

# Low Impact Development (LID) Handbook Hamilton, Massachusetts



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## **1.0 INTRODUCTION**

### **1.1 What Is Low Impact Development (LID)?**

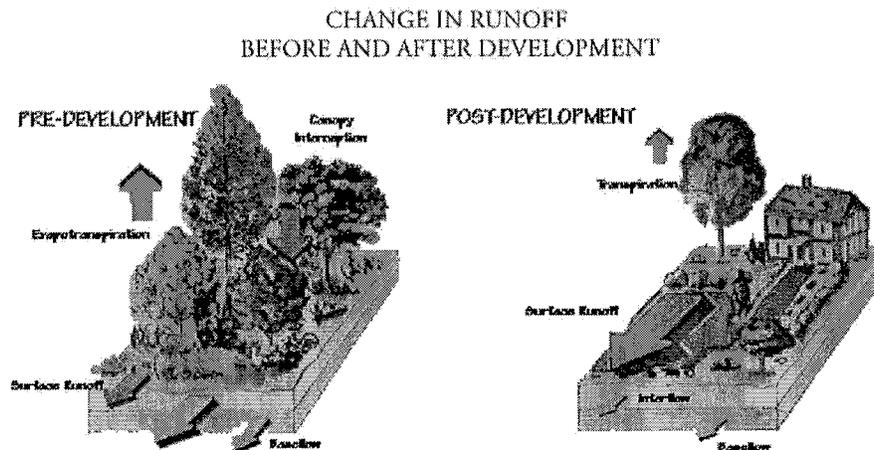
The term Low Impact Development (LID) refers to a variety of design techniques used in the planning of both residential and commercial developments. LID uses a variety of methods to:

- Reduce paved (impervious) areas,
- Distribute and diffuse stormwater runoff,
- Conserve natural habitats, and
- Provide groundwater recharge.

These techniques help reduce the amount of runoff that a site generates. LID management measures are encouraged to minimize reliance on structural management measures. The use of one or more site design measures by the applicant may allow for a reduction in the water quality treatment volume required and the stream channel protection volume required.

The design components that are evaluated as part of LID or better site design include street widths, street length, parking lots, rooftop runoff, and conservation of natural habitats. LID encourages minimization of impervious surfaces, protection of critical environmental resource areas, and preservation of naturally-vegetated buffers. Any reductions in impervious cover result in reduced stormwater runoff and, consequently, smaller land consumption areas and lower construction costs.

An example of low impact development is the reduction of individual lot sizes. Many residential neighborhoods are often designed using large uniformly shaped lots that use more land than necessary, and create more impervious cover and more turf, as shown in Figure 1. With LID, open space developments are encouraged. Open space developments can conserve existing natural areas by minimizing the amount of impervious cover and turf created while providing the same number of housing units. In addition, open space developments can preserve existing farmland and agricultural uses.



This diagram shows how development and its corresponding increase in impervious cover disrupts the natural water balance. In the post-development setting, the amount of water running off the site is dramatically increased.

*Copyright 2000, Center for Watershed Protection*

*Figure 1: Post Development Runoff Changes*

The principles presented here are not strict guidelines. For example, street width decisions should be balanced with maintenance access, safety, and economic issues. LID principles should fit in with the character of Hamilton to meet unique conditions in the community. LID guidelines act as benchmarks, but are not applied as cookie cutters and they must be consistent with environmental and watershed plans.

## 1.2 Methods to Minimize Impacts from Impervious Surfaces

When considering total impervious cover in the landscape, as much as 65% can be classified as "car habitat." Consequently, several of these principles address how to reduce car habitat in new developments, including streets, parking lots, and other structures designed for the car. Ways to minimize impervious surfaces include:

- Reducing
  - Required Road Widths;
  - Residential Street Lengths;
  - Paved Right of Ways;
  - Parking Lot Impervious Area;
- Minimizing cul-de-sac paving;
- Lowering Parking Space Ratios; and
- Using Natural Stormwater Treatment.

### **1.3 Low Impact Development Credits**

In an effort to apply a unconventional approach to stormwater management, the Executive Office of Environmental Affairs (EOEA) developed five specific non-structural practices called LID credits, or incentives for better environmental site design, are provided for designers that will significantly reduce the size and cost of structural practices. The LID credit descriptions are included in Attachment A.

