CHAPTER 2

Guidance for Sustainable and Resilient Development Design

- √ Elements of Sustainable Site Design
- √ Preservation of Natural Features
- √ Resilient Design and Hazard Mitigation
- √ Conservation Design for Subdivisions
- √ Reduction and Disconnection of Impervious Cover
- √ Wetland and Stream Buffers

Sustainable site design incorporates approaches to new and redevelopment projects which reduce impacts on watersheds by conserving natural areas and better integrating stormwater treatment and flood protection.

2.1 INTRODUCTION TO SUSTAINABLE SITE DESIGN

The aim of sustainable site design is to reduce the environmental "footprint" of the site while retaining and enhancing the owner/developer's purpose and vision for the site. Many of the sustainable site design concepts employ non-structural on-site treatment that can reduce the cost of infrastructure while maintaining or even increasing the value of the property relative to conventional designed developments. Non-structural treatment is the treatment of stormwater by maintaining a focus on preserving open space, protecting natural systems, and incorporating existing landscape features such as wetlands and stream corridors into a site plan to manage stormwater at its source. In other words, it is the treatment of stormwater without a structure.

The goals of sustainable site design include:

- Prevent stormwater impacts rather than having to mitigate for them;
- Manage stormwater (quantity and quality) as close to the source as possible and minimize the use of large or regional collection and conveyance;
- Preserve natural areas, native vegetation and reduce the impact on watershed hydrology;
- Use natural drainage pathways as a framework for site design;
- Reduce soil compaction during construction to maintain infiltration capacities of the soil;
- Minimize the amount of disturbance to existing, mature stands of vegetation;
- Utilize simple, non-structural methods for stormwater management that are lower cost and lower maintenance than structural controls; and
- Create a multifunctional landscape.

The first series of stormwater site design practices and techniques can be grouped into Preservation of Natural Features and Conservation Design. Discussion of non-structural techniques on site and lot, such as reductions in impervious surface and disconnection, will follow.

2.2 PRESERVATION OF NATURAL FEATURES

Preservation of natural features includes techniques to foster the identification and protection of natural areas that can be used in the conservation of water resources. Whether a large contiguous area is set aside as a preservation zone or certain smaller areas have been identified as appropriate for preservation, protecting established vegetation (existing trees, shrubs, grasses, and other flora) can help reduce revegetation requirements, reduce long-term erosion, preserve habitat, protect water and land resources, and maintain a healthy ecosystem.

Other benefits include:

- An immediate finished "aesthetic" that does not require time to establish;
- Increased stormwater infiltration due to the ability of mature vegetation to process higher quantities of stormwater runoff than newly seeded areas;
- Reduced runoff velocity, quantity, (by intercepting rainfall, promoting infiltration, and lowering the water table through transpiration, among others);
- Provides a buffer against noise and visual disturbance during construction; and
- Usually requires less maintenance (e.g., irrigation, fertilizer), land clearing labor and costs than planting new vegetation.

SITE ASSESSMENT

In order to reach these benefits, it is important to first identify and preserve sensitive areas on the site. A site assessment is the process whereby the design team conducts an in-depth evaluation of the overall environmental conditions of the proposed development or redevelopment prior to detailed site design. Natural conservation areas are typically identified using mapping and field reconnaissance assessments. Areas proposed for protection should be delineated early in the planning stage, long before any site design, clearing or construction begins.

The goal is to broadly identify and evaluate the ecological systems influencing the area to reduce cost and time impacts from a design, construction and maintenance perspective. Achieving cost reductions is a direct result of an understanding of environmental characteristics and integrating the most appropriate construction. The initial design and planning phase is the most appropriate time to conduct the site assessment. Items to examine during a site assessment should include:

- soil types and infiltration rates;
- health and types of existing vegetation (trees, grasses, shrubs and forbs);
- riparian areas and significant waterways;
- prominent landforms;
- depression storage;
- wetlands; and
- floodplains.

Identifying these areas can help inform later development, as sites should be located to avoid sensitive resource areas such as floodplains, erodible soils, wetlands, mature forests and critical habitat areas. Buildings, roadways, and parking areas should be located to fit the terrain and in areas that will create the least impact.

