

Chapter 2

General Planning Concepts for Erosion Control, Sediment Control and Stormwater Management

This chapter provides important concepts and other selected information that is important for qualified design professionals to know about various aspects of erosion control, sediment control and stormwater management. It is believed that the contents will, as a minimum, cause qualified design professionals to recognize when other professionals may need to be involved. A qualified design professional should recognize that planning involves several disciplines and that each discipline has a body of in-depth knowledge that is important and needed on complex sites. Although often discussed separately, erosion control, sediment control and stormwater management are interrelated and when planning occurs the thought process must conceive a system of practices and measures that consider all three together.

The basic details of planning, including step-by-step procedures, are located in Chapter 3.

Potential Erosion and Sediment Problems Associated with Land Development

The principal effect land development activities have on the erosion process consists of exposing disturbed soils to raindrops and to storm runoff. Shaping of land for construction or development purposes alters the soil cover in many ways, often detrimentally affecting physical properties of the soil, onsite drainage and storm runoff patterns and, eventually, off-site stream and stream flow characteristics. Adverse effects of erosion and sedimentation include impacts on soil, water quantity, water quality and the aquatic ecosystem. Potential hazards associated with development include the following items.

1. An increase in developed areas exposed to storm runoff and soil erosion.
2. Increased volumes of storm runoff, accelerated soil erosion and sediment yield and higher peak flows caused by:
 - a. Removal of existing protective vegetative cover.
 - b. Exposure of underlying soil or geologic formations potentially more erodible than original soil surface.
 - c. Reduced capacity of exposed soils to absorb rainfall due to compaction caused by heavy equipment.

- d. Enlarged drainage areas caused by grading operations, diversions and street construction.
 - e. Prolonged exposure of unprotected disturbed areas due to scheduling problems and/or delayed construction.
 - f. Shortened times of concentration of surface runoff caused by altering slope steepness, slope length, and surface roughness and through installation of “improved” storm drainage facilities.
 - g. Increased impervious surfaces associated with the construction of streets, buildings, sidewalks and paved driveways and parking lot.
3. Creation of exposures facing south and west that may hinder plant growth due to adverse temperature and moisture conditions.
 4. Exposure of subsurface materials which are rocky, acid, droughty or otherwise unfavorable to the establishment of vegetation.

Erosion and Sediment Control

A wide array of practices and measures are used for erosion and sediment control. Most of the practices and measures have application over the State and only a few, such as those practices used for dune stabilization, have use in a small geographical area.

There are numerous simple concepts that can provide an effective framework for minimizing erosion on a construction site and reducing delivery of sediment off of the site.

- Minimize the area disturbed by leaving existing vegetation that does not have to be removed.
- Minimize the period of bare ground by shortening construction periods and staging a project when possible.
- Sequence installation in a manner that supports shortened construction periods and permits the use of temporary and permanent seeding when the practices can be most effective.
- Use sediment control and turbidity measures that minimize sediment and turbid water from leaving the disturbed site.
- Plan appropriate erosion control for all kinds of erosion that may occur depending upon specific site conditions.
- Give special attention to cut and fill slopes.

- Give special attention to sites that are transected by streams or are in close proximity to streams or reservoirs.
- Make erosion control plantings at every opportunity.
- Prevent sediment from leaving a construction site at entrance/exits during muddy periods.
- Maintain practices to ensure their effectiveness. This includes regular and timely inspections.

Potential Stormwater Problems Associated with Land Development

All forms of land use affect water quality. In an undeveloped area, many ongoing physical, chemical and biological processes interact to recycle most of the materials found in the runoff. As the human land use intensifies, these processes are disrupted. Man's activities add materials to the land surface (pesticides, fertilizers, animal wastes, oil, grease, heavy metals, etc.). These materials are then washed off by the rainfall and runoff, thereby increasing the pollutant load carried to receiving waters by stormwater runoff.

Of primary importance to water quality is the "first flush". This term describes the washing action that stormwater has on accumulated pollutants in the watershed. In the early stages of runoff, the land surfaces, especially impervious surfaces like streets and parking areas, are flushed clean by the stormwater. This flushing creates a shock loading of pollutants. Extensive studies in Florida have determined that the first flush equates to the first 1" of runoff which carries 90% of the pollution load from a storm (USGS, 1984). More recently, research has identified that the first 1/2", of runoff provides the first flush in some instances while other research has determined that runoff in excess of 1", including cut/fill areas associated with construction, may be more realistic. It is proper to say at this time that the amount of runoff that creates the "first flush" depends on several factors, including the activity, site conditions and pollutants. Treatment of the first flush, whatever the runoff amount, will help ensure that the water quality effects of stormwater are minimized.

Finally, the value of the hydrologic environment as an amenity is primarily affected by three factors: stability of the stream channel, accumulation of trash, and disruption of the stream community. A channel which is gradually enlarged because of increased floods caused by urbanization tends to have unstable and unvegetated banks, scoured or muddy channel beds, and unusual accumulations of sediment and debris. Together with the accumulation of trash in the channel and floodplain (beer cans, lumber scraps, lawn clippings, concrete, wire, etc.) these all tend to severely decrease the visual attractiveness of a stream. Ultimately these factors disrupt the natural balance in the streams' biota resulting from the addition of nutrients, organics, and sediment. These disruptions increase algal growth and turbidity, lower the oxygen content of the water, and thereby change the biological character of the stream.

In summary, each progression toward more intensive land use tends to disrupt the ongoing natural processes which protect and preserve water quality. Therefore, to ensure future protection of water resources, it is imperative that land uses be managed in a responsible way.

What is Stormwater Management?

Historically, urbanization has resulted in the development of stormwater management systems to reduce flooding. These systems were required because man was unwilling to suffer inconvenience where it could be avoided and because he would not tolerate the loss of life or property. Typically such concerns have meant that stormwater management systems were designed for safety and convenience without recognition of other important considerations. Therefore, no matter how large the rainfall or its duration, the stormwater system was expected to remove the runoff as quickly as possible, to restore maximum convenience in the shortest possible time. In other words, until recently, stormwater management was concerned with only the quantitative effects of runoff.

Today, however, stormwater management is far more comprehensive. An effective program involves the implementation of actions to control water in its hydrologic cycle with the objectives of providing: (1) flood control; (2) nonpoint source pollution control; and (3) off-site erosion control. Stormwater management applies to rural and urban areas alike; however, the techniques presented in this manual are most relevant to urban or urbanizing situations.

To accomplish the three objectives of stormwater management, it is necessary to ensure that the volume, rate, timing and pollutant load of runoff after development are similar to that which occurred prior to development. The approach suggested in this manual is to minimize the adverse impacts of stormwater through a coordinated system of source controls. Source controls emphasize the prevention and reduction of nonpoint pollution and excess stormwater flow before it ever reaches a collection system or receiving waters. Typical control strategies and management criteria to accomplish the objectives of stormwater management are discussed below.

Flood Control

This has been the most common goal of local stormwater management programs. The property damage, safety hazards, and inconvenience which can result from increased stream flooding in urbanizing watersheds usually get wide public attention and urgent demands for government action. Two levels of drainage systems must be considered in developing a management strategy for flood control: the primary drainage system and the major drainage system.

The primary drainage system consists of the street gutters and ditches, storm sewers, culverts, and open channels which are designed to prevent inconvenience and minor property damages from relatively frequent storm events. Of course, the most effective strategy for flood control at this level is to plan and design the primary drainage system adequately in advance, keeping in mind the future development potential of the drainage area. Unfortunately, many existing

drainage systems were designed on a piecemeal, “as needed” basis with little regard for future upstream development. The capacity of such systems often becomes severely inadequate as upstream development progresses, resulting in frequent minor flooding and property damages.

One strategy for dealing with this problem is to replace or modify elements of the primary drainage system to provide the required capacity. This option is often expensive and does not control the source of the problem. However, this may be the only feasible method of correcting existing problems. To prevent future problems, an alternative strategy may be employed. Persons wishing to undertake new development may be required to control runoff from their sites in a manner which will not adversely affect the downstream drainage system. This control is usually accomplished through stormwater detention criteria.

Typical detention criteria will specify that stormwater runoff from a new development must be controlled so that the post-development peak runoff rate does not exceed the pre-development peak rate for some specific frequency design storm or range of design storm events. In many localities, a 10-year design storm is specified to preserve the effectiveness of downstream drainage structures which were originally designed to pass a 10-year pre-development storm. Other localities require that larger storms (i.e., 50-100 year events) must be detained and released at a controlled rate to reduce the downstream effects of major storms.

It should be kept in mind that the larger the storm event which is required to be controlled and the slower the allowable release rate, the greater the storage volume which will be required in the detention facility.

The major drainage system comes into play when the capacity of the primary drainage system is exceeded.