The five proposed non-structural LID credits are:

- Environmentally Sensitive Development
- Disconnection of Rooftop Runoff
- Disconnection of Non-Rooftop Runoff
- Stream Buffers
- Grass Channels

Non-structural practices are increasingly recognized as a critical feature of effective stormwater management, particularly with respect to site design. In most cases, non-structural practices will need to be combined with structural practices to meet stormwater requirements. The key benefit of non-structural practices is that they can reduce the generation of stormwater from the site. In addition, they can provide partial removal of many pollutants and contribute to groundwater recharge.

## 2.0 REDUCE RESIDENTIAL STREET WIDTH

Excessively wide residential streets can often be attributed to blanket applications of high volume, high speed highway design criteria applied to local subdivision streets and a perception for the need for on-street parking on both sides and unobstructed access for emergency vehicles.

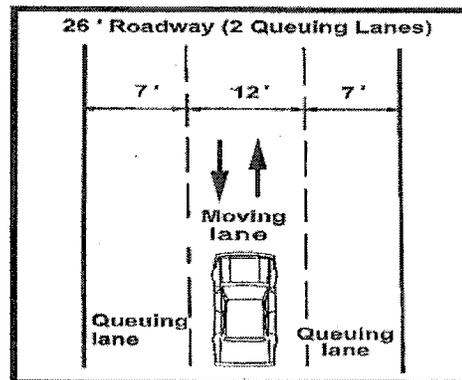
Instead, design residential streets for minimum pavement width needed to support travel lanes; on-street parking; emergency, maintenance, and service vehicle access. Street widths should be based on traffic volume.



*Residential streets are often excessively wide, especially when blanket application of highway design criteria are used.*

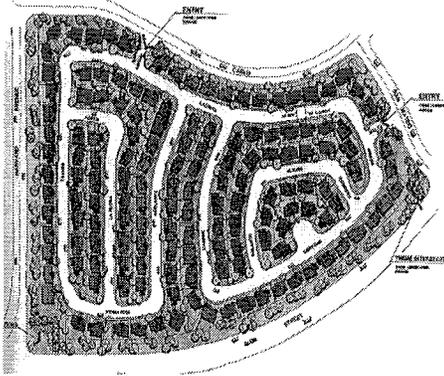


*Narrow residential streets reduce traffic speeds, improve safety, provide sufficient access and parking, and reduce the amount of impervious cover created.*



### 3.0 REDUCE RESIDENTIAL STREET LENGTH

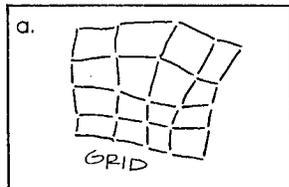
Reducing the total street length constructed for new residential developments can be achieved by examining alternative layouts that increase the number of homes served per unit length of street.



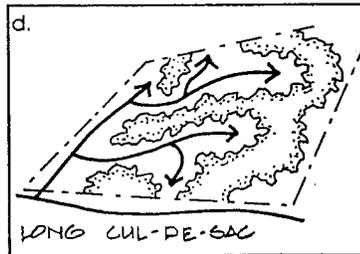
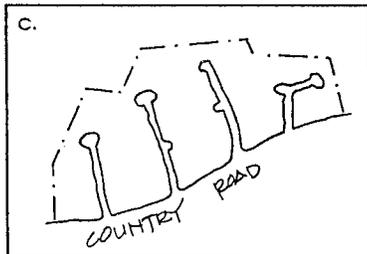
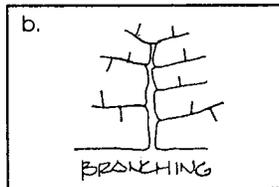
Most communities do not explicitly require the shortest street network needed to serve individual lots on residential streets. It is generally assumed that the cost of constructing roads is sufficient incentive to assure short street networks. Streets are designed to accommodate rapid, smooth traffic flow, and consequently, total street length is rarely the most important design consideration.

While no particular street layout can guarantee a reduction in street length, some alternatives can help maximize the number of homes served per unit length.

