapes. <www.pennsylvaniahorticulturalsociety.org/impact2000/Feb99.html>.
- ⁹⁹Chicago Department of Environment. Rooftop Gardens and Green Roofs. <www.ci.chi.il.us/Environment/AirToxPollution/UrbanHeatIsland/heatland6.html>.
- ¹⁰⁰Chicago Department of Environment. City Hall Rooftop Garden. <www.ci.chi.il.us/Environment/rooftopgarden>.
- ¹⁰¹Prince George's County Department of Environmental Resources. January 2000. Low Impact Development Design Strategies: An Integrated Design Approach.
- ¹⁰²Puget Sound Action Team. Low Impact Development. <www.psat.wa.gov/Programs/LID.htm>.
- ¹⁰³U.S. EPA. Development, Community, and Environment Division. Smart Growth Policy Database. <cfpub.epa.gov/sgpdb/sgdb.cfm>.
- ¹⁰⁴City of Columbus. 2003. Planning Overlay, 33 Columbus City Codes, ch. 3372, §701-10.
- ¹⁰⁵Metropolitan Council. January 2000. Model Storm Water Management Ordinance. <www.metrocouncil.org/environment/Watershed/model_sw_ord.pdf>.
- ¹⁰⁶Grand Traverse County Department of Public Works. Stormwater and Sediment and Erosion Control Ordinance: Operation and Maintenance. <www.epa.gov/owow/nps/ordinance/documents/D2a-GrandTraverse.pdf>.
- ¹⁰⁷New York City Department of Environmental Protection. New York City's Water Supply System. <www.nyc.gov/html/dep/html/agreement.html>.

¹⁰⁸U.S. Water News Online. "Proposed Denver law nurtures xeriscape growth." <www.uswaternews.com/archives/arconserv/2proden4.html>.

¹⁰⁹Florida Departments of Community Affairs and Environmental Protection. November 2002. *Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices*. <www.dca.state.fl.us/fdcp/DCp/publications/springsmanual.pdf>.

¹¹⁰Witherall, Don. Maine Department of Environmental Protection. Email communication with Lynn Richards, U.S. EPA, Office of Policy, Economics, and Innovation. June 19, 2003. Also see: <www.state.me.us/dep/blwq/stand>.

¹¹¹Montgomery County Department of Public Works and Transportation Parking Services. Public Parking District Overview. <www.dpwt.com/parking/Overview.htm>.

¹¹²City of Olympia, Public Works Department. Impervious Surfaces Study. <www.ci.olympia.wa.us/publicworks/images/pdf/ipds.pdf>.

¹¹³Cherry Creek Stewardship Partners. Home Page. <cherry-creek.org>.

¹¹⁴Planning with POWER. Home page. <www.planningwithpower.org>.

¹¹⁵Ottawa County Planning Department. October 2003. "If You Are Thinking About Moving to the County You Want to Consider This..." Ottawa County, MI.

¹¹⁶Hottenroth, Dawn, C. February, 2003. "Using Incentives and Other Actions to Reduce Watershed Impacts from Existing Development." Presented at the National Conference on Urban Stormwater: Enhancing Programs at the Local Level. Chicago, IL. February 17-20, 2003. U.S. EPA, Office of Wetlands, Oceans, and Watersheds. <www.epa.gov/owow/nps/natlstormwater03>.

¹¹⁷Southwest Florida Water Management District. Project WET. <www.swfwmd.state.fl.us/infoed/educators/wet.htm>. (Accessed July 30, 2003).

¹¹⁸Center for Watershed Protection. Builders for the Bay. <www.cwp.org/builders_for_bay.htm>.