This major system consists of the flood plains and surface flow routes which water will follow during major storms. The most effective strategy for dealing with flooding at this level is to ensure that stormwater has a route to follow which will not cause major property damage or loss of life. To implement this strategy, flood plain ordinances, zoning regulations or other land use controls should be used to restrict flood plain development. In areas where development has already encroached on the flood plain, land owners should be encouraged to purchase flood insurance, if available.

Nonpoint Source Pollution Control

Pollutants which are washed from the land surface and carried into the streams, rivers, and lakes with stormwater runoff have only recently been recognized as major contributors to water quality degradation in urban and urbanizing watersheds. The goal of controlling this problem is therefore relatively new. Nonpoint source pollution control is likely to receive highest priority in watersheds which feed public water supplies or recreation reservoirs; however, this goal should be addressed in all local stormwater management programs.

In urban areas most of the stormwater detention practices which are used to control runoff quantity may also be adapted for use as best management practices for nonpoint source pollution control. The design criteria of these practices for this purpose, however, are often different. The primary design strategy for pollution removal is to maximize the detention time of captured runoff. Although there have not been many monitoring studies to produce definitive design criteria, it is believed that basin drawdown times between 30-40 hours will result in significant pollutant removal. The required storage volume of detention facilities can be tied to a first flush capture (i.e., the initial 0.1" to 1" of runoff).

Off-Site Erosion Control

This goal must be addressed in all local stormwater management programs. The strategies for dealing with this problem are similar to those for flood control. The major difference is in the frequency of the storm which must be controlled.

Studies have shown that most natural stream channels are formed with a bank-full capacity to pass runoff from a storm with a 1.5 to 2-year recurrence interval. As upstream development occurs, the volume and velocity of flow from these relatively frequent storms increase. Even smaller storms with less than 1-year recurrence intervals begin to cause streams to flow full or flood.

Stream channels are often subject to a 3 to 5-fold increase in the frequency of bank-full flows in a typical urbanizing watershed. This increase in the flooding frequency places a stress on the channel to adjust its shape and alignment to accommodate the increased flow. Unfortunately, this adjustment takes place in a very short time period (in geologic terms) and the transition is usually not a smooth one. Meandering stream channels which were once parabolic in shape and covered with vegetation typically become straight, wide rectangular channels with barren vertical banks. This process of channel erosion often causes significant property damage, and the resulting sediment which is generated is transported downstream, further contributing to channel degradation.

An old strategy for dealing with this problem is to increase the carrying capacity and stability of affected streams through channel modifications (i.e. straightening, widening, lining with non-erodible material, etc.). Modifications to natural, continuous flowing streams, however, can be the subject of intense local controversy and requires special permits such as a 404 permit issued by the Corp of Engineers. Recent innovations based on natural stream hydrology concepts are rapidly gaining favor and should be considered because of their beneficial effects on the aquatic environment.

Wherever modifications to natural flowing streams are being considered, extreme care must be taken to weigh the benefits of such modifications against the cost and the concerns of the local citizens. Where channel modifications are necessary, an attempt must be made to incorporate measures which will minimize adverse impacts to fish, wildlife, and the aesthetic quality of the stream.

On-site stormwater detention criteria for new development projects can also be an effective strategy for preventing future increases in channel erosion. However, such criteria should be tied to more frequent storm events than typical flood

control criteria. Maintaining the pre-development peak runoff rate from a 10-year storm, for example, will probably not effectively reduce downstream erosion since the majority of storm events will pass right through the detention system unimpeded.

For example, the minimum state or local stormwater management criteria could be tied to a 2-year storm event. Receiving channels would then be capable of passing a 2-year storm without flooding or erosion after development of the site or stormwater would be detained on the site so that the pre-development peak flow rate from a 2-year storm is not exceeded after development. While flows from larger, less frequent storm events may cause erosion problems downstream, it is felt that because such events will occur less often, streams will have more time to recover and restabilize themselves.

Local stormwater detention criteria can be made more restrictive by requiring that storms larger than a 2-year event be detained. However, the allowable release rate should be tied to the actual carrying capacity of the receiving stream or the 2-year pre-development peak runoff rate.

Multiple-Purpose Criteria

Stormwater management criteria for flood control, erosion control, and pollution control are not necessarily mutually exclusive. In many cases, stormwater can be managed to accomplish all three goals simultaneously. For example, a stormwater detention basin can be designed as a multipurpose structure by incorporating different release rates at different stages (storage elevations).

The first stage is designed to capture an initial volume of runoff (i.e., the first flush) and release it very slowly through a subsurface drainage system. The second stage begins with an orifice cut in the riser pipe which has the capacity to pass stormwater runoff at a 2-year pre-development rate when water elevation reaches the top of the riser. The purpose of this stage would be to control downstream channel erosion from frequent storms. The top of the riser pipe could serve as the outlet for the third stage and may be designed to pass a 10-year storm at a pre-development rate for moderate flood protection downstream. The emergency spillway should be designed to pass at least the 100-year storm. While such a multi-purpose design may not be feasible for all detention systems, there are often innovative approaches which can be taken to satisfy two or more local stormwater management goals.

Flexibility

Flexibility is extremely important in stormwater management programs. Each development project has a unique set of conditions and circumstances and a different potential for affecting the downstream drainage system.

Criteria which may be perfectly applicable to one project may be totally unsuitable for another. For example, requiring stormwater detention for flood control may be highly applicable to projects constructed in the upper reaches of a watershed, but may be unnecessary or even undesirable for new projects constructed near the outlet of the watershed.

A qualified design professional should be given an opportunity to design a drainage system which contributes to the achievement of established local stormwater management goals in the most cost-effective manner. To accomplish this, each project must be considered on an individual basis.

Principles of Stormwater Management

It is much more efficient and cost-effective to prevent problems than to attempt to correct problems after the fact. Sound land use planning decisions based on the site planning principles are essential as the first, and perhaps the most important, step in managing stormwater related problems. All new development plans (e.g., subdivisions, shopping centers, industrial parks, office centers, etc.) and redevelopment plans should include a comprehensive stormwater management system.

Every piece of land is part of a larger watershed. A stormwater management system for each development project should be based on, and should support a plan for the entire drainage basin.

Optimum design of the stormwater management system should mimic (and use) the features and functions of the natural drainage system which is largely capital, energy and maintenance cost free. Every site contains natural features which contribute to the management of stormwater under the existing conditions. Depending upon the site, existing features such as natural drainageways, depressions, wetlands, floodplains, highly permeable soils, and vegetation provide natural infiltration, help control the velocity of runoff, extend the time of concentration, filter sediments and other pollutants, and recycle nutrients. Each development plan should carefully map and identify the existing natural system. "Natural" engineering techniques should be used to preserve and enhance the natural features and processes of a site and to maximize the economic and environmental benefits. Engineering design can and should be used to improve the effectiveness of natural systems, rather than negate, replace or ignore them.

The volume, rate, timing and pollutant load of stormwater after development should closely approximate the conditions which occurred before development. To accomplish these objectives two overall concepts must be considered: (1) the perviousness of the site should be maintained to the greatest extent possible; and (2) the rate of runoff should be slowed. Preference should be given to stormwater management systems which use measures that maintain vegetative and porous land cover and include on-site storage mechanisms. These systems will promote infiltration, filtering and slowing of the runoff.

Maximize on-site storage of stormwater. Provision for storage can reduce peak runoff rates; aid in groundwater recharge; provide settling of pollutants; lower the probability of downstream flooding, stream erosion and sedimentation; and provide water for other beneficial uses. Stormwater runoff should never be discharged directly into surface or ground waters. Runoff should be routed over a longer distance, through grassed waterways, wetlands, vegetated buffers and other works designed to increase overland flow. These systems provide time for

increased infiltration and evaporation, allow suspended solids to settle, and remove pollutants before they are introduced to waters of the State.

Stormwater management systems, especially those emphasizing vegetative practices, should be planned, constructed and stabilized in advance of the facilities that will discharge into them. This principle is frequently ignored thereby causing unnecessary off-site impacts, extra maintenance, re-working of grades, re-vegetation of slopes and grassed waterways, and extra expense to the developer. The stormwater management system, including erosion and sedimentation controls, should be constructed and stabilized at the start of site disturbance and construction activities.

The stormwater management system must be designed beginning with the outlet or point of outflow from the project. The downstream conveyance system should be evaluated to ensure that it contains sufficient capacity to accept the design discharge without adverse downstream impacts such as flooding, streambank erosion and sedimentation. It may be necessary to stabilize the downstream conveyance system, especially near the stormwater system outlet. A common problem is a restricted outlet which causes stormwater to back up and exceed the storage capacity of the collection and treatment system resulting in temporary upstream flooding. This may lead to hydraulic failure of the stormwater management system causing re-suspension of the pollutants and/or expensive repairs to damaged structures or property. In such circumstances it is advisable to use more than one outlet or to increase the on-site storage volume.