WETLANDS

Generally, wetlands are areas where regular or intermittent saturation with water determines soil type, flora and fauna. Non-tidal wetlands are most common in floodplains along rivers and streams, in isolated depressions surrounded by dry land, along the margins of lakes and ponds, and in other low-lying areas. While wetland plants and soils filter stormwater before it goes into groundwater or into rivers, a significant cause of loss for tidal and non-tidal wetlands is new development.

Wetlands that are considered waters of the United States are regulated under §404 of the Federal Clean

Water Act. The U.S. Army Corps of Engineers, under provisions of the Clean Water Act and the Rivers and Harbors Act, must issue a federal permit to allow impacts to both tidal and non-tidal wetlands and shallow water habitat. It is illegal to drain or fill a wetland without a permit from the U.S. Army Corps of Engineers. The entire Texas coast is under the jurisdiction of the Corps' Galveston District Office. Before a permit can be granted, the requestor must show that the project has considered all viable alternatives and minimized impacts as much as possible. Any wetland loss must be compensated for by constructing new wetlands, restoring or enhancing existing wetlands, or purchasing credits from an approved wetland mitigation bank.

FLOODPLAINS

Development in floodplain areas can reduce the ability of the floodplain to convey stormwater, potentially causing safety problems or significant damage to the site in question, as well as to both upstream and downstream properties. Ideally, the entire 100-year floodplain should be avoided for clearing or building activities and should be preserved in a natural undisturbed state. If development has already occurred in the floodplain, it should follow FEMA guidelines and, when possible, future development should stay out of these and other local floodplains.

Once identified, preservation areas should be incorporated into site development plans and clearly marked on all construction and grading plans. This will ensure that construction activities are kept out of these areas and that native vegetation is kept in an undisturbed state. The boundaries of each preservation area should be mapped by carefully determining the limit which should not be crossed by construction activity.

SOILS

Areas of a site with permeable soils (hydrologic soil group A and B), such as sands and sandy loam soils, should be conserved as much as possible. These areas should ideally be incorporated into undisturbed natural or open space areas. Conversely, buildings and other impervious surfaces should be located on those portions of the site with the least permeable soils. Similarly, areas on a site with highly erodible or unstable soils should be avoided for land disturbing activities and buildings to prevent erosion and sedimentation problems, as well as potential future structural problems. These areas should be left in an undisturbed and vegetated condition.

CONSTRUCTION & MAINTENANCE CONSIDERATIONS

Once a site is under construction, methods to minimize disturbance should be used to limit the amount of clearing and grading that takes place on a development site. This will help in preserving the undisturbed vegetation and natural hydrology of a site. A limit of disturbance (LOD) should be established based on the maximum disturbance zone. These maximum distances should reflect reasonable construction techniques and equipment needs together with the physical situation of the development site such as slopes or soils. LOD may vary by type of development, size of lot or site, and by the specific development feature involved.

Not only should these natural conservation areas be protected during construction, but they should also be managed after occupancy by a responsible party able to maintain the areas in a natural state in perpetuity. Typically, conservation areas are protected by legally enforceable deed restrictions, conservation easements, and a maintenance agreement.

2.2.1. BUFFER ZONES

A riparian buffer is a special type of natural conservation area along a stream, wetland or shoreline where development is restricted or prohibited. The primary function of buffers is to protect and physically separate waterbodies from future disturbance or encroachment. If properly designed, a buffer can provide stormwater management functions, act as a right-of-way during floods, and sustain the integrity of water resource ecosystems and habitats. Ideally, all buffers should remain in their natural state.

Buffer zones protect waterways, coastal marshes, and wetlands from the short- and long- term impacts of development activities. Buffer zones prevent conversion of sensitive lands to developed areas, which minimizes the potential for erosion and sediment loss into tidal waters. In addition, buffer zones preserve areas that provide important water quality benefits and maintain riparian and aquatic habitats.

TIDAL BUFFERS

Buffers serve as the protective zone between upland development and the salt marsh and open water beyond. Buffers reduce erosion and capture pollutants such as nitrogen, phosphorous, pesticides, fertilizers, and sediments before they reach the water or marsh. Buffers also serve as wildlife habitat corridors and increase the aesthetic appearance of the marsh. All of these functions ultimately help to protect the adjacent marsh from the effects of development.