TRADITIONAL

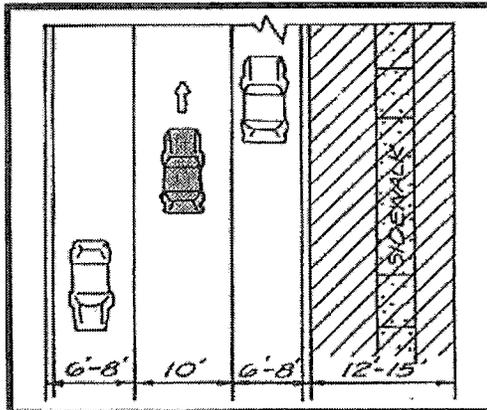


ALTERNATIVE



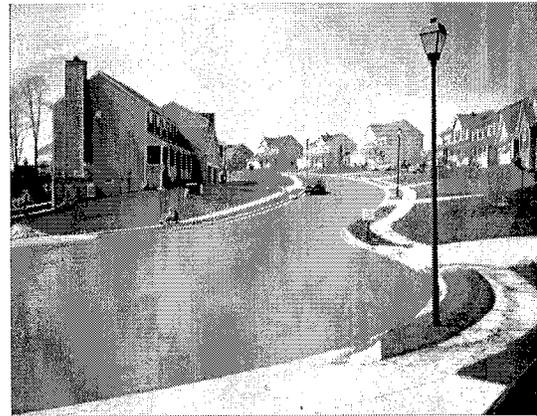
### 3.1 Reduce Residential Right-of-Way Widths

Residential street right-of-way widths should be the minimum to accommodate the travel-way, the sidewalk, and open channels. While a wide right of way does not necessarily create more impervious cover, it subjects a greater area to clearing and consumes land that could be preserved as open space by achieving a more compact site design.



In many communities, a single right of way width of 50 - 60 feet is applied to all residential street categories. Utilities and storm drains should be located within the pavement section of the right-of-way. By redesigning each of the main components of the right-of-way (ROW), residential street sections can be significantly reduced.

Some techniques include reducing street width, narrowing sidewalks or restricting it to one side, narrowing the border width between street and sidewalk, and/or installing utilities under street pavements. The combined effect can be a reduction of 10 to 25 feet in total street width. Another technique is to use monumental entryways to provide open space and a more attractive street layout between right-at-ways.



*Blanket application of street design standards can create excessively wide right-of-ways.*



*Rather than a small median dividing the street right-of-ways, this monumental entryway can provide open space and a more attractive street layout between right-of-ways.*

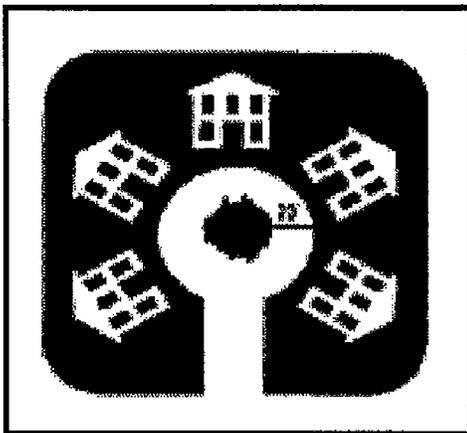
### 3.2 Minimize Cul-de-Sacs

Many communities require the end of cul-de-sacs to be 50 to 60 feet in radius, creating large circles of impervious cover. Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. The radius should instead be the minimum needed for emergency and maintenance vehicles. Alternative turnarounds should be considered

There are several different options for reducing the total amount of impervious cover created by traditional cul-de-sacs. One option is to reduce the radius of the turnaround bulb. Several communities have implemented this successfully and the smaller radii can range from 33 to 45 feet.



*This aerial photograph emphasizes the excessive amount of impervious cover created by large cul-de-sacs.*



Secondly, since most vehicles only use the outside of a cul-de-sac when turning, a second option is to create a pervious island in the middle of the cul-de-sac creating a donut like effect.

The amount of impervious surface created by cul-de-sacs can be reduced by creating a pervious island in the center. With proper grading of the island, it could also provide stormwater drainage.

### 3.3 Lower Parking Ratios

The required parking ratio for a land use should be enforced as both a maximum and a minimum in order to curb excess parking. In many cases, Town parking ratios are excessive and there are no set maximum parking ratios. The size of parking lots proposed by developers may be larger than necessary.

The fear of complaints and loss of customers, as well as the requirements for commercial loans are disincentives for setting maximum parking ratios. As a result, many parking lots are often fully utilized only for a few hours each year.