Stormwater is a component of the total water resources which should not be casually discarded but used to replenish those resources. Stormwater represents a potential resource out of place, with its location determining whether it is a liability or an asset. Given the water quantity and quality problems and challenges facing Alabama, it is imperative that stormwater is considered to be an asset. Treated stormwater has a great potential for providing many beneficial uses such as irrigation (farm, lawn, parks, golf courses, etc.), recreational lakes, groundwater recharge, industrial cooling and process water, and other non-potable domestic uses.

Whenever practical, multiple use temporary storage basins should be an integral component of the stormwater management system. All too often, storage facilities planned as part of the system are conventional, unimaginative ponds which are aesthetically unpleasing. Recreational areas (e.g., ball fields, tennis courts, volleyball courts, etc.), greenbelt areas, neighborhood parks and even parking facilities provide excellent settings for the temporary storage of stormwater. Such areas are not usually in use during periods of precipitation and the ponding of stormwater for short durations does not seriously impede their primary functions. Storage areas should be designed with sinuous shorelines. Shorelines which are sinuous rather than straight increase the length of the shoreline. The increased shoreline also provides more space for the growth of shoreline vegetation thus providing for greater pollutant filtering and for increased and diversified aquatic habitat.

Vegetated buffer strips should be retained in their natural state or created along the banks of all water bodies. Vegetated buffers prevent erosion, trap sediment,

filter runoff, provide public access, enhance the site amenities, and function as a floodplain during periods of high water. They also provide a pervious strip along a shoreline which can accept sheet flow from developed areas and help minimize the adverse impacts of untreated stormwater.

The stormwater management system must receive regular maintenance. Failure to provide proper maintenance reduces the pollutant removal efficiency of the system and reduces the system's hydraulic capacity. Lack of maintenance, especially to vegetative systems which may require revegetating, can increase the pollutant load of stormwater discharges. The key to effective maintenance is the clear assignment of responsibilities to an established agency (local government) or organization (homeowners association) and a regular schedule of inspections to determine maintenance needs. In addition, stormwater system designers should find ways to make their systems as simple, natural and maintenance free as possible.

Low Impact Development

Low Impact Development or LID is “an innovative stormwater management system approach with a basic principal that is modeled after nature” (Low Impact Development Center). It is the practice of taking steps during design development to minimize changes to the hydrologic cycle (runoff and infiltration after a storm). LID strategies integrate green space, native landscaping, natural hydrologic functions, and various other techniques to generate less runoff from developed land (NRDC, Stormwater Strategies Report, 2001). These types of practices encourage infiltration and reduce the volume of stormwater discharged from the site. Many innovative site designs and stormwater management practices are grouped together under the heading of LID, but true LID strategies have certain key distinctions. These key distinctions of LID include:

- Stormwater management at a local scale to minimize impact of development on the local watershed.
- Ecosystem-based. Design what you are building as a functional part of the ecosystem (not apart from it).
- Relies on advanced technologies more than conservation and growth management (Smart Growth plans).

LID promotes hydrologic function at the lot level. It addresses stormwater through small, cost-effective landscape features and integrated management practices, also known as IMPs.

Integrated Management Practices

The term IMP is used to denote controls that are integrated throughout the project and provide landscape amenity. The terms BMP and IMP are frequently used interchangeably. When Integrated Management Practices are linked together they form *BMP trains* that address water quantity and water quality in succession. Such a train could be created by linking a rain barrel (overflow) to a rain garden, and the overflow drain of the rain garden to a constructed wetland.

History of LID

Many communities are turning to LID to assist with stormwater management. Conventional solutions to handling stormwater runoff are not always compatible with community interests, or local, state, and federal water quality regulations. Prince George's County, Maryland is known as the originator of the LID movement, and has pioneered many stormwater management practices and protective policies since the early 1980's. The state of Wisconsin has also promoted LID since the late 1980's, but dates to the early 1900's in the origin of sustainable products such as Milorganite, a fertilizer used in the golf course industry made from the byproduct of the Milwaukee sanitary sewer system.

What are the Key elements of LID?

The key elements of LID include:

- Conservation
- Small scale controls
- Customized site design
- Pollution prevention and education
- Directing runoff to natural areas

The preservation of native trees, understory vegetation and natural drainage processes are important in LID development. They are enhanced by the small scale controls on the lot level that mimic natural hydrology and processes. The customized design of these controls protects these processes and reduces pollutant loads, and sends stormwater to areas of infiltration to facilitate ground water recharge.

Planners/designers should consider using LID because it enhances the local environment, protects public health, improves community livability and saves developers and local governments' money. There is at least a 25% - 30% reduction in costs associated with site development, stormwater fees, and maintenance for residential developments that use LID techniques (Low Impact Development Center). These savings are recognized through reductions in clearing, grading, pipes, ponds, inlets curbs, and paving.

Low Impact Development practices are easily applied to open space, roof tops, streetscapes, parking lots, sidewalks, and medians. The preservation of existing open space or the creation of new open space allows for large conservation areas where stormwater can soak into the ground and promote groundwater recharge. Roof top gardens or green roofs provide excellent insulation in warm climates and reduce heat island effects in urban environments. LID promotes narrow streets and driveways which reduce impervious surfaces as well as flooding and pollution from stormwater. There is typically no curb and gutter in LID developments, and houses are usually closer to the street. Shared driveways are quite common.

Typical LID design components

Typical LID design components to be considered include vegetation, pervious surfaces and bioretention systems. Vegetation removes water through evapotranspiration and assist in pollutant removal through nutrient cycling. Pervious surfaces allow stormwater to infiltrate into underlying soils promoting groundwater recharge and pollutant processing while reducing the volume of rainwater runoff. Bioretention systems detain water long enough for infiltration and pollution removal to occur. Bioretention systems may be designed as buffer strips, rain gardens, stormwater wetlands and grass swales.

Bioretention areas

Bioretention areas, also known as bioretention filters or rain gardens, capture and temporarily store water. Water is conveyed to the treatment area as sheet flow. They can be designed to capture the first inch of rain and allow it to soak into the soil, watering the plants in the rain garden. Rain gardens are typically saucer shaped depressions that typically have six to eighteen inches of water when completely filled with stormwater. They are designed to detain water just long enough for infiltration and pollution removal to occur, but not cause mosquito problems.

Rain gardens are attractive gardens that typically use native plants. Native plants are used because they are more drought-tolerant, and require less maintenance. Pollutant removal is facilitated by microbes that live in the soil and interact with the plant roots. Stormwater drains from the rain garden within 24 – 48 hours which eliminates concern about mosquito habitat. Pathogens are left high and dry as water is absorbed.

Landscaping is critical to performance and function of a rain garden. A diversity of plant types should be planted to replicate a natural ecosystem. Trees should be spaced at least 10 feet apart, hardwood mulch should be used (not pine bark; it floats), and plants should be both water tolerant and drought tolerant.

Rain gardens come in many shapes and sizes and can be used in commercial and residential landscapes, parking lots and medians, highway drainage, and on golf courses. There are several different types of rain gardens and the design can be tweaked to fit many uses. Basically, they take advantage of an existing low spot, are excavated and filled with amended soil to aid in the drainage process. There is an overflow drain that may be a perforated pipe or an existing stormwater outlet that has been raised to aid the ponding of water.

Rain Barrels & Cisterns

Rain Barrels are small roof recapture systems that store residential rooftop runoff for localized use. Water collected in a rain barrel would normally flow through a gutter system or flows off a roof on to the ground possibly causing erosion. A rain barrel can save approximately 1,300 gallons of water during peak summer months of normal rainfall (Center for Watershed Protection, 2007). For every inch of rain that falls on a catchment area of 1,000 square feet, you can expect to collect approximately 600 gallons of rainwater. All systems should use covered

barrels or cisterns that keep the water from accumulating leaves and other contaminants. Perhaps the simplest use of rainwater is to put a barrel under one of the gutter downspouts and use the water on sensitive indoor plants. Storing rainwater for garden and outdoor work use helps recharge groundwater naturally by slowing down and reducing stormwater runoff.

Cisterns work on the same principal as rain barrels but typically have a large storage capacity. Modern cisterns are manufactured of plastic and may or may not be completely enclosed. Rather they typically have a lid made of the same material as the cistern, which is removable by the user. In the USA, cisterns are predominately used for irrigation; however, some areas promote reuse of gray water (water from hand washing, dish washing, etc.) for toilet flushing.

Filter strips, grass swales and stormwater wetlands

Filter strips can be designed as landscape features within parking lots or other areas to collect flow from large impervious surfaces. Grass swales use grass or other vegetation to reduce runoff velocity and allow filtration, while high volume flows are channeled away safely. They function as alternatives to curb and gutter systems. Stormwater wetlands treat stormwater runoff by slowing stormwater and trapping pollutants.