FOREST BUFFERS

In a forested ecosystem, existing forested riparian buffers should be maintained. Where no wooded buffer exists, reforestation should be encouraged. Proper restoration should include all layers of the forest plant community, including trees, understory, shrubs and groundcover.

CREEK AND RIVER BUFFERS

Natural buffer areas play an important role in maintaining pre-development water quality. Riparian vegetation stabilizes stream channels and floodplain areas, reducing the potential for creek erosion. Riparian buffers also provide filtration for overland flow from adjacent development projects. This filtering is beneficial during construction to retain sediment from up-gradient disturbed areas and also after construction to polish stormwater discharged from water quality measures. There are many benefits provided by buffer systems including:

- Minimizing activities that degrade, destroy, or negatively impact the value and function of coastal marshlands;
- Increasing pollutant removal including trapping sediment;
- Increasing distance of impervious areas from the drainage/creek/wetland/tidal waters;
- Moderating overland flow;
- Discouraging excessive storm drain systems;
- Increasing property values;
- May prevent severe rates of soil erosion;
- Minimizes disturbance to creek bank slopes;
- Improves water quality;
- Providing effective flood control;
- Helping protect nearby properties from the shifting and widening of the stream channel that occurs over time;
- Reducing small drainage problems and complaints by residents that are likely to experience backyard flooding;
- Enhancing the marshlands' scenic value and recreational opportunities;
- Protecting the terrestrial coastal habitat for nesting and feeding wildlife;
- Protecting important nursery areas for fisheries, which provide food and habitat to numerous species of fish, shellfish, including commercially important species; and
- Serving as the foundation for present or future greenways.

The purpose of the riparian buffer is to adequately protect waterways and aquatic resources from the short- and long-term impacts of development activities by providing a contiguous protection zone along the riparian corridor that is associated with natural drainage features. In many creeks, streams, and rivers, the floodplain is an integral part of the stream-riparian ecosystem. Due to natural topography and geomorphology, some streams are constrained to narrow valleys or ravines.

Many scientists and engineers have evaluated the effectiveness of riparian buffers and have found that riparian buffers can be an effective tool to reduce overland flow to streams, wetlands, and coastal marshes. Riparian buffer effectiveness has also been shown to be dependent on the condition of the watershed and should be used in concert with upslope watershed management.

LAND OR DEVELOPMENT RIGHTS ACQUISITION TO PROTECT SENSITIVE AREAS

An effective way to protect environmental integrity of an area is to preserve the land. The following practices can be used to protect beneficial uses:

- Fee Simple Acquisition/Conservation Easements
- Transfer of Development Rights
- Purchase of Development Rights
- Land Trusts
- Agricultural and Forest Districts

2.2.2. DEPRESSION STORAGE PRESERVATION

Depression storage occurs when a particular area of land retains water in natural depressions, effectively storing stormwater and allowing it more time to infiltrate into the soil. Generally, areas draining to depression generate no runoff until the storage has been filled, thus, making depression storage a natural, effective, and cost-free method of reducing the volume of stormwater runoff from a site. Standard design and construction practices remove these natural depressions in order to promote drainage; however minor depressions in the landscape should be treated as sensitive resource areas and should be protected from construction activities.

Due to the important role depressions play within drainage, water quality, and ecological components of the natural stormwater system, all attempts shall be made to incorporate depressions within localized stormwater management plans.