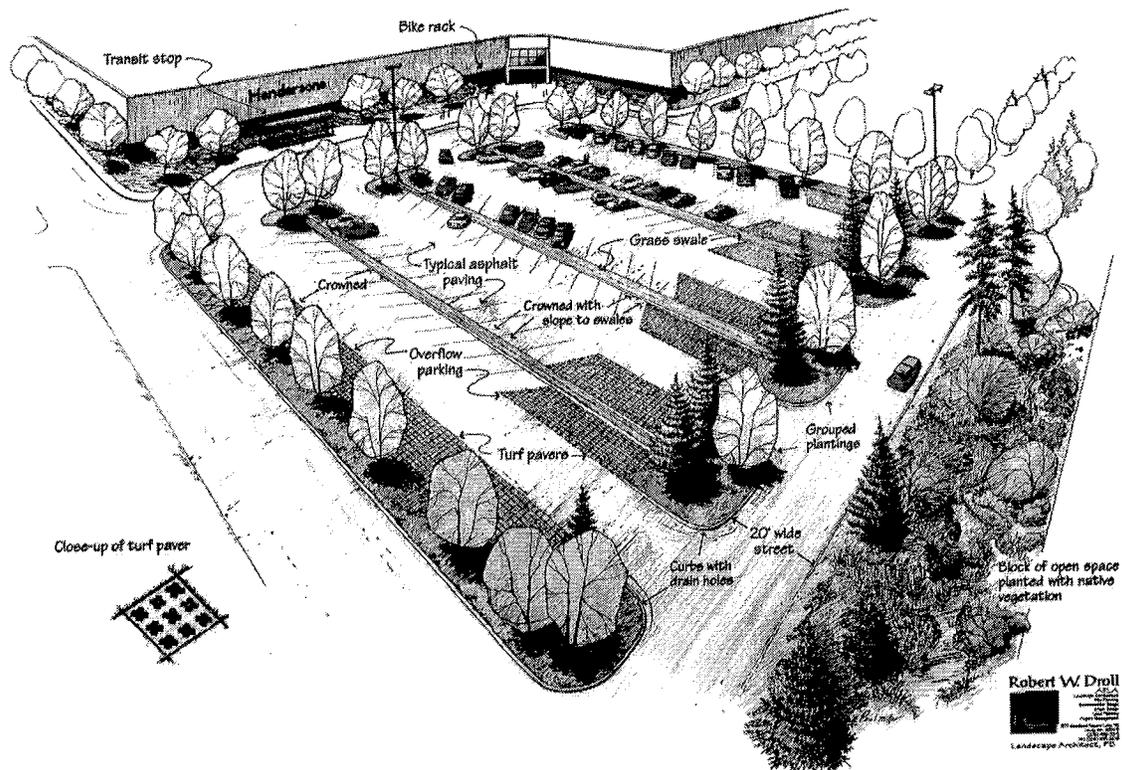
*One of the goals of LID is to avoid big, empty parking lots like this.*

Communities should check their codes to make sure that the minimum and maximum number of spaces required is consistent with the demand for uses. This type of management can reduce construction and stormwater management costs.

### 3.4 Reduce Parking Lot Impervious Area

One of the goals of LID is to avoid big, empty parking lots. By providing parking spaces according to appropriate land use needs, large, unused lots can be avoided. Parking lots can also be reduced by minimizing standard parking dimensions in length and width, amending parking codes to require a fixed percentage for compact cars, and requiring designation of spillover parking areas using alternative paving materials. While reducing the number of parking spaces created is essential to reducing the amount of impervious cover, reducing the size of standard parking stall dimensions is another opportunity.

Some real challenges to these techniques are that there is an increasing trend toward larger sports utility vehicles and the performance of alternative pavements is not well documented. In addition, construction costs for alternate pavers are generally greater than conventional surfaces, but the reductions in stormwater management and storm drainage construction and maintenance may offset those costs.



### 3.5 Use Natural Stormwater Treatment on Parking Lots

Structural drainage systems and storm sewers are designed to efficiently remove storm water. However, in doing so these systems tend to increase peak runoff discharges, flow velocities, and the delivery of pollutants to downstream waters. Where possible, provide storm-water treatment for parking lot runoff using dry swales, vegetative channels, bioretention areas, filter strips, and other practices that can be integrated into landscaping areas.

Natural open channels store more storm water onsite, lower storm-water peak flows, reduce erosive runoff velocities, infiltrate a portion of the runoff volume, and capture and treat storm-water pollutants. Used upstream from natural drainage ways, they reduce post-development flows and prevent erosion and degradation.

Runoff can also be directed toward riparian buffers and other undisturbed natural areas delineated in the initial stages of site planning. They can infiltrate runoff, reduce runoff velocity, and remove pollutants. Natural depressions can temporarily store and infiltrate water. Natural areas can intercept and infiltrate runoff before it becomes substantially concentrated.