Pervious Paving

Porous pavements allow air and water to pass through the surface providing groundwater recharge. "If used properly, porous pavements can facilitate biodegradation of the oils from cars and trucks, help rainwater infiltrate soil, decrease urban heating, replenish groundwater, allow tree roots to breathe, and reduce total runoff, including the magnitude and frequency of flash flooding." In his book, *Porous Pavements* (2005), Ferguson identifies nine categories of porous pavement: decks, open-celled paving grids, open-graded aggregate, open-jointed paving blocks, plastic geocells, porous asphalt, pervious concrete, porous turf, and soft paving. It is the most popular form of structural post-construction BMP in Alabama.

Mixing Structural and Nonstructural Post-Construction BMPs

Mixing structural and nonstructural post-construction BMPs allow for the flexibility to create the proper BMP efficiency and cost for pollutant removal. The resulting configuration resembles a *BMP Train*, that is, a string of mix and match BMPs that are custom selected to a site's pollutant situation. There are now several BMP calculators (typically Excel format) that will calculate the train's efficiency and cost.

The benefits of LID provide high level of water quality treatment. LID tends to control volume of the first flush (first ½ inch to 1 inch) runoff. It is cost effective for developers and local governments, and is aesthetically pleasing. LID increases quality of water in local streams, rivers, lakes or bays. It also controls impacts to our natural ecosystems through selective BMP implementation. Instead of large investments in complex and costly centralized conveyance and treatment infrastructure, LID allows for the integration of treatment and

management measures into urban site features. This involves strategic placement of distributed lot-level controls that can be customized to more closely mimic a watershed's hydrology and water quality regime. The result is a hydrologically functional landscape that generates less surface runoff, less pollution, less erosion, and less overall damage to lakes, streams, and coastal waters.

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Vegetation for Erosion and Sediment Control

Introduction

A dense, vigorous growing vegetative cover protects the soil surface from raindrop impact, a major force in causing erosion and sedimentation. Also, vegetation will shield the soil surface from the scouring effect of overland flow and decreases the erosive capacity of the flowing water by reducing its velocity.

The shielding effect of a plant canopy is augmented by roots and rhizomes that hold the soil, improve its physical condition, and increase the rate of infiltration, further decreasing runoff. Plants also reduce the moisture content of the soil through transpiration, thus increasing its capacity to absorb water.

Suitable vegetative cover offers excellent erosion protection and sediment control. Vegetative cover is essential to the design and stabilization of many structural erosion control practices. Vegetative cover is relatively inexpensive to achieve and maintain. Also, it is often the only practical, long-term solution to stabilization and erosion control on many disturbed sites.

Timely vegetative establishment or retention reduces the cost of vegetation, minimizes maintenance and repairs, and makes structural erosion control measures more effective and less costly to maintain. Landscaping is also less costly where soils have not been eroded. Natural areas (those left undisturbed) can provide low-maintenance landscaping, shade, and screening. Large trees increase property values if they are properly protected during construction.

Besides preventing erosion, healthy vegetative cover provides a stable land surface that absorbs rainfall, cuts down on heat reflectance and dust, and complements architecture. Property values can be increased dramatically by small investments in erosion control.

Plant selection should be considered early in the process of preparing the erosion and sediment control plan. A diversity of species can be grown in Alabama due

to the variation in both soils and climate. However, for practical, economical stabilization and long-term protection of disturbed sites, plant selection should be made with care. Many plants that will grow in Alabama are inappropriate for soil stabilization because they do not protect the soil effectively, or they cannot be established quickly. Some plants may be very effective for soil stabilization, but are not aesthetically acceptable on some sites.

Stabilization of most disturbed sites requires grasses and/or legumes that grow close together to provide a thick close-growing cover. This is true even where part or the entire site is planted to trees or shrubs. In landscape plantings, disturbed areas between trees and shrubs must also be protected either by mulching or by permanent grass, legumes, or mixtures.

Trees are excellent for long-term soil and water protection, but they will not stabilize concentrated flow areas.

Site Planning For Tree Protection

Select trees to be saved before beginning construction. No tree should be destroyed or altered until the construction plans are final. Flood plains and wetlands should be left in their natural condition. Locate roadways to cause the least damage to valuable trees. Follow contours where feasible to minimize cuts and fills. Minimize trenching by locating several utilities in the same trench. Excavations for basements and utilities should be kept away from the drip line of trees.

Storage areas for construction materials and worker parking areas should be noted on the site plan, and located where they will not cause soil compacting over roots.

When retaining existing trees in parking areas, leave enough ground ungraded around the tree to allow for its survival. Tree wells may be needed.

Locate erosion and sediment control measures within the limits of clearing and not in wooded areas to prevent deposition of sediment within the drip line of trees being preserved. Sediment basins should be constructed in the natural depressions if possible rather than in locations where extensive grading and tree removal will be required.

Selecting Trees to Be Retained or Planted

Trees may be exposed to insufficient sunlight and water; high winds; heat radiation from highways and parking lots; pollutants from cars and industries; root amputation because of sewer, water, gas and electric lines; and pruning or “topping” because of power lines; and covering of roots by pavement and compaction. These items make the selection and management of trees extremely important.

The proper development of a forested urban site requires a plan for tree retention or tree planting before construction begins. An overall requirement for selecting trees is that those trees selected should be appropriate for the proposed use of the

development. The selection of tree species depends on the desired function of the tree, whether it be just erosion control or other functions such as shade, privacy screening, noise screening, appearance, enhancement of wildlife habitat or a combination of these. The following characteristics of a tree should be considered when choosing a tree to retain or plant.

Hardiness

Select trees that are recommended for the area. See practice Tree Planting on Disturbed Areas.

Mature Height and Spread

The eventual height of a tree must be considered in relation to location on the site to avoid future problems with buildings and utility lines. See practice Tree Planting on Disturbed Areas.

Growth Rate

Some trees attain mature height at an early age, others take many years. Fast growing trees may be brittle and possibly short-lived while slow growing trees are usually less brittle and live longer.

Root System

Avoid trees which have fibrous roots which may cause damage to water lines, septic tanks or sidewalks and driveways.

Cleanliness

Maintenance problems can be avoided by not selecting trees that drop seedpods, cones, flowers, or twigs in large amounts.

Moisture and Fertility Requirements

If suitable soils with adequate fertility are not available, trees tolerant of poor growing conditions should be planted.

Ornamental Effects

If a tree is unusually attractive in appearance, some other shortcomings may be overlooked.

Evergreen vs. Deciduous

Evergreens retain their leaves throughout the year, and are useful for privacy screens and noise barriers. Most deciduous trees drop their leaves in the fall and are preferable as shade trees. Some deciduous trees do not drop their leaves until spring.

Pest Resistance

Insects and disease problems exist among many trees. Each pest is related to the trees species itself, its vigor and the site on which it is planted. Where control techniques are available, the tree owner's commitment and ability to apply them to a pest problem will determine whether the tree should be planted.

Life Expectancy and Present Age

Tree species with expected long life spans should be favored. Long-lived species that are old may succumb to the stresses of construction, so younger trees of desirable species are preferred since they are more resilient and will last longer.

Health and Disease Susceptibility

Unhealthy trees and those with damaged areas should be considered for removal.

Structure

Check for structural defects that indicate weakness or reduce the aesthetic value of a tree: trees growing from old stumps, large trees with overhanging limbs that endanger property, trees with brittle wood, misshapen trunks or crowns, and small crowns at the top of tall trunks. Trees with strong tap or fibrous root systems are preferred to trees with weak rooting habits.

Aesthetics

Trees that are attractive and pleasing to the eye are desirable. Trees that have beauty during several seasons of the year are desirable and add value to the site.

Comfort

Trees provide cooling during the summer and buffer the cold winds of winter. Summer temperatures may be 10 degrees cooler under hardwoods than under conifers. Most deciduous trees drop their leaves in winter, allowing the sun to warm buildings and soil. Evergreens are more effective wind buffers.

Wildlife

Preference may be given to trees that provide food and cover for wildlife.

Relationship to Other Trees

Trees growing alone generally are more valuable than trees growing in groups but trees in groups are more effective in preventing erosion and reducing stormwater runoff.

Suitability for the Site

Consider the height and spread of trees and how they may interfere with proposed structures and overhead utilities. Roots may interfere with walls, walks, driveways, patios, parking lots, waterlines, and septic systems.

Desirable trees should be identified and located on a map as part of the planning process.

Damage to Trees from Construction

Construction activities expose existing trees to a variety of stresses resulting in injury ranging from superficial wounds to death. Understanding the types of damages that may occur to trees is important in planning for protection.

