CHAPTER IV

PERFORMANCE CRITERIA

INTRODUCTION

The purpose of this chapter is to provide local officials with a framework of interpretation, explanation and guidance regarding the Land Use and Development Performance Criteria found in Part IV of the Regulations. These performance criteria are the second set of criteria referred to in § 10.1-2107A of the Act,

". . . for use by local governments in granting, denying, or modifying requests to rezone, subdivide, or to use and develop land in these areas."

This chapter provides clarification and guidance in implementing the performance criteria. The chapter first discusses basic principles inherent in the performance standards. The chapter next discusses the General Performance Criteria, which apply to all lands within Chesapeake Bay Preservation Areas (both RPAs and RMAs). The following sections of the chapter discuss more specific performance criteria addressing Erosion and Sediment Control, Septic Systems, Stormwater Management, Agriculture, Forestry, Wetlands and Buffer Areas.

Local Adoption Of Performance Criteria

These criteria become mandatory upon the local program adoption date. They are supplemental to the various planning and zoning concepts employed by local governments in granting, denying, or modifying requests to rezone, subdivide, or to use and develop land in Chesapeake Bay Preservation Areas. (§ 4.1.A)

This subsection of the Regulations means the requirements do not apply to individual property owners, renters or developers until the local government has officially adopted a local implementation program through ordinance, regulations or other legally acceptable mechanism. As noted in Chapter I of this Manual, localities in Tidewater Virginia have twelve months from the adoption date of the Regulations to designate their Preservation Areas **and employ** (by local adoption) the performance criteria.

Furthermore, the criteria are considered supplemental to existing planning and zoning authority and development regulations. To the extent that a locality already requires any of the performance criteria, the locality would simply continue, with whatever implementation modifications necessary to fully comply. Generally, the locality will make adjustments as necessary to incorporate the performance criteria into the existing local land use management system. Suggestions of ways to effectively implement each of the criteria are made in this chapter and in the model ordinances. (Chapter V.)

Rebuttable Presumption

Local governments may exercise judgement in determining site-specific boundaries of Chesapeake Bay Preservation Area components and in making determinations of the application of these Regulations, based on more reliable or specific information gathered from actual field evaluations of the parcel, in accordance with plan of development requirements in Part V. (§ 4.1.B)

This subsection establishes the concept of "rebuttable presumption" as applicable to the Regulations. Procedures and determinations included in a local program may be based on certain generally defensible assumptions. However, with data that is more specific to actual site conditions these assumptions may be refined.

For instance, a locality with Preservation Areas on a planning-scale map (e.g., 1:24,000 or 1:12,000 scale) will be able to assert that the types of sensitive lands listed in the Regulations can **generally** be assumed to exist within the designated boundaries. A developer will delineate site-specific boundaries of RPA features as part of the water quality impact assessment or plan of development process. Site-specific delineations may show there is less RPA land on the development site than is indicated on the planning-scale map and appropriate adjustment may be approved by the local government. Such site-specific delineations can also be useful to localities in more precisely locating and mapping their wetlands.

to requirements in § 208 of the Clean Water Act, the State Water Control Board published Virginia's first set of BMP Handbooks in 1979. These Handbooks were developed largely through the cooperative efforts of a number of state and federal conservation and environmental protection agencies. At that time, a greater number of BMPs were listed for each land use than are considered effective with current knowledge. In addition, BMP descriptions were more conceptual, since some of the recommended practices were in their infancy and had not been subjected to extensive research and the test of time.

Over the last ten years considerable research on BMPs has proven certain practices to be less effective than originally assumed. As a result, a more specific list of practices has been developed for each type of land use. Design, construction and maintenance guidelines and criteria have also been refined through experience. Virginia's BMP Handbooks are currently being revised under leadership from the Department of Conservation and Recreation, Division of Soil and Water Conservation. However, other sources providing updated guidance can be used until those revisions are completed. For urban development applications, two resources in particular provide excellent guidance:

1. ***Controlling Urban Runoff: A Practical Manual For Planning and Designing Urban BMPs,*** Metropolitan Washington Council of Governments, 1987.

2. ***BMP Handbook for the Occoquan Watershed,*** Northern Virginia Planning District Commission, 1987. [1]

Both of these resources provide information on BMP design, construction, and maintenance. (See Figure 4-1.)

For agricultural applications, information should be sought from the U.S. Department of Agriculture - Soil Conservation Service; local Soil and Water Conservation Districts; the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation; and local Virginia Cooperative Extension Service offices. All of these agencies cooperate in implementing combined agricultural conservation programs aimed at reducing agricultural NPS pollution. (See Appendix A: Government Resources.)