*This parking lot island has been designed as a bioretention facility. Runoff is directed into the shallow landscaped areas where treatment is provided.*

### 3.6 Open Space Design Options

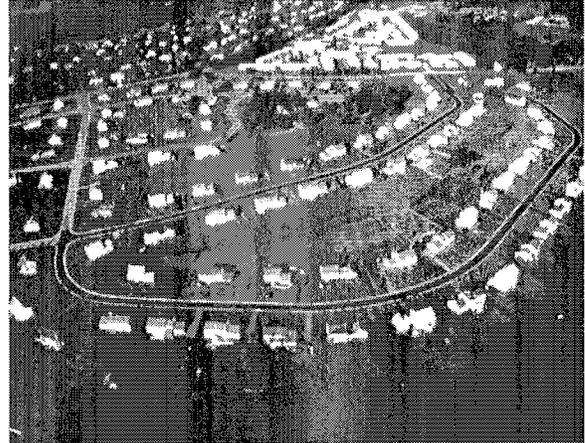
Open space developments encourage the evaluation of development to determine if they really meet impervious cover reduction and land conservation goals.

Open space development design;

- Incorporates smaller lot sizes to minimize total impervious area,
- Conserves natural areas,
- Provides community space, and
- Promotes watershed protection.

Open space developments can reduce impervious cover, stormwater runoff, construction costs and preserve existing farmland and agricultural uses. Although open space development (or cluster design)

has been advocated by planners for many years, they are only rarely applied in the development process. In addition, open space developments often require a special exception zoning variance (i.e. they are not a by-right form of development) or additional review step which require more time for review.



*Many residential neighborhoods are often designed using large uniformly shaped lots that use more land than necessary, and create more impervious cover and more turf.*



*One of the goals of open space development is to conserve existing natural areas by minimizing the amount of impervious cover created while providing the same number of housing units.*

### 3.7 Relax Setback & Frontage Distances

Relaxed side yard setbacks and narrower frontages reduce total road length in new developments. In addition, relaxed front setback requirements minimize driveway lengths. Many current subdivision codes have very strict requirements that govern lot geometry, including setbacks and lot shape. These criteria constrain site planners from designing open space or cluster developments that can reduce impervious cover.

Smaller front and side setbacks, often essential for open space designs, are typically not permitted or require a zoning variance which may be difficult to obtain. Relaxing setback requirements allows developers to create attractive, compact lots that are marketable and livable.



*One of the goals of LID is to reduce large front setbacks, which create the need for longer driveways and more impervious cover.*

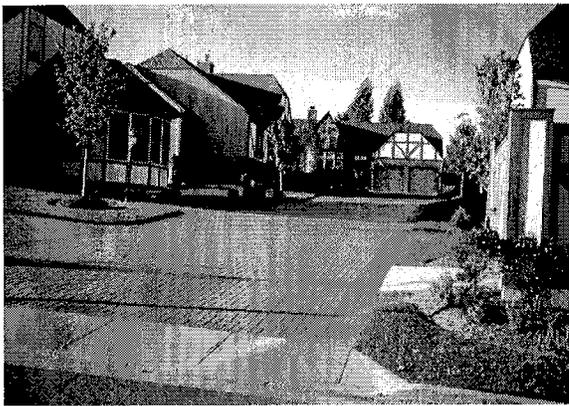
Concerns that fire could spread easily from one home to another and the potential for housing too close to the street to limit sight distance for drivers are also common reasons cited against relaxed setbacks. In fact, typical requirements allow detach housing to be as close at 5 feet without specific fire protection measures and with the development of fire retardant materials and the use of fire walls, large setbacks are unnecessary.

### 3.8 Alternative Driveways

Impervious areas can be reduced by promoting alternative driveway surfaces and shared driveways that connect two or more homes together. The typical 400-800 square feet of impervious cover per driveway can be minimized by specifying narrower driveway widths, reducing the length of driveways and front setbacks, and providing incentives for permeable paving materials.



*Shorter driveways and the use of alternate materials can also help reduce impervious areas which in turn reduce stormwater management costs*

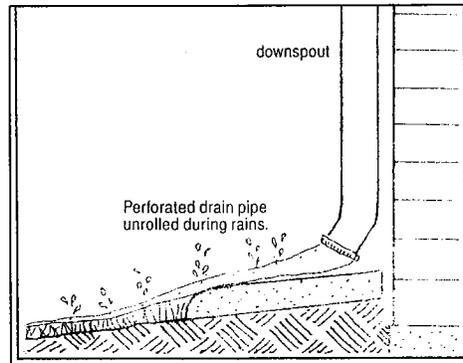


must pour concrete, keep the paved area as small and narrow as possible.