Surface Impacts

Tree trunks are often damaged during construction activities. Trees scarred by construction equipment are more susceptible to damage by insects and disease. Excessive pruning of trees to prevent contact with utility lines or buildings may destroy the visual appeal of the tree, may provide a source of entry for disease causing fungi, or it may kill the tree.

Wind damage is a greater potential problem especially when some of the trees have been removed from a group of trees because the survivors are exposed to greater wind velocities. Also, trees develop root anchorage where it is needed the most. Isolated trees develop anchorage rather equally all around with stronger root development on the side of the prevailing wind. The more a tree has been protected from the wind the less anchorage it usually has. The result of thinning of trees may be that some of the remaining trees are blown over by strong winds (windthrow). A factor related to thinning is that thinning in favor of a single tall tree increases the hazard of lightning strike.

Root Zone Impacts

Disturbing the relationship between soil and tree roots can damage or kill a tree. The roots of an existing tree are established in an area where a specific environment of soil, water, oxygen, and nutrients are present. The mass of the root system must be the correct size to balance the intake of water from the soil with the transpiration of water from the leaves.

Raising the grade as little as 6" can retard the normal exchange of air and gases. Roots may suffocate due to lack of oxygen or be damaged by toxic gases and chemicals released by soil bacteria. Raising the grade may also elevate the water table and change the potential of the soil to function as a growing medium suitable for the trees that were growing there before the filling occurred.

Lowering the grade is usually not as damaging as elevating the grade. Shallow cuts of 6" to 8" will remove most of the topsoil and some feeder roots and expose some to drying and freezing. Deep cuts may sever a large portion of the root system, depriving the tree of water and increasing the chance of windthrow. Lowering the grade may also lower the water table.

Trenching or excavating through a tree's root system eliminates part of the root system and can be very detrimental. Trees which lose as much as 40 percent of their root system usually die within 2 to 5 years. Tunneling may be a better alternative with species that do not have tap roots.

Soil compaction caused by heavy equipment, materials storage, and paving within the drip line of trees restricts air and water from roots by reducing pore space of the soil and by reducing infiltration.

Site Considerations for Non-woody Vegetation

Species selection, establishment methods, and maintenance procedures should be based on site characteristics, including soils, slope, aspect, climate, and expected management.

Soils

Many soils characteristics, including acidity, moisture retention, drainage, texture, organic matter, fertility, and slope influence the selection of plants and their establishment requirements. For example, bahiagrass and centipede are suited to droughty soils since they are more drought tolerant than most other grasses. [Appendix A1 Soils in Alabama](#) contains tables that provide a number of interpretations related to the soils that occur in Alabama. One characteristic that will not be found in tables is the occurrence of compaction created incidentally as a result of equipment traffic, especially when the soil is wet or moist. Compaction can have an extremely adverse impact on plant establishment and maintenance and should be addressed before establishment of vegetative cover.

Slope

The steeper the slope, the more essential is a vigorous vegetative cover. Good establishment practices, including seedbed preparation, liming fertilizing, proper planting, mulching, and anchoring of mulch are critical. The degree of slope may limit the equipment that can be used in seedbed preparation, planting, and maintenance.

Woody plants, shrubs, vines, and trees generally provide better long-term erosion control on steep slopes. They may be more costly and slower to establish, but can provide substantial savings in maintenance. Also, they can be more desirable in the overall landscape plan.

Aspect

Aspect affects soil temperature and available moisture. South and west facing slopes tend to be warmer and drier, and often require special treatment. Warm season species tend to do better on south and west facing slopes in Alabama because they are usually more drought and heat tolerant.

Climate

The regional climate must be considered in selecting well adapted plant species. Species adaptation and seeding dates in Alabama are based on three broad geographical areas: North, Central, and South. Climatic differences determine the appropriate plant selections based on such factors as cold-hardiness, heat tolerance, and tolerance to a cool growing season.

Management Requirements

When selecting plant species for erosion control and stabilization, the post-construction land use and the expected level of maintenance must be considered. In every case, future site management is an important factor in plant selection.

Select plant species that are wear resistant and have rapid wear recovery for sites that receive heavy use, such as a sports field. A wear resistant plant that also recovers rapidly from foot traffic is bermudagrass. Bermudagrass also has a fast establishment rate and is adapted to all geographical areas in Alabama.

Where a neat appearance is desired, use plants that respond to frequent mowing and other types of intensive maintenance. Likely choices for quality turf in north Alabama are bermudagrass or tall fescue, while in central or south Alabama bermudagrass, centipede, or zoysia are good choices.

At sites where low maintenance is desired, low fertility requirements and vegetation persistence are particularly important. *Sericea lespedeza* and tall fescue are good choices in north Alabama while bahiagrass and centipede do well in central and south Alabama.

Seasonal Considerations for Non-Woody Vegetation

Newly constructed slopes and other barren areas should be seeded or sodded as soon as possible after grading. Grading operations should be planned around optimal seeding dates for the particular region, where feasible. The most effective times for planting perennial grasses and legumes generally extend from March through May and from late August through October. Outside these dates the probability of failure is higher. If the time of year is not suitable for seeding permanent cover (perennial species) a temporary cover should be planted or the area may be stabilized with crimped or tackified mulch. Temporary seedings of annual species (small grains, ryegrass, millets etc.) often succeed at times of the year that are unsuitable for seeding permanent (perennial) species. Planting dates may differ for temporary species depending on the geographical area of Alabama.

Growing seasons must be considered when selecting species. Grasses and legumes are usually classified as warm-season or cool-season in reference to their season of growth. Cool-season species produce most of their growth during the fall and spring and are relatively inactive or dormant during the hot summer months. Therefore, fall is the most dependable time to plant them. Warm-season plants grow most actively during the summer, and go dormant after the first frost

in the fall. Spring and early summer are the preferred planting times for warm-season species.

Selecting Grasses and/or Legumes

Mixtures vs. Single Species Plantings

A mixture may be more desirable than a single species. Mixtures can be selected to provide cover more quickly and can be more enduring than a single species. Mixtures need not be elaborate. The addition of a quick-growing annual or short-lived perennial provides early protection and facilitates establishment of a slower growing long-lived perennial. It is important to evaluate the merits and weakness of each species in selecting the mixtures for the specific site to be treated. If a quick establishing species such as common bermudagrass is planned for the final cover then a mixture is probably not appropriate.

Companion or “Nurse” Crop

The addition of a companion or “nurse” crop (quick-growing annual or weak perennial added to permanent mixtures) is a good practice on difficult sites, late seeding, or in situations where the development of permanent cover is likely to be slow. The companion crop germinates and grows rapidly, holding the soil until the perennial species becomes established. The seeding rate of the companion crop must be limited to avoid crowding and competing with the desired perennial species, especially under optimum growing conditions. It is important to not plant a nurse crop that will compete to the detriment of the desired species.

Plant Species Selection

Information on plant species adapted for soil stabilization use in Alabama is contained later in this chapter and in the tables associated with the practices that are used for plantings. Using this information makes plant selection straightforward for most situations. Specific seeding rates and planting instructions are given in the tables of the practices.

Annuals

Annual plants grow rapidly, then mature and die in one growing season. They are useful for quick, temporary cover or as a companion crop for slower growing perennials.

Small Grain

Rye (cereal) is usually superior to other small grains (wheat, oats, or barley) for temporary cover. It has more cold hardiness than other annuals and will germinate and grow at lower temperatures. It will provide more fall and early winter growth and matures earlier than other small grains. Rye germinates quickly and is tolerant of poor soils. Including rye in fall seeded perennial mixtures is particularly helpful on difficult soils and erodible slopes or when seeding is late. However, seeding rates of rye should be limited to the suggested rates because thick stand will suppress the growth of perennial seedlings. No

more than 60 lbs/acre should be planted when rye is used as a companion crop. Rye grows fairly tall in the spring which may be undesirable. If this is a problem some of the shorter growing varieties of wheat may be used.

Annual Ryegrass

Annual ryegrass is outstanding for temporary cover because it provides dense cover rapidly. It is not recommended for use as a companion crop in perennial mixtures in Alabama because it is highly competitive and crowds out most other species leaving no lasting cover. Also, if allowed to mature the seed volunteers and can seriously interfere with subsequent efforts to establish permanent cover.

Millets

Millets (Browntop, Foxtail) are warm season annuals, useful for temporary seeding or as a nurse crop. Browntop millet has early rapid growth and grows to 2 to 3 feet in height. Foxtail is a fine stemmed plant growing to a height of 4 to 5 feet. The leaves are broad and flat. Foxtail millets do best under fairly abundant moisture conditions.

Sudangrass and Sorghum-sudangrass Hybrids

Sudangrass and sorghum-sudangrass hybrids, like the millets, are warm season annuals which are useful for temporary vegetation. The small stemmed, shorter growing varieties are more satisfactory for temporary vegetation than the tall coarse-stemmed varieties.