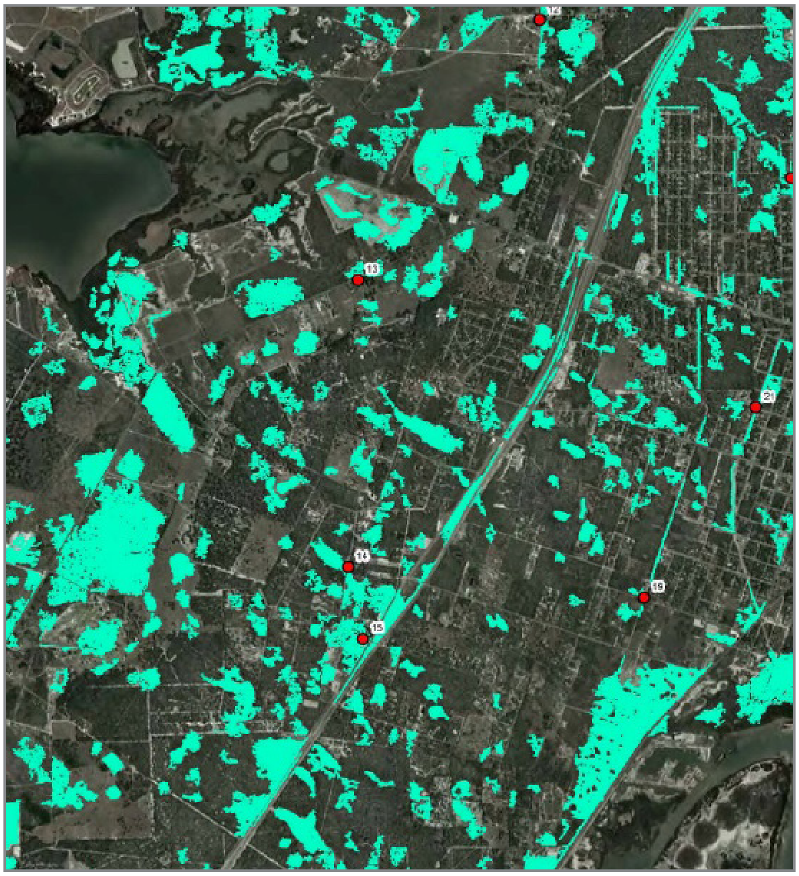

Figure 2-1: Depression storage in Aransas County, Texas (Larger than 1 acre in size and deeper than 2 feet).

2.3 RESILIENT DESIGN AND HAZARD MITIGATION

The Texas General Land Office (GLO) is leading the development and implementation of the Coastal Resiliency Master Plan (Plan) to protect communities and natural resources along the Texas Coast. The Plan will provide a framework for community, socio-economic, ecologic and infrastructure protection from coastal hazards, including short-term direct impact (e.g., flooding, storm surge) and long-term gradual impacts (e.g., erosion, habitat loss). The GLO is committed to protecting coastal resources and infrastructure by reducing vulnerability and protecting assets and the environment.

The Plan also provides a list of projects and strategies to address those problems – ensuring that the Texas coast is more resilient for generations to come. The initial screening process resulted in approximately 500 projects, programs, and land acquisitions warranting further evaluation. The Plan will continuously evolve along with the concerns and needs of the coast and its residents to ensure that recurrent and up-to-date coastal management is provided to coastal communities.

Key project types pertinent to stormwater management include:

- Restoration of beaches and dunes
- Bay shoreline stabilization and estuarine wetland restoration
- Freshwater wetlands and coastal uplands conservation
- Delta and lagoon restoration
- Water quality and restoration projects

While the Plan primarily focuses on existing development, this guidance manual also lends insight into creating new developments and communities that are resilient, strong and flexible. This can be accomplished by designing lifeline systems of roads, utilities, stormwater management, and water supply facilities that can continue functioning in the face of rising water, high winds, and subsiding ground. New development should be guided away from known hazard areas such as high tides, hurricane surges, and flood waters. Additionally, natural environmental protective systems should be conserved to maintain valuable hazard mitigation functions. The resiliency of an area is important to consider during the planning process for both new and existing developments. It is critical for community planners and engineers to attempt to mitigate future unknown hazards early on in the design process. This way, when disasters strike destruction to both people and property can be minimized. This sort of comprehensive approach to stormwater planning can protect every level of the community – from infrastructure and businesses to the lives and homes of citizens – during floods.

Hazard mitigation activities include planning to identify hazards and vulnerability, implementing smart growth and hazard mitigation plans before disasters occur, avoiding disaster areas (floodplains), and directing new development away from hazardous locations. Hazard mitigation also seeks to control identified hazards, using structural approaches such as flood works, slope stabilization, and shoreline hardening to attempt to reduce risks from potentially dangerous natural systems and to limit unwise public expenditures. Education is key in promoting development in this direction.