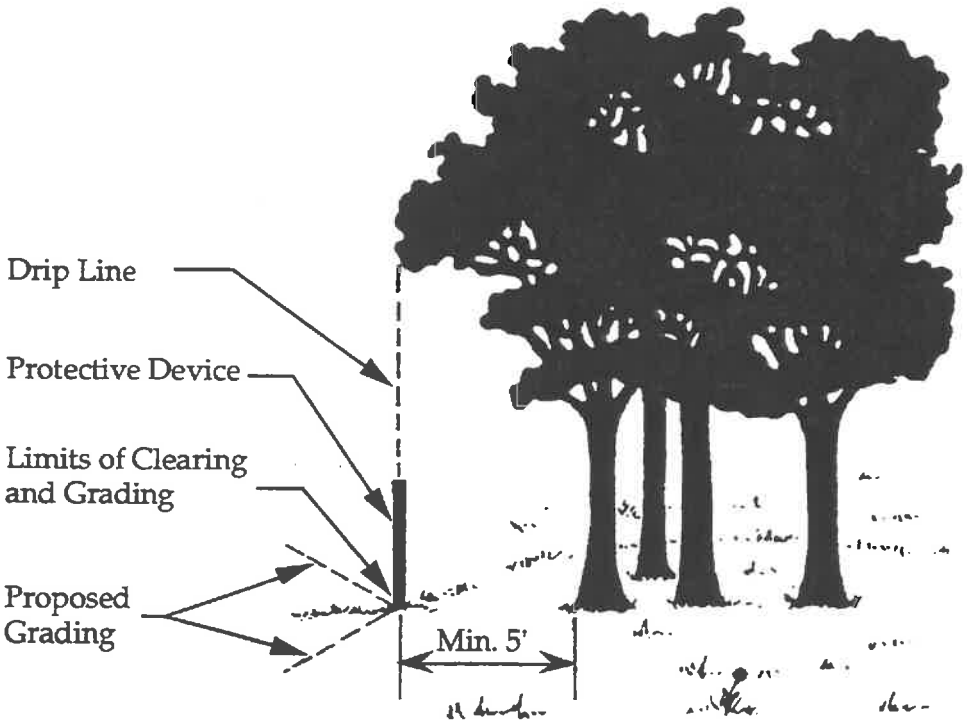
The Board agreed to allow the silvicultural industry and the Virginia Department of Forestry an opportunity to demonstrate the effectiveness of their non-regulatory forestry BMP program prior to determining whether forestry needs to be addressed by the Regulations. Therefore, there are no specific criteria applicable to silvicultural activities in the Regulations at present. However, anyone interested in forestry BMP guidance can obtain information from local offices of the Virginia Department of Forestry.[2]

The best current stormwater runoff control BMPs can remove only **60 to 65 percent** of the pollutants in runoff.[5] As the Regulations require site runoff to contain or contribute no more pollution after development than before development, there must be a balance between the amount and type of development and the amount of vegetation preserved. This is true even with the use of pollutant loading factors based on average watershed conditions. Generally, the more existing woody vegetation on-site before development, the more difficult it will be to satisfy the runoff loading control requirement if this vegetation is replaced by impervious surfaces.

Greater pollution removal efficiencies can be obtained by using a connected system of BMPs. However, such systems increase project costs and require more land area, reducing the area left for development in a manner comparable to preserving existing vegetation at little or no cost. In view of these factors, careful consideration should be given in the planning stage of a project to preserving vegetation on the site in balance with the desired development and runoff control requirements.

Local governments should consider adding provisions to their local Erosion and Sediment Control (ESC) Programs that require all ESC plans to show the limits of clearing and grading and contractors to physically mark those limits on the site. The latter should be done not only at the site's perimeter, but also around tree groupings to be preserved within the site. This can prevent damage to tree trunks and compaction over the root zones that might otherwise result in the eventual loss of the vegetation.

CONSTRUCTION TECHNIQUES TO PROTECT TREES *FIGURE 4-2*



Source: Adapted from *Virginia Erosion & Sediment Control Handbook*, 2nd Edition, 1980

ensure that the applicable performance criteria of the Regulations are satisfied.

That review process can be an expansion of a plan of development or other procedures for project review currently being implemented by a locality, such as site plan review, subdivision plan review, or stormwater management plan review. A locality may decide to initiate a new or separate review process for this program. However, a comprehensive, integrated review process for all locally required plans benefits all participants in the process.

The Board included this requirement because numerous Tidewater localities conduct little or no review of actual project plans prior to issuing building permits. A project may change considerably both in concept and in potential for impact on the environment from the time it receives zoning or subdivision plat approvals to the time the construction permits are sought.