Annual Lespedeza

Annual lespedeza is a warm-season reseeding annual legume that grows to a height of 6-12". It is tolerant of low fertility and is adapted to the climate and most soils throughout Alabama. It is not adapted to alkaline soils of the Black Belt or deep sands. It is a good companion crop for spring planted sericea lespedeza, filling in weak or spotty stands the first season without suppressing the sericea. Annual lespedeza can heal thin areas in the perennial cover for several years after initial establishment. Two species of annual lespedeza are grown in Alabama. "Common" annual lespedeza volunteers in many parts of Alabama and is sold under the variety name Kobe. Korean lespedeza is a slightly larger, coarser and earlier-maturing plant sold under several variety names. Kobe is superior on sandy soils and preferable in south Alabama. Korean is better in north Alabama because the seeds mature earlier.

The preferred seeding dates for annual lespedeza are in the late winter to early spring. It can be mixed with a fall seeding, in which case some seeds remain dormant over the winter and germinate the following spring.

Cool-Season Perennials

Perennial plants, once established, will live for more than one year. They may die back during a dormant period, but will grow back from their underground tubers or rhizomes in succeeding years. Stands of perennials will persist for a number

of years under proper management and environmental conditions. They are the principal components of permanent vegetative cover.

Cool-season perennials produce most of their growth during the spring and fall and are more cold-hardy than most warm-season species. Tall fescue is the only cool-season perennial grass recommended for vegetating disturbed soils in Alabama. A description of tall fescue follows.

Tall Fescue

Tall fescue, a cool-season grass, is the most widely used species in north Alabama for erosion control. It is well adapted to all of north Alabama and all but the driest soils of central Alabama. Also, it can be grown on the Black Belt soils of Alabama. It thrives in full sun to partial shade and is fairly easy to establish. Liberal fertilization and proper liming are essential for prompt establishment, but once established it can tolerate minimal maintenance almost indefinitely. It will provide stabilization the year of establishment if planted early during the planting period. Because tall fescue has a bunch growth habit, it is slow to fill in areas with poor stands. Therefore, some replanting may be required on eroded areas or areas of spotty stands to complete stand establishment. Fescue does not tolerate frequent and close mowing during the summer, especially on sites that are droughty.

White Clover

White clover is sometimes planted with tall fescue. It is usually short-lived.

Crownvetch

Crownvetch is a deep-rooted, perennial legume adapted only to north exposures in the northern tier of counties in Alabama. It is useful on steep slopes and rocky areas that are likely to be left unmoved. Crownvetch requires a specific inoculant.

Warm-Season Perennials

Warm-season perennials initiate growth later in the spring than cool-season species and experience their greatest growth during the hot summer months. Most species of warm-season perennials do better in the southern one-half of Alabama, but there are species or varieties that will grow in north Alabama. The following grasses have proven the most useful for soil stabilization.

Bahiagrass

Bahiagrass is a warm-season perennial grass particularly well adapted for growing on sandy soils in the southern half of Alabama. It will tolerate acid and low fertility soils, grow in full sun to light shade, and persist almost indefinitely with little or no maintenance after it is established. However, bahiagrass seedlings are small and lack the vigor some species of warm-season grasses possess; it usually takes 2 years to establish a good sod. Bahiagrass is established with seed.

Bahiagrass produces a fairly dense sod suitable for low maintenance areas. It has a high resistance to wear and recovers fairly fast from wear. It produces rhizomes and will fill in small bare spots, but not fast like bermudagrass. Bahiagrass produces seed heads about one to 2 feet in height throughout the growing season and, where this is not a problem, it is probably the best choice for stabilizing soil in the southern one half of the State. It grows slowly in the northern part of the state and is not recommended for erosion control plantings. Pensacola is the recommended variety of bahiagrass for soil stabilization in Alabama. It is more tolerant to upland sites and more cold tolerant than Argentine bahiagrass. Argentine bahiagrass is not recommended for erosion control in Alabama.

Common Bermudagrass

Common Bermudagrass is a long-lived perennial that spreads by stolons and rhizomes. It will grow in all areas of the State on suitable sites. It is best adapted to well-drained fertile soils and will survive extreme heat and drought. It does poorly on extremely droughty sandy soils and will not grow on poorly drained soils. It is not shade tolerant. It responds well to fertilizer and will establish a dense sod quickly from seed. Bermudagrass requires more maintenance than bahiagrass and, if a regular maintenance fertility program is not used, it will tend to slowly decline. It has a high resistance to wear and fast recovery from wear which makes it a good choice for heavy use areas that have high fertility.

There are two types of bermudagrass which are important in soil stabilization: common bermudagrass, which can be established with seed or sprigs, and turf-type bermudagrasses which must be established from vegetative material. Common has longer internodes and larger leaves than the turf-type hybrid bermudagrass. When using common bermudagrass for permanent vegetation, only seed that is 98% pure common bermudagrass should be planted. Common bermudagrass seed are often contaminated with giant-type bermudagrass seed. Giant-type bermudagrass is very competitive and fast growing, but it is not cold hardy in Alabama. So when common bermudagrass seed contains even a small percent of giant type bermudagrass seed, they will be “choked out” by the giant-type bermudagrass. Since the giant-type bermudagrass will be killed by a cold winter, a good bermudagrass sod the year of establishment can become a poor stand the following year.

The turf type hybrid bermudagrass varieties have fine leaves and short internodes which make them desirable for lawn, golf courses and other areas where a quality turf is desired. However, turf type hybrid bermudagrass is more costly to establish because it must be planted from sprigs, plugs, or solid sodded.

The agronomic varieties of hybrid bermudagrass, such as Coastal, do not lend themselves to soil stabilization of construction areas. They too must be established with vegetative material which usually makes them too costly to establish.

Sericea Lespedeza

Sericea lespedeza, or sericea as it is commonly known, is a deep-rooted, drought resistant perennial legume, adapted to all but the poorly drained and deep sandy soils of Alabama. It is long-lived, tolerant of low fertility soils, pest free, and will fix nitrogen. It can be a valuable component in most low maintenance mixtures. Sericea is slow to establish and will not contribute much to prevention of erosion the first year; however, once established it persists indefinitely on suitable sites. Where esthetic is important, sericea may be considered unsightly because the old top growth breaks down slowly and the previous years' growth is conspicuous in following years. It may invade adjoining sites that have full sunlight and is recognized by the forest industry as an invasive species.

Plantings that include sericea require mulch and should include a companion crop such as annual lespedeza or common bermudagrass. Sericea should be planted as early as possible within the planting date to avoid as much weed competition as possible. Also, sericea may be planted in the late fall and winter months because many of the seed will lie dormant until the following spring.

Sericea does not tolerate frequent mowing and late mowing before frost because these mowing regimes deplete food reserves and adversely affect the stand the next year.

Selecting Shrubs, Vines and Groundcovers to be Retained or Planted

As with trees, several plant characteristics and environmental requirements should be considered when selecting shrubs, vines and groundcovers. Closer adherences to plant requirements yield a greater chance of achieving a successful landscape.

Hardiness

Plants have varying capacities to tolerate cold or heat. Cold tolerance is of most concern. The state of Alabama spans two major plant hardiness zones, Zone 7 (from the central part of the state northward) and Zone 8 (the southern half of the state). The zones are determined by the range of average annual minimum temperatures. The average range of minimum temperatures for Zone 7 is 0 to 10 degrees F; for Zone 8 it is 10 to 20 degrees F (See Plant Adaptation Zones in practice Shrub, Vine and Groundcover Planting).

Landscape plants which are not capable of tolerating temperatures below 10 degrees should not be expected to escape injury during an average winter in Zone 7. However, they should be adequately adapted to Zone 8.

Plant hardiness can be greatly influenced by nearby bodies of water since water buffers change in temperature. Other structures or other plants can moderate extreme temperatures and shelter landscape plants, enabling marginal species to better tolerate winter conditions.

Summer Heat Tolerance

A plant's capacity to survive the stress of high temperature is also a concern. Heat interacts with other environmental factors, especially soil moisture conditions and sunlight to influence the range of adaptability of a plant. Usually associated with high temperatures is rapid depletion of soil moisture, especially in late summer. Direct sunlight increases the severity of heat effects on plants. Since Alabama has periods of high temperatures and short winters, spruce, hemlock, and yew are generally poor performers. Other conifers such as deodar cedars and cryptomeria are not hardy further north into Zone 6 but offer good substitutes for hemlocks and spruces in Alabama.

Moisture Requirements and Soil Drainage

Landscape plants vary widely in the amount of moisture they need to thrive. If a drought tolerant plant receives a lot of rain, it can be more susceptible to invasion by normally weak pathogens, especially where the soil drains slowly. On the other hand, plants which require large amounts of water for best performance are easily drought stressed when water is withheld or if planted in very well-drained soils. Such conditions may actually attract insect pests to stressed plants.