This guidance manual includes stormwater practices and development approaches that will function better when struck by disasters and enhance public safety. The guidance manual encourages low impact approaches for projects to obtain permit compliance while protecting water quality, managing runoff, minimizing long-term maintenance, and promoting public safety. Several of these development approaches are listed below with design guidance found in Chapter 4. In other words, this guidance manual connects low impact development practices to resilient design.

2.4 CONSERVATION DESIGN

Conservation design, also known as open space design or cluster development, includes laying out the elements of a development project in such a way that the site design takes advantage of a site's natural features, preserves the more sensitive areas, and identifies any site constraints and opportunities to prevent or reduce impacts. Techniques include:

- Preserving undisturbed areas;
- Preserving stream buffers;
- Reducing clearing and grading;
- Locating projects in less sensitive areas;
- Reducing front and side yard setbacks;
- Aggregating shared open space rather than individual yards; and
- Clustering built features so as to minimize the amount of disturbed area.

As mentioned above, these natural conservation areas are typically identified through a site assessment. Depending on the site, an assessment can be performed by professionals on the project development team (engineers, landscape architects or planners for example). However, to fully examine a site and its ecological conditions which will influence drainage design, more in-depth site analysis should be done by hydrologists, ecologists, biologists or other professionals with site assessment experience. These professionals will be able to test infiltration rates, assess soil type and quality, and be able to properly identify existing vegetation. In many cases, a geotechnical report may also be required to assess depth to groundwater, among other factors. When done before the concept plan phase, the identification of sensitive features outlined above and the designation of conservation areas can be used to guide the layout of a project. For more guidance on conducting a site assessment, visit the Sustainable Sites Initiative™ guidelines, at http://www.sustainablesites.org/.

Conservation subdivisions typically incorporate smaller lot sizes to reduce overall impervious cover while providing more undisturbed open space and protection of water resources. This approach concentrates structures and impervious surfaces in a compact area in one portion of the development site in exchange for providing open space and natural areas elsewhere on the site. Typically, smaller lots and/or nontraditional lot designs are used to cluster development and create more conservation areas on the site.

Conservation developments have many benefits compared with conventional commercial developments or residential subdivisions. They can:

- Reduce impervious cover and thus reduce runoff volume and rate;
- Reduce development and construction costs by reducing grading, landscaping, and the need for expensive stormwater conveyance infrastructure;
- Place development above flood levels and potential stormwater hazard areas;
- Protect floodplains, tidal waters, and wetlands;
- Enhance the community experience;
- Enhance access to natural amenities;
- Enhance the sense of place and character; and
- Provide a safer pedestrian environment.

Along with reduced imperviousness and its associated benefits, conservation designs provide a host of other environmental benefits lacking in most conventional designs. They can prevent encroachment on conservation and buffer areas. They create community-wide interconnected networks of protected meadows, fields and woodlands. They can help provide larger areas of contiguous habitat in order to protect farmland and other natural resources while still allowing the maximum number of residences under current community zoning. As less land is cleared during the construction process, alteration of the natural hydrology and the potential for soil erosion are also greatly diminished. Perhaps most importantly, open space design can preserve 25 to 50% of development sites in conservation areas that would not otherwise be protected.

Conservation developments can also be significantly less expensive to build than conventional projects. Most of the cost savings are due to reduced infrastructure cost for roads and stormwater management controls and conveyances. Furthermore, developers find that these properties often command higher prices than those in more conventional developments because of the enhanced quality of life they provide. Several studies including one in Texas estimate that residential properties in open space developments garner premiums that are higher than conventional subdivisions and moreover, sell or lease at increased rates (Crompton 2007).

Once established, common open space and natural conservation areas must be managed by a responsible party able to maintain the areas in a natural state in perpetuity. Typically, these conservation areas are protected by legally enforceable deed restrictions, conservation easements, and maintenance agreements.

Preservation of natural areas and the use of conservation designs can help preserve pre-development hydrology of sites and aid in reducing stormwater runoff and pollutant load. Undisturbed vegetated areas also promote soil stabilization and provide for filtering and infiltration of runoff. Maintaining existing vegetation can be particularly beneficial to sites with floodplains, wetlands, stream banks, steep slopes, critical environmental features, or where erosion controls are difficult to establish, install, or maintain.