Impervious Cover

Land development shall minimize impervious cover consistent with the use or development allowed. (§ 4.2.5)

This criterion is to be interpreted the same as §§ 4.2.1 and 4.2.2. The intent is to ensure that any use or development proposed for a property -- regardless of the zoning classification or how extensive or sparse the coverage -- is accomplished in a manner that results in the minimum impervious cover necessary to accommodate the proposed development. The intent is not necessarily to restrict developers to only those building types or concepts that result in minimal impervious cover. However, greater impervious cover results in greater runoff pollution and developers who limit the amount of impervious surface will reduce their site development costs.

Local governments may choose to adopt impervious cover performance standard thresholds. In a large sense, impervious surface is dictated by conventional setback and other bulk requirements for development. However, such building coverage restrictions have little relationship to the natural characteristics of a site or the site's capacity for the proposed use or development. Open space or natural area ratios can be used to define the limits of impervious cover based on the site's physical character. Open space ratios alone may not protect sensitive lands or minimize land disturbance unless open space is carefully qualified. For this reason, some localities have required a "natural area" ratio which limits clearing and grading to a proportion of a site and restricts impervious cover to the remaining "footprint."[6] Importantly, the restrictions of impervious surface to a certain percentage of a site need not limit the scale or intensity of the desired development.

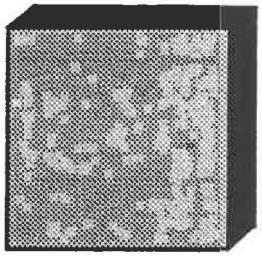
Careful site design and layout are very important in satisfying this criterion of the Regulations. Use of grass drainage ditches instead of curb and gutter, efficient layout of parking areas, minimizing the size of driveways, and minimizing site coverage by using multi-story structures where they are permitted all can be effective design techniques. Land planning and design professionals involved early in the site design phase of a project can assist a developer in enhancing the integration of the built environment with the natural environment.

Many local erosion and sediment control ordinances use the standard definition of "land disturbing activity" from §15.1-560, Code of Virginia. The language in the definition can be revised to comply with the Regulations by striking out the septic tank exemption, clarifying the single family exemption, and changing the 10,000 square foot limit as shown on the following page.

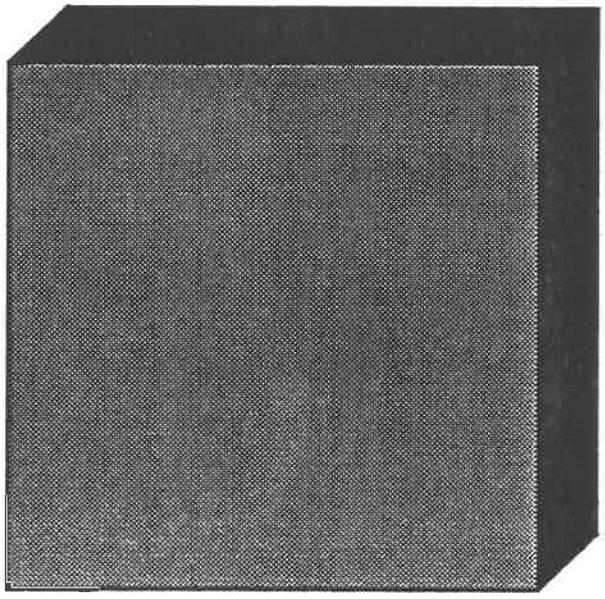
SEDIMENT VOLUME LOSS *FIGURE IV-3*

Forest: 24 tons /acre/year

Grassland: 240 tons/acre/year



Cropland: 4,800 tons/acre/year



Construction: 48,000 tons/acre/year

Source: Based on Virginia Department of Conservation and Historic Resources, ***Urban Erosion and Sediment Control in Virginia, Training Notebook,*** 1985

SEPTIC SYSTEMS

On-site sewage treatment systems serve a significant percentage of residents throughout the Tidewater region of Virginia. Some rural localities have 100 percent of their population served by on-site sewage treatment systems. Even some rapidly growing localities may have 25 percent or more of their residents served by on-site sewage treatment systems, which include: septic systems, low-pressure distribution systems, elevated sand mounds, package treatment plants, as well as other types of systems.

Package treatment plants (package plants) operate under a Virginia Pollutant Discharge Elimination System permit (VPDES) which regulates their discharge. This permit is currently issued and enforced by the Virginia State Water Control Board (SWCB.) The SWCB must first obtain a General Permit from the Environmental Protection Agency. The 1990 General Assembly gave the Virginia Department of Health (VDH) the authority to develop regulations for single family package plants with a discharge of 1000 gallons/day or less. Package plants and other systems which operate under a VPDES permit are not subject to the Regulations.