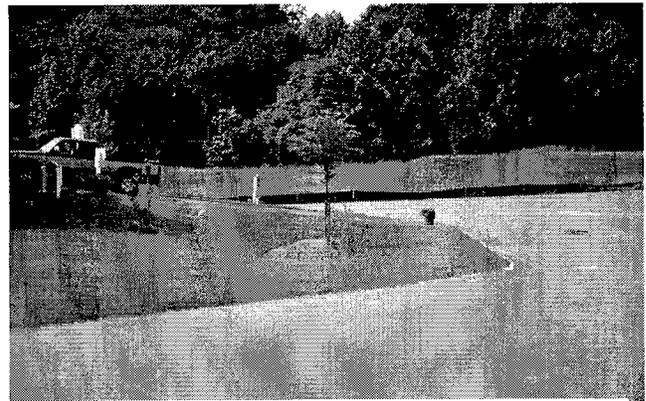
Concrete and asphalt roads, driveways, and walkways are completely impervious; they prevent any rainwater from soaking into the ground. Consider alternative materials such as gravel or wood chips for walkways. Where you need a more solid surface, consider using a "pervious pavement" made from interlocking cement blocks, hard plastic grids filled with stone or earth, or rubber mats that allow spaces for rainwater to seep into the ground. If you

### 3.9 Direct Rooftop Runoff to Pervious Areas

Design rooftops to runoff to pervious areas such as yards, open channels, or vegetated areas and avoid routing rooftop runoff to the roadway and the stormwater conveyance system. Unfortunately, code requirements discourage the storage and treatment of rooftop runoff on individual lots, thus bypassing opportunities to promote bioretention and infiltration. Most subdivision codes require that yards have a minimum slope to facilitate drainage away from house foundations for fear of nuisance ponding, basement flooding, or ice formation on driveways or sidewalks.



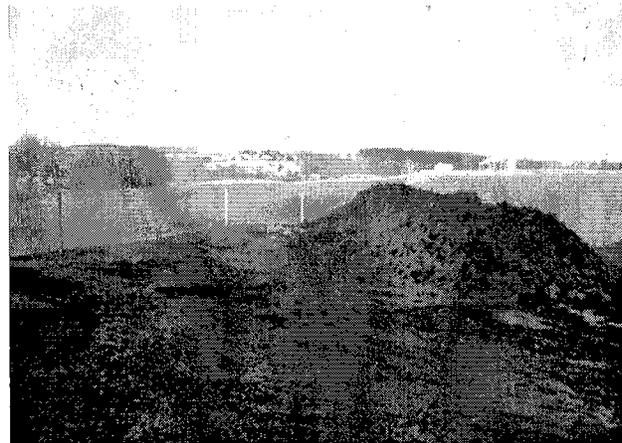
Sending rooftop runoff over a pervious surface before it reaches an impervious one can decrease the annual runoff volume from residential development sites by as much as 50%. Some possible techniques to encourage treatment of rooftop runoff on-site include directing flow into BMPs (infiltration swales, infiltration trenches, or dry wells), encouraging sheet flow through vegetated areas, directing runoff to depression storage areas, or using a rain barrel.



*One alternative to managing rooftop runoff is to provide filtration on the lot by using a bioretention area.*

### 3.10 Minimize Clearing Native Vegetation

Clearing and grading of native vegetation should be limited to the minimum needed to build lots, allow access, and provide fire protection. Most communities allow clearing and grading of an entire development site, with a few exceptions for regulated areas such as jurisdictional wetlands, steep slopes, and floodplains. The preservation of natural areas helps balance the impacts of development by maintaining the natural hydrologic cycle and limiting the amount of disturbed soils.



*Simultaneously clearing and grading an entire development site is a common construction practice.*

Clearing should be limited to the minimum area required for building footprints, construction access, and safety setbacks. Existing tools that could be adapted to limit clearing include erosion and sediment control ordinances, grading ordinances, forest conservation or tree protection ordinances, and open space development.



*Site fingerprinting minimizes clearing and grading by removing only the vegetation necessary to build and provide access for construction of the buildings.*

Site fingerprinting minimizes clearing and grading by removing only the vegetation necessary to build and provide access for construction of the buildings. In addition, phasing construction is another technique that can be a very effective erosion and sediment control measure.