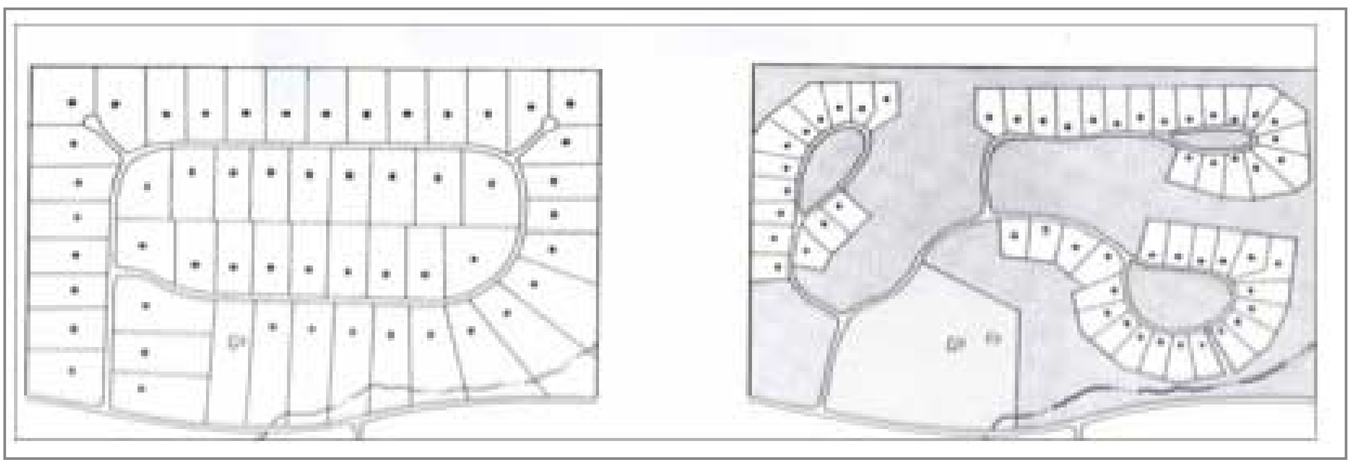

Figure 2-2: Conventional design (left) and conservation design (right). (Photo courtesy of Town of Pine Plains, NY)

2.5 REDUCTION OF IMPERVIOUS COVER

Once a development or redevelopment project has undergone a site assessment to identify all the features mentioned above, and the initial planning and design phase has begun, there are several additional non-structural sustainable development tools to implement. Two of these that will be discussed in this section are: reduce total impervious cover and disconnect impervious surfaces.

Methods of reducing total impervious cover include reducing the total square feet of rooftops, parking lots, roadways, sidewalks and other surfaces that do not allow rainfall to infiltrate into the soil. This reduces the volume of stormwater runoff, increases groundwater recharge, and reduces pollutant loadings generated from a site.

Another non-structural sustainable development tool is disconnection of hard surfaces. However, the degree to which this is true is a function of several factors, such as soil type, rainfall intensity, flow path and the amount of connected impervious cover, among others. Thus, the effectiveness of disconnection practices – directing gutter downspouts into vegetated areas or disconnecting pavement – can be difficult to quantify. Therefore, many municipalities may not give any credit for these types of activities, even though there is obviously some benefit. The following section describes techniques to reduce overall impervious cover and methods to disconnect existing or proposed impervious areas to maximize the benefit of sustainable development.

2.5.1. STREETS

The first step in achieving a reduction in impervious cover for streets is examining street lengths and widths. The use of alternative road layouts that reduce the total linear length of roadways can significantly reduce overall imperviousness of a development site. Site designers are encouraged to analyze different site and roadway layouts to see if they can reduce overall street length. Streets should be designed for the minimum required pavement width needed to support travel lanes, on-street parking, and emergency access. Several design options exist to reduce the total length and width of streets, including:

- One-way single-lane loop roads can reduce the width of lower traffic streets;
- On-street parking can be reduced to one lane or eliminated on local access roads with less than 200 average daily trips (ADT), and on short cul-de-sac streets;
- Reducing side yard setbacks and using narrower frontages can reduce total street length, which is especially important in Conservation Designs (Section 3.3);
- Emphasizing grid patterns for roadways;
- Eliminating dead ends and cul-de-sacs; and
- Designing/building narrower, neighborhood-scale streets.