Septic systems in particular have been identified by EPA as the most frequently reported sources of groundwater contamination in the United States.[7] A properly designed, installed, maintained, and utilized septic system, however, should function well for many years.[8] Bulky wastes should not be disposed of in septic systems nor should such items as plastics, grease, liquid fats, oils, disposable diapers, other sanitary items, or toxic and hazardous chemicals. Conservation of water is also very important for the efficient function of septic-type systems.[9] A list of principles for best use of septic systems is reproduced as Table 4-1. Because septic systems have a potential to degrade water quality through surface leaching and groundwater mixing, the Regulations include performance criteria for periodic pump-out and 100 percent reserve drainfields.

PERIODIC PUMP-OUT

On-site sewage treatment systems not requiring a Virginia Pollution Discharge Elimination (VPDES) permit shall:

a. Have pump-out accomplished for all such systems at least once every five years; (§ 4.2.7)

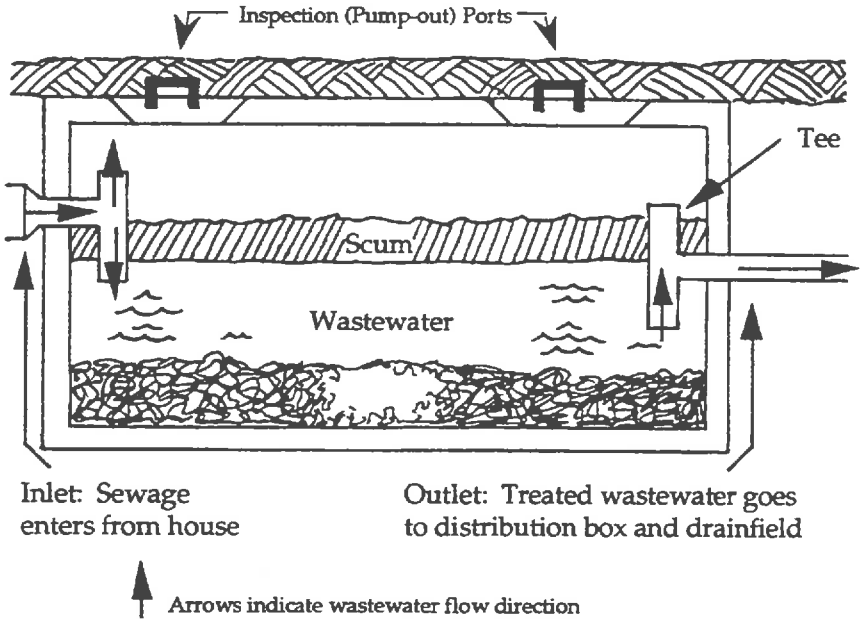
Septic systems function by providing both anaerobic (without oxygen) and aerobic (with oxygen) treatment of biological wastes. This treatment is provided by micro-organisms. Solids are transferred from commodes to the septic tank via household plumbing. Within the septic tank the solids are combined with all other household wastewater from the kitchen, bath and laundry. The solids are partially liquified and digested within the anaerobic environment of the septic tank. (See Figure 4-4.) Lighter materials float on top of the liquid in the tank and form a scum layer. Each time the septic tank fills up the overflow goes first into a distribution box and then into parallel lines of perforated pipe or open-jointed tile. These "lines" are placed in trenches partially filled with gravel and completely surrounded by soil. These trenches make up the drainfield of a conventional septic system.

Aerobic treatment of the wastewater takes place in the soil of the drainfield. If the septic tank is not pumped out, it will eventually fill up with solids. Solids will begin to be transported into the trenches and, over time, will clog the soil pores. Septic system "failure" will occur when sufficient solids have infiltrated into the soil pores to cause sewage to leach out onto the surface or back up into the residence that the system serves. Rehabilitation of a drainfield which has failed due to solids infiltration is often either impossible or ineffective, and is extremely expensive even where it can be done. In addition, long before this type of failure occurs, inefficient treatment of the wastewater may have occurred for a number of years.

In order to ensure the efficient operation of on-site sewage treatment systems, the Regulations include the provision for pump-out of all **(both new and existing)** on-site sewage treatment systems not requiring a VPDES permit and located within Chesapeake Bay Preservation Areas at least once every five years. Research by EPA and others, recommends an average pump out frequency of three to five years for conventional septic systems in order to maintain efficient effluent treatment.[10]

Additional research at Pennsylvania State University's College of Agriculture, Cooperative Extension Service resulted in the publication of an agricultural engineering fact sheet on septic tank pump-out. This paper recommends pump-out of a 750 gallon septic tank, serving a two-person household, every 4.2 years. The paper further recommends a 2.6 year pump-out frequency for use of a 750 gallon septic tank by three persons.[11] The minimum size septic tank currently allowed in Virginia for one and two bedroom homes is 750 gallons. Virginia state code currently requires a minimum septic tank capacity of 900 gallons for three bedroom homes. The Penn State recommendation for pump-out frequency of a 900 gallon septic tank with a two-person household was 5.2 years. The fact sheet is reproduced in Appendix B.