Plants that normally require a lot of water can be irrigated so that the ornamental attributes of the plant are maintained. However, this is a use of water resources that can be avoided if consideration is given to appropriate plant selection.

Soil pH

Soil pH can have a profound influence on the performance of landscape plants. However, most landscape plants perform adequately within a soil pH range of 5.5 to 6.2. Plants listed in Tables SVG 1-5 should grow satisfactorily within this pH range.

Plant Pest Susceptibility

It is unwise to use pest-susceptible plants in areas where those particular pests thrive. For example, most species of euonymus are attacked by euonymus scale and Red Tip is highly susceptible to leaf spot. Other landscape options for plant materials might be selected which do not have the same susceptibilities. Plants listed in Tables SVG 1-5 have few major pest problems.

Nutritional Requirements

Newly set plants often require little additional fertilizer because of the presence of residual fertilizer in the root ball. At this stage, supplying water is far more important than adding fertilizer. Also, most well-established shrubs require less fertilizer to maintain an attractive plant than is usually required by poorly established shrubs.

Light Requirement

Plants which require full sun (at least 8 hours of direct sunlight per day) are weakened in low light situations. Plants that need some shade are often vigorous and unattractive in full sun.

Rate of Growth and Mature Size

Obviously, for rapid cover, faster-growing plants are desired. However, mature size and other plant characteristics should be considered. For example, where a screen is needed, a slower-growing evergreen shrub may be desired over a fast-growing deciduous plant. Take all plant characteristics into account when selecting plants for a site. If money is available, both needs can be met by planting fast growing, short-lived plants to provide a quick screen and at the same time planting slower growing plants and allowing them to mature. When the fast-growing plants become over grown, they can be removed to allow the more desirable plants to take their place.

Treating Sites to Establish Grass, Legumes, Shrubs, Vines and Groundcover

Topsoiling

The surface layer of an undisturbed soil is often enriched in organic matter and has physical, chemical, and biological properties that make it a desirable planting and growth medium. These qualities are particularly beneficial to plant establishment. Consequently, where practical, topsoil should be stripped prior to construction and stockpiled for use in final vegetation of the site. Stockpiling topsoil may eliminate costly amendments and repair measures later. Topsoil may not be required for the establishment of less demanding, lower maintenance plants, but it is essential on sites having shallow soils or soils with other severe limitations. It is essential for establishing fine turf and ornamentals.

The need for topsoil should be evaluated, taking into account the amount and quantity of available topsoil and weighing this against the difficulty of preparing a good seedbed on the existing subsoil. Where a limited amount of topsoil is available, it should be reserved for use on the most critical areas.

Soil Amendments

Lime is almost always required on disturbed sites in Alabama to decrease soil acidity. Lime raises the pH, reduces exchangeable aluminum, and supplies calcium and magnesium for vigorous plant growth. Only the alkaline soils of the Black Belt and north Alabama do not require lime. A soil test should be used to determine the need for liming materials.

Plant nutrients, such as phosphorus and potassium, will usually be required even on the best soils. Plant nutrient application rates for a particular species of vegetative cover should be applied according to a soil test report.

Soil amendments should be applied uniformly and well mixed with the top 6" of soil during seedbed preparation.

Site Preparation

The soil on a disturbed site must be modified to provide an optimum environment for germination and growth. Addition of topsoil, soil amendments, and tillage are used to prepare a good seedbed. At planting, the soil must be loose enough for water infiltration and root penetration, but firm enough to retain moisture for seedling growth. Tillage generally involves disking, harrowing, chiseling, or some similar method of land preparation. Tillage should be done on the contour where feasible to reduce runoff and erosion. Lime and fertilizer should be incorporated during the tillage.

Planting Methods

Seeding is by far the fastest and most economical method that can be used with most species. However, some grasses, such as hybrid bermudagrass do not produce seed and must be planted vegetatively. Seedbed preparation, liming, and fertilization are essentially the same regardless of the method chosen.

Uniform seed distribution is essential. This is best obtained using a cyclone seeder, conventional grain drill, cultipacker seeder, or hydraulic seeder. The grain drill and cultipacker seeder are pulled by a tractor and require a fairly clean, smooth seedbed.

Seeding rates recommended in this handbook have taken into account the “insurance” effect of extra seed. Rates exceeding those given are not recommended because over dense stands are more subject to drought, competitive interference and are unnecessarily costly.

Because uniform distribution is difficult to achieve with hand broadcasting, it should be considered only as a last resort. When hand broadcasting of seed is necessary, uneven distribution may be minimized by applying half the seed in one direction and the other half at right angles to the first. Small seed should be mixed with sand for better distraction.

A sod seeder (drill seeder or no-till planter) can plant seed into an existing cover or mulch or be used to restore or repair a weak stand. It can be used on moderately uneven, rough surfaces. It is designed to penetrate the sod, open narrow slits, and deposit seed with a minimum of surface disturbance.

Hydroseeding may be the most effective seeding method on steep slopes where equipment cannot work safely. A rough surface is particularly important when preparing slopes for hydroseeding. In contrast to other seeding methods, a rugged or rough seedbed gives the best results.

Sprigging refers to planting stem fragments consisting of runners (stolons) or lateral, below-ground stems (rhizomes), which are sold by the bushel. Sprigs can be broadcast or planted in furrows using a transplanter. This method works well with bermudagrass. Also sprigs may be broadcast and covered with soil by light disking, or cultipacking. Broadcasting is easier but requires more planting material. Common and forage type hybrid bermudagrass will cover over much more quickly than the lawn type bermudagrass.

Plugging differs from sprigging only in the use of plugs cut from established sod, in place of sprigs. It requires more planting stock, but usually produces a complete cover more quickly than sprigging. It is usually used to introduce a superior grass into an old lawn.

In sodding, the soil surface is completely covered by laying cut sections of turf. It is limited primarily to lawns, steep slopes, and sod waterways in Alabama. Turf-type bermuda, centipede, and zoysia are usually the types of turf used for sodding. Plantings must be wet down immediately after planting, and kept well watered for a week or two thereafter.

Sodding, though quite expensive, is warranted where immediate establishment is required, as in stabilizing drainage ways and steep slopes, or in the establishment of high quality turf. If properly done, it is the most dependable method and the most flexible in seasonal requirements. Sodding can be done almost anytime of the year in Alabama.

Inoculation of Legumes

Legumes have bacteria called rhizobia which invade the root hairs and form gall like “nodules”. The host plant supplies carbohydrates to the bacteria, which supply the plant with nitrogen compounds fixed from the atmosphere. A healthy stand of legumes, therefore, does not require nitrogen fertilizer. Rhizobium species are host specific in that a given species will inoculate some legumes but not others. Therefore, successful establishment of legumes requires the presence of specific strains of nodule forming, nitrogen fixing bacteria on their roots. In areas where a legume has been growing, sufficient bacteria may be present in the soil to inoculate seeded plants, but in other areas the natural Rhizobium population may be too low.

In acid subsoil material, if the specific Rhizobium is not already present, it must be supplied by mixing it with the seed at planting. Cultures for inoculating various legume seed are usually available through seed dealers.

Among the legumes listed for use in this manual, crownvetch is the only one generally requiring inoculation. Lespedeza nodule bacteria are widely distributed in the soils of Alabama unless the site has had all surface soil removed.

Irrigation

Irrigation, though not usually required, can extend seeding dates into the summer and ensure seedling establishment. Damage can be caused by both under and over irrigating. If the amount of water applied penetrates only the first few inches of soil, plants may develop shallow root systems that are prone to desiccation during droughts. If supplementary water is used to get seedlings up, it must be continued until plants become completely established.

Mulching

Mulch is essential to the successful establishment of vegetation of most disturbed sites, especially on difficult sites such as southern exposures, channels, and excessively dry soils. The steeper the slope and the poorer the soil, the more valuable mulch becomes. Mulch protects the site from erosion until the vegetation is established. In addition, mulch aids seed germination and seedling growth by reducing evaporation, preventing soil crusting, and insulating the soil against rapid temperature changes.

Mulch may also protect surfaces that cannot be seeded. Mulch prevents erosion in the same manner as vegetation, by protecting the surface from raindrop impact and by reducing the velocity of overland flow.

Small grain straw (wheat, oats, barley or rye) is the most widely used and one of the best mulch materials. However, there are other materials, including manufactured mulches that work well. Mulching materials covered in this manual have their respective advantages and appropriate applications, and a material should not be selected on the basis of cost alone. The effectiveness of straw mulch can be increased by crimping or tacking.