Another large opportunity to reduce impervious cover on streets is with alternative turnaround areas, such as cul-de-sac design. Many of these cul-de-sacs can have a radius of more than 40 feet. From a stormwater perspective, cul-de-sacs create a huge bulb of impervious cover, increasing the amount of runoff. For this reason, reducing the size of cul-de-sacs through the use of alternative turnarounds or eliminating them altogether can reduce the amount of impervious cover created at a site. Alternative design options include:

- Reducing cul-de-sacs to a 30-foot radius;
- Allowing hammerheads as an alternative cul-de-sac form;
- Creating uncurbed, below-grade pervious areas (rain gardens) in the center of the cul-de-sac to provide stormwater attenuation;

- Incorporating sustainable development features in the center of the cul-de-sac such as bioretention areas to capture and treat runoff from the circular pavement; or
- Eliminating turnarounds altogether or building loop roads and pervious islands in the cul-de-sac center.

Sufficient turnaround area is a significant factor to consider in the design of these cul-de-sacs. For example, fire trucks, service vehicles and school buses are often cited as needing large turning radii. However, some fire trucks are designed for smaller turning radii. In addition, many newer large service vehicles are designed with a tri-axle (requiring a smaller turning radius) and many school buses usually do not enter individual cul-de-sacs.

Another option for designing cul-de-sacs involves the placement of a pervious island in the center. Vehicles only travel along the outside of the cul-de-sac when turning, leaving an unused "island" of pavement in the center. These islands can be attractively landscaped and designed as bioretention areas to treat stormwater.

2.5.1. SIDEWALKS

Most codes require that sidewalks be placed on both sides of residential streets (e.g. double sidewalks) and should be constructed of impervious concrete or asphalt. Many subdivision codes also require sidewalks to be 4 to 6 feet wide and 2 to 10 feet from the street. These codes are enforced to provide sidewalks as a safety measure. Alternative sidewalk designs include:

- Placing sidewalks on only one side of the street;
- Placing sidewalks further from the street. The added space in between the street and sidewalk is an ideal location to place sustainable development practices to capture runoff from the road;
- Grading sidewalks to drain to vegetated areas between the sidewalk and the street, rather than directly to the street;
- Using alternative surfaces for sidewalks and walkways, such as pervious pavements, to reduce total impervious cover; and
- Reducing sidewalk requirements, as allowed under the Americans with Disabilities Act, if developers include alternative pedestrian networks, such as trails.

Providing a landscaped area between sidewalks and the streets will also provide substantial opportunity for stormwater infiltration.

Figure 2-3: Example of Residential narrow street and disconnected impervious cover. (Picture courtesy of Google Earth)

2.5.3. DRIVEWAYS & SETBACKS

Typical residential driveways range from 12 feet wide for one car to 20 feet wide for two. There are several alternative driveway designs developers should be allowed to implement which help reduce impervious cover and these include:

- Share driveways, which can reduce impervious cover and should be encouraged with enforceable maintenance agreements and easements;
- Narrower driveway widths and lengths when homes are positioned with a greater setback. This allows the first portion of the driveway to be a single lane, while the second portion expands to the full width of the garage;
- Alternative design such as double-tracks; and
- Alternative surfaces such as reinforced grass, or permeable paving materials.

Building and home setbacks should be shortened to reduce the amount of impervious cover from driveways and entry walks. A setback of 20 feet is more than sufficient to allow a car to park in a driveway without encroaching into the public right-of-way and reduces driveway and walk pavement by more than 30% compared with a setback of 30 feet.

Figure 2-4: Sustainable design in medium density residential development. (Chambers County, Texas)

2.5.4. PARKING

Many parking lots are built with more spaces than are actually used. In part, this is because minimum parking standards are often set to accommodate the highest hourly parking during the peak season or the highest hourly parking demand for the particular site and use. Since ordinance language provides flexibility for the designer and developer to provide additional parking spaces beyond the minimum, the result is often excessive levels of parking. Setting parking standards as both a minimum and maximum can ensure that sufficient parking is established to meet the demand without creating excess spaces.