TYPICAL SEPTIC TANK *FIGURE 4-4*



Source: Virginia Water Resources Research Center, VPI&SU, *A Homeowners Guide to Septic Systems*, 1986

SEPTIC SYSTEM MANAGEMENT — TABLE 4-2

*For further information contact: **National Small Flows Clearinghouse** at 1 (800) 624-8301.*

1. CONTRACTING BY COMMUNITY
   a. ***Westboro, Wisconsin ($36/quarter)***
      - inspections and pump-out as necessary
      - accepts bids for contracts to keep costs down.

   b. ***Somers, Connecticut ($128.47/year, new $112.96/year, rehabilitated)***
      - inspection every 2 years and pump out if necessary
      - accepts bids for contracts to keep costs down.

2. MONITORING
   Stinson Beach, California ($36/quarter)
   - issues wastewater permits for two years or less
   - inspects all systems every two years

3. MANAGEMENT CORPORATIONS
   Larimar County, Colorado ($100/year)
   - fee for lot owners in rural subdivision
   - up to 2000 gallons of water delivered and up to 2000 gallons of sewage picked up annually

4. REGIONAL SEPTAGE DISPOSAL
   Towns of Wayland and Sudsbury, Massachusetts
   - built a regional facility for treatment
   - private pumpers dispose of septage free of charge
   - towns charge homeowners per gallon treatment costs
   - unpaid fees added to homeowners' taxes

5. LOCAL UTILITY MANAGEMENT
   a. ***Anne Arundel County, Maryland ($53/quarter)***
      - Mayo Peninsula residents guaranteed service
      - maintenance and replacement are county responsibilities
      - reserve fund for replacement of failed systems

   b. ***Glide, Oregon ($16/month)***
      - Septic Tank Effluent Pumps (STEP)
      - county inspects and pumps tanks every 12 years

   c. ***Otter Trail Lakes in Battle Lake, Minnesota***
      - 1,350 residences and businesses
      - one full-time operator
      - resorts and businesses inspected once a year
      - individual homes inpsected once every three years
      - private pumpers contracted
      - septage used as fertilizer

6. PUBLIC/PRIVATE AGREEMENTS
   Chesterfield County, Virginia ($10/year)
   - private pumpers submit standardized form to county
   - county maintains data base to record dates individual systems are pumped out
   - once per cycle (5 years) county notifies residents by mail with no record of pump-out
   - county contracts to have system pumped if owner does not comply (back charges and fines)
   - fees pay for staff (one inspector, two clerical), and maintenance of data base

requirements. Those VDH septic permits issued after October 1, 1989, but prior to local program adoption will undergo a second site evaluation and will be required to comply with both the 100% reserve sewage disposal site and be located outside of Resource Protection Areas to the maximum extent possible. VDH permits issued after local program adoption must comply fully with the Regulations.

Redevelopment And Expansion Of Existing Structures

The Regulations state in § 4.2.7.b that a 100% reserve sewage disposal area shall be set aside for "new construction." All redevelopment in Chesapeake Bay Preservation Areas constitutes new construction and would require a 100% reserve sewage disposal area. For lots or parcels recorded prior to October 1, 1989, however, this requirement would apply only to the extent that there is sufficient area on that lot or parcel for the 100% reserve area.

Expansion of existing structures within Chesapeake Bay Preservation Areas could require a 100% reserve sewage disposal area depending on the size of the expansion. The Regulations define 2,500 square feet as the threshold for substantial alterations within Resource Management Areas (RMAs). Any alteration within Resource Protection Areas (RPAs) may be considered substantial. If an expansion of existing structures will require a new on-site sewage treatment system permit from the Health Department, then a 100% reserve sewage disposal area will also be required unless the lot or parcel was recorded prior to October 1, 1989 and there is insufficient room for the 100% reserve area. A local government could, therefore, by reasonable interpretation of § 15.1-492 of the Code of Virginia, require a 100% reserve area for any substantial alteration of existing structures within Chesapeake Bay Preservation Areas even where the nature of the expansion would not otherwise require a new sewage disposal permit from the Health Department.

Alternating Drainfields

There is another method to prolong the useable life of a conventional drainfield. Fairfax County has required a diversion valve, as illustrated in Figure 4-6, since June 1984. Citizens are notified by the county to turn their diversion valve once a year. By so doing, half of each drainfield is taken out of use every year. This action prevents excess buildup of a biological mat and allows sufficient time for breakdown of a mat which has developed. Such a technique could be employed between two full-size drainfields if initial failure occurs due to biological mat buildup alone. In addition to alternating between each half of the drainfields, Fairfax County achieves more sidewall storage of effluent within the drainfield trenches by requiring more gravel between the lines and the gravel/soil interfaces.

The 100% reserve drainfield requirement can be met by alternating between halves of one drainfield annually if an additional 50% reserve is maintained and alternation between the two halves of a drainfield is assured. The spirit of the requirement is met given this circumstance because the 50% reserve of the total drainfield area equals 100% of the drainfield capacity in use at any given time.

STORMWATER MANAGEMENT

INTRODUCTION

Most routine and human activities introduce contaminants into the earth's environment. Just driving a car to work, letting the dog outside, or applying an extra bag of fertilizer in the fall hoping to make the spring lawn a *little* bit greener can take a toll on our waterways. Natural processes also release contaminants from volcanic eruptions, forest fires and hurricane battered shorelines. Contaminants introduced into state waters from such diffuse activities and locations are collectively called "nonpoint source" (NPS) pollution. Rarely can we control the forces of nature. However, we can modify both individual and collective practices to improve, enhance, and protect water quality. This section discusses the ways stormwater management (SWM) practices can be applied toward the goals of the Act by explaining the SWM criteria in § 4.2.8 of the Regulations and describing ways to improve and reduce the runoff from the places where we live and work.

As development occurs, existing local stormwater management programs have handled the increased rate and volume, velocity and flow rate of runoff by requiring developers to construct on-site ponds and drainage systems that control one or more of those runoff characteristics. In some cases, localities have conducted regional stormwater management studies and publicly funded stormwater improvements including elaborate drainage systems, channelized watercourses, dams, and reservoirs. However, very few localities have required developers to control increased loads of pollutants in runoff resulting from their development projects.

The Chesapeake Bay Preservation Act recognizes NPS pollution as having a significant and detrimental effect on the Chesapeake Bay. Passage of this legislation demonstrates that the General Assembly values the Chesapeake Bay enough to protect *and improve* its water quality. In order to protect the Bay's resources, localities at large are charged to:

"... encourage and promote [the] ... prevention of any increase in pollution [and the] reduction of existing pollution ..." (§ 10.1-2107)

These provisions of the Act are reflected in regulatory criteria that require **no net increase** in NPS loads resulting from **new development** projects and a **10 percent reduction** in NPS loads resulting from **redevelopment** projects.

In 1989, the General Assembly passed the State Stormwater Management Act (§ 10.1-603.1 et seq., Code of Virginia) that provides localities optional authority to adopt local stormwater management ordinances consistent with minimum state regulations. Most localities have required stormwater management for years to control flow volume and velocity through erosion and sediment control ordinances and floodplain regulations. However, until passage of the SWM Act and previously noted amendments to § 15.1-489 of the state zoning code, no **clear** authority for localities to protect water quality existed. The SWM Act integrates all of these objectives into one piece of comprehensive enabling legislation.

Although the Chesapeake Bay Preservation Act preceded the SWM Act, the objectives for NPS pollution control are consistent. As well, the Department participated in the Department of Conservation and Recreation's regulatory development advisory committee to ensure that the SWM criteria in the Regulations would be consistent with regulations adopted pursuant to the SWM Act (proposed VR 215-02-00.)

If localities have a stormwater management ordinance, the SWM criteria of the Regulations should be **integrated into** the local program. However, the Regulations must be implemented within Chesapeake Bay Preservation Areas even if a locality chooses **not** to adopt a local SWM ordinance.

New Development

Stormwater runoff is a principal transporter of NPS pollution. Chapter II describes how pollutants enter and are transported by the water system.

*For development, the post-development nonpoint source pollution runoff load **shall not exceed the pre-development load based upon average land cover conditions**... (§ 4.2.8)* [emphasis added]

The Manual includes a guidance calculation procedure that outlines the technical standards to meet this performance criterion. The guidance calculation procedure has been designed to be easy to use, even for those localities without an engineer or technically trained employees. The guidance calculation procedure will not produce the design of a BMP structure. The procedure will merely indicate what level of performance is required of a BMP. The Department will provide training in use of the calculation procedure to local government staff.

NOTE: The guidance calculation procedure is provided in Appendix C and is formatted as a pull-out leaflet for immediate distribution.

Because NPS pollution encompasses many different contaminants (such as sediment, nutrients, metals and toxic substances), the procedure is based on the concept of **keystone pollutants**. A keystone pollutant shares the general characteristics of most other urban pollutants.[12] Although the Act and Regulations refer to sustaining no net increase in "nonpoint source pollution" collectively, accurate modelling, monitoring, and control of <u>all</u> pollutants would be cost-prohibitive. Properly identified, keystone pollutants can be realistic indicators of total nonpoint source pollution loads. Both pre- and post-development loadings should be determined by the same procedure to ensure consistent methodology.

The guidance calculation procedure also provides guidelines for localities in order to designate "average land cover conditions." The Board included a default average land cover condition clause in the Regulations to

For New Development

$$NPS_{\text{POST-DEVELOPMENT}} \leq NPS_{\text{PRE-DEVELOPMENT}}$$

ment sites, the following provision(s) must be satisfied to constitute "being served by water quality best management practices":

(1) **In general, runoff pollution loads must have been calculated and the BMP selected for the expressed purpose of controlling NPS pollution.** However, if existing facilities can be shown to achieve the current standard of NPS pollution control, local authorities *may* consider the site as being served by water quality BMPs.

(2) **If BMPs are structural, facilities must currently be in good working order, performing at the design levels of service.** The local authority may require a review of both the original structural design and maintenance plans to verify this provision. A new maintenance agreement may be required to ensure consistency with the locality's SWM requirements.

As with the performance criterion for development, the post-development loads for a redevelopment site should be calculated. However, in the case of redevelopment, **default loads (e.g. average land cover loads for a watershed) may not be used to establish a pre-development load.** The pre-development load for a redevelopment site must be determined based upon the existing conditions on the site. In cases where existing development is served by BMPs and the original design data is still available, the original post-development NPS loadings may be substituted for the "existing" development NPS loadings.

For redevelopment sites not served by BMPs, modern techniques for NPS pollution control must be employed to achieve a minimum 10 percent reduction from existing pollutant loadings.[13]

Where sites are small or coverage is proposed to be extensive, underground BMPs such as cisterns with detention features may be necessary if sufficient open space cannot be provided.

FOR SITES SERVED BY BMPS:

Before the Regulations:

$NPS_{\text{EXISTING DEVELOPMENT}} \leq NPS_{\text{PRE-DEVELOPMENT}}$

After the Regulations:

$NPS_{\text{REDEVELOPMENT}} \leq NPS_{\text{PRE-DEVELOPMENT}}$

NOTE: A future installment of the Manual will generally describe selection, design, construction, and maintenance of BMPs appropriate for use in Tidewater Virginia.

If, however, the site is located in an area served by an adopted regional SWM plan which satisfies this criterion as a whole, participation in that regional plan will be considered as complying with this section under option #2. Localities must demonstrate that their program achieves water quality protection standards equivalent to the goals of the Regulations. In addition, all locally adopted SWM programs should be consistent with state laws and regulations covering SWM and erosion and sediment control.

Another means of satisfying the Regulations, option #3, allows developer participation in SWM programs necessitated by the federal Clean Water Act's storm sewer discharge permit requirements, after such a program is implented by a local government. The federal program will consist of two tiers with separate timeframes. Localities with populations exceeding 250,000 are in the first tier and localities with populations between 100,000 and 250,000 are in the second. By including option #3, the Board assumes the EPA program will achieve water quality protection at least equivalent to the Regulations. Even if programs have standards different from the Regulations, EPA approval of such programs will classify them as equivalent under this provision.

Some redevelopment sites, particularly those proposing a high proportion of impervious cover, may have significant difficulties complying with the 10% NPS pollution reduction requirements. Impervious areas increase both runoff and pollutant loadings.

In general, maintaining or restoring areas of natural vegetation plays a major role in effective stormwater management and NPS pollution control by infiltrating and filtering more of rainwater. Vegetated areas:

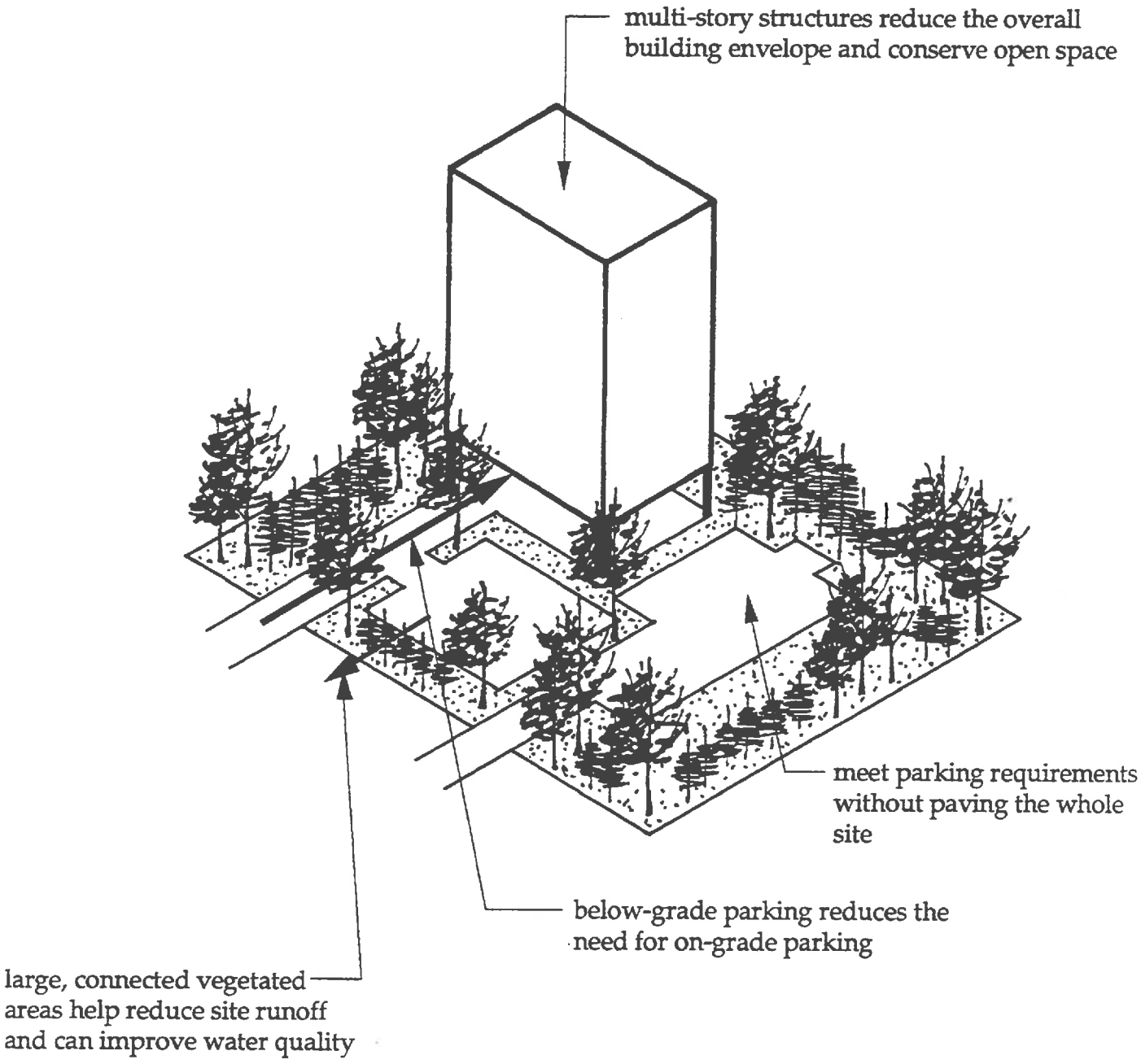
1. Reduce runoff volumes;
2. Generally provide for greater infiltration, further reducing runoff;
3. If on-grade and properly placed can intercept, filter, and infiltrate runoff generated on other impervious areas;
4. Have aesthetic value; and
5. Generally need less maintenance to remain effective.

For all these reasons, converting impervious areas to vegetated areas under option #4 is one way to reduce NPS pollution runoff -- a BMP in its own right. Experience with SWM programs shows a 1% reduction in NPS pollution can be achieved for every 1-2% of the land restored to vegetation.[14]

To achieve these goals and to comply with the provisions of option #4, **the entire 20% of the vegetated area should be continuous, permanent, and on existing grades.** If possible, areas should be placed so non-erosive sheet flow runoff from impervious areas can pass across and through the vegetated area. Vegetation suggested in the section addressing buffer areas (see pages IV-45-60) would most likely have appropriate mitigating qualities.

The Board specifically included this reference to clarify its intent **not** to treat minor expansions as redevelopment. While any expansion *can* degrade water quality by creating more impervious surface, local authorities will be expected to make reasonable judgments concerning "maintenance, alteration, use or improvement(s)." Localities are encouraged to use existing expansion classification policies or establish guidelines to address such cases. Consistency should be a goal.

PROPOSED TYPICAL DEVELOPMENT *FIGURE 4-11*



Conservation Plans

Conservation plans as a voluntary practice have been part of the agricultural management programs of both SCS and local SWCDs since the 1930s. Conservation plans are based on the principle of "land capability" – every acre of land has its own specific potential and constraints. To achieve the most productive long-term use of the land while protecting it from erosion and water quality degradation, land capability must be the foundation of any plan for agricultural management. Conservation plans take into account the particulars of local soils and climate conditions, as well as the specific type of agricultural operation. They may include a single BMP or a combination of BMPs.

Agricultural conservation plans are developed by a technical expert in coordination with a land operator, who may be either the farm owner or a farmer who leases the land. They examine the land, study the local soil survey covering that farm, and discuss the land use objectives and priorities of the farmer. The resulting plan is a record of decisions the land operator will carry out.

In recent years, regulations have made cost-share benefits contingent on the development of conservation plans on certain agricultural lands. Since passage of the 1985 Food Security Act, farms with highly erodible lands have been required to develop conservation plans for