Maintenance

Satisfactory stabilization and erosion control requires a complete vegetative cover. Even small breaches in vegetative cover can expand rapidly and, if not repaired, can result in excessive soil loss from an otherwise stable site. A single heavy rain will enlarge rills and bare spots and the longer repairs are delayed the more costly they become. Prompt action will keep soil loss, sediment damage, and repair costs down. New plantings should be inspected frequently and maintenance performed as needed. If rills and eroded areas develop, they must be repaired, seeded, and mulched as soon as possible.

Maintenance requirements extend beyond the seeding phase. Damage to vegetation from disease, insects, traffic, etc., can occur at any time. Pest control (weed or insect) may be needed at any time. Weak or damaged spots must be fertilized, seeded and mulched as promptly as possible.

Vegetation established on disturbed soils often requires additional fertilization. Frequency and amount of fertilizer to apply can best be determined through periodic soil testing. A fertilization program is required for the maintenance of turf and sod that is mowed frequently. Maintenance requirements should always be considered when selecting plant species for vegetation.

Measures for Stabilizing Coastal Dunes

Introduction

Dunes are reservoirs of sand that help keep a sea shore intact. They act as flexible barriers to high tides and waves, and dissipate energy that can cause shore recession (beach erosion). Coastal dune ridges block the movement of storm tides

and waves into the low-lying areas behind a beach. If they do give way to storm winds and water, these shifting mounds of sand will soon reappear. Dunes are not effective, however, against persistent, continuous beach erosion caused by permanent changes in the shoreline.

Dunes are formed by waves and wind, and when unstable, they are extremely vulnerable to these same forces. They may be stabilized by grasses and woody plants that are well adapted to this environment.

Dunes stabilized with grasses provide for enrichment of dunes, a natural barrier, reducing the velocity of waves and absorbing their energy. These stabilizing plants are tolerant of salt, intense heat, soils lacking humus, and a limited water supply. As sand piles up around beach grass plants, new shoots emerge from the sand surface and trap more windblown sand. Structures such as crosswalks and sand fences also catch and hold sand, and help to build or repair dunes.

Dune stabilization projects usually require a combination of vegetative and structural measures. They include planting adapted dune grasses, providing adequate moisture during the first growing season (often with an irrigation system), and constructing walkover structures to prevent pedestrian traffic from destroying dune vegetation. The use of sand fences and dune vegetative plantings are more effective than using either vegetation or structural measures alone.

Selecting Vegetative Measures

There are only a few plant species that are tolerant of the stresses of the beach environment. These plants must be able to survive being buried by blowing sand, sand blasting, salt spray, saltwater flooding, drought, heat, and low nutrient supply. Perennial grasses are effective under these conditions. From 1984 to 1989, the USDA, Natural Resources Conservation Service (formerly Soil Conservation Service) Jimmy Carter Plant Materials Center (PMC) evaluated sea oats, marshhay cordgrass, and bitter panicum for dune stabilization on Tybee, Jekyll, and St. Simons Islands Georgia, and at Gulf Shores Alabama. As a result, the Jimmy Carter PMC recommends the following plant materials for coastal dune stabilization: sea oats (*Uniola paniculata*); 'FLAGEO' marshhay cordgrass (*Spartina patens*); 'NORTHPA' bitter panicum (*Panicum amarum*); 'SOUTHPA' bitter panicum (*Panicum amarum*); 'ATLANTIC' coastal panicgrass (*Panicum amarum* var. *amarulum*).

Sea Oats

Sea oats is a warm-season dune grass ranging throughout the Gulf and south Atlantic coastal region from southeastern Virginia to Mexico. It is vigorous, drought tolerant, heat tolerant and relatively free of pests. This perennial is the most important and widespread grass on southern coastal dunes.

The leaves are narrow and pale green, and in northern locations, they die back close to the ground each winter. The seed head matures in the fall and has compressed spikelets at the end of stiff stems 3 feet long or more.

Sea oats can be established by digging and dividing native plants, or from small potted plants grown from seed that are commercially available. Under natural conditions, seed germination is not high and seedling survival is low. When replanting seedlings, set the stock at least 1 foot deep into the sand and pack it tightly.

'FLAGEO' Marshhay Cordgrass

'FLAGEO' marshhay cordgrass was cooperatively released in 1990 by the NRCS Jimmy Carter PMC, the Brooksville PMC (Florida) and Fort Valley State College in Fort Valley, Georgia. This perennial occurs on dunes throughout the south Atlantic and Gulf regions and in Puerto Rico and is especially salt tolerant.

The stems of marshhay cordgrass are slender and grow 2 to 3 feet tall and the leaves are rolled inward, resembling rushes. The seed head is composed of two or more compressed spikes attached at nearly a right angle to the culm. The plant spreads by means of a network of slender rhizomes.

Plantings of vegetative material in early spring can be successful. For large plantings, bare root planting stock is recommended. Stems rooted at the base, preferably with a section of rhizome attached, can be planted at a depth of 4" to 5".

'NORTHPA' and 'SOUTHPA' Bitter Panicum

'NORTHPA' and 'SOUTHPA' bitter panicum varieties were released by the Brooksville, PMC in 1992. Vegetative plant material is commercially available.

Bitter panicum is a perennial grass found throughout the south Atlantic and Gulf regions. It is most common in southern Florida and Texas.

The plant grows to an average height of 3 to 4 feet. The leaves are smooth and bluish green and the seed head is narrow, compressed, and generally sparsely seeded. The plant spreads from an aggressive, scattered system of rhizomes, but the stands are rather open.

Bitter panicum produces few viable seed, and it is better adapted for transplanting than sea oats. It can be propagated from a stem with part of the rhizome attached or from an 8" to 12" length of rhizome without any above ground parts. Plant the rhizome 4" deep in early spring, spaced no more than 6 feet apart.

Another method of propagation is to snap off robust stems at ground level and plant them at an angle of about 45 degrees so that several nodes are buried.

'ATLANTIC' Coastal Panicgrass

'ATLANTIC' coastal panicgrass was released by the Cape May Plant Materials Center (New Jersey). Its origin is Princess Ann County, Virginia. Seed is commercially available.

'ATLANTIC' coastal panicgrass is a somewhat dense, upright perennial bunchgrass found on coastal dunes throughout the south Atlantic and Gulf regions. It is a dominant plant at many locations, especially in west Florida, Alabama, and Texas.

The stems are coarse, straight, stiff, and grow up to 4 feet tall. Partially compressed seed heads produce moderate amounts of viable seed each fall. The crowns enlarge slowly from short, almost vertical tillers.

It can be propagated by either seeding or planting divided plant parts. Plant the seed 1 to 3" deep in dune sand, and mulch the area for best results. Seedling survival depends on adequate rainfall after germination. Clumps of coastal panicgrass can be dug, divided, and planted with good results during the summer rainy season.

Irrigation

Irrigation is required on all dune plantings to provide adequate moisture during the initial establishment period. The irrigation system will consist of mains and laterals, control zones, supports, control valves, fittings, and related hardware that is capable of applying ½" of water over the entire zone in an 8 hour period.

Structural Measures

The coastal dune stabilization plan should include structural measures such as dune walkovers and sand fences.

Dune Sand Fence

Dune sand fence is an artificial barrier of evenly spaced wooded slats or approved fabric erected perpendicular to the prevailing wind and supported by posts. It reduces wind velocity at the ground surface and traps blowing sand. Dune sand fences are used primarily to build frontal ocean dunes to control erosion and flooding from wave overwash.

Dune Walkover

Dune walkover structures control pedestrian traffic and keep traffic off of the sand, allowing the dune vegetation to establish and protect the dunes from erosion.

Dune Maintenance

Well stabilized dunes will not remain that way unless a reasonable maintenance program is followed. Major considerations include:

Control of Foot and Vehicular Traffic

The primary dune is intolerant of trampling. Traffic should be prevented to the extent possible. However, since dunes must be crossed to reach the beach, mechanical crossovers should be installed at selected sites. Elevated walkovers

are satisfactory. These walkways should be curved to reduce wind erosion. The inland or secondary dune should also be protected from pedestrian and vehicular traffic.

Maintenance of Dune Line

A dune system is like a chain in that it is no stronger than its weakest point. Consequently, to receive maximum protection from dunes, a strong and uniform dune line must be maintained. Blow outs, wash pits, and other natural or human produced damage must be repaired quickly to prevent weakening of the entire protective dune system. Blow outs in a dune system can be repaired by placing sand fences between existing dunes, and tying the ends of the fence into these dunes.

Maintain sand fences and erect additional sand fences as needed, until the eroding area has been permanently stabilized or until the dune has reached the desired height and is properly vegetated. Any loose or damaged boards on cross-over structures should be repaired or replaced.

Maintenance of Vegetation

Maintain plantings by applying fertilizer as needed to keep a healthy stand with the desired density. A minimum annual application of 50 lbs/acre of an inorganic nitrogen fertilizer is usually needed for grass stands. Sparse areas should be replanted during the next planting season for the desired grass or legume.