There are many options available to reduce the overall parking footprint and site imperviousness. First steps include determining average parking demand and lot location. A lower maximum number of parking spaces can be set to accommodate most of the demand. The number of parking spaces needed may be reduced by a site's accessibility to public transportation. Additional design strategies include:

- Setting maximums for parking spaces rather than minimums;
- Minimizing stall dimensions (by reducing both the length and width of the parking stall);
- Requiring a certain number of spaces be sized for compact vehicles;
- Using structured parking (which can reduce the conversion of land to impervious cover);
- Incorporating efficient parking lanes such as utilizing one-way drive aisles with angled parking rather than the traditional two-way aisles;
- Encouraging shared parking, particularly in mixed-use areas and for non-competing parking lot users; and
- Using alternative porous surfaces.

Utilizing alternative surfaces such as porous pavers or porous concrete is an effective way to reduce the amount of runoff generated by parking lots. This can replace conventional asphalt or concrete in both new development and redevelopment projects.

2.6 DISCONNECTION OF IMPERVIOUS COVER

Disconnection of downspouts and impervious surfaces is encouraged to maximize the function of the sustainable development practices. Disconnection is a low-cost, effective non-structural control which can reduce total runoff volume, increase the time of concentration and promote infiltration. The first step in disconnection is to identify the source of runoff and understand how it will be managed once disconnection occurs. Well-conceived use of disconnection methods can reduce project costs by reducing or eliminating the need for more expensive structural practices.

By disconnecting impervious areas and directing the flow to infiltration basins or designated buffer areas, a portion of additional runoff that would contribute to stormwater runoff is infiltrated close to the source instead. Further, runoff that would potentially carry pollutants from the site to surface water instead gets treated and helps recharge groundwater.

Disconnection methods should be incorporated at the planning and design level. However, the designer and reviewer should note that these methods must be used in concert with the design of other stormwater conveyance and treatment practices. The use of these disconnection methods does not relieve the designer or reviewer from following the standard engineering practices associated with safe conveyance of stormwater runoff and good drainage design.

2.6.1. DOWNSPOUT DISCONNECTION

Rooftops with exterior drains for the gutter (the normal configuration for most residential structures) are one of the easiest disconnection practices to implement. Downspouts should be directed to landscaped portions of the site rather than driveways or sidewalks unless the driveway is constructed of pervious paving materials (Figure 2-5). While uncommon, driveways can be crowned so that a portion of the runoff is directed to vegetated areas rather than the street.

In addition to directing downspouts to vegetated areas, roof runoff may also be directed to cisterns and other rain barrels, or even to depressed storage or other underground storage areas for later consumption. Design details for impervious cover disconnection are found in Chapters 4 and 5 to add in preparing a low impact development plan.

Figure 2-5: Downspouts directed to permeable pavement on driveway. (Photo courtesy of Montgomery County, Maryland)

2.6.2. DISCONNECTING URBAN AREAS

Downtowns and commercial strip centers often promote an urban, “walkable” feel by putting buildings close to the sidewalk, and the sidewalk close to the street or parking area. While this practice promotes a fun street activity ambiance, there are some benefits to be had by disconnecting these impervious surfaces.

Site design should allow for a space of approximately 2-3’ between the street and the sidewalk, and the sidewalk and the building. These spaces between the street, sidewalk and building should be vegetated areas designed to intercept a portion of stormwater, and may also be fitted as a biofiltration area, vegetated swale, or vegetated filter strip. Disconnection can also be used when designing parking lots. Instead of a parking lot being sited directly adjacent to a roadway, the insertion of a grassy area between the road and the edge of the parking area reduces the velocity of water moving across the site and provides an opportunity for additional sustainable drainage techniques to be included.

These disconnected, vegetated areas alone will not be enough to filter all of the stormwater from the site; however, when used in tandem with other site design practices in this chapter and sustainable drainage techniques outlined in Chapter 4, they become part of an overall strategy for managing stormwater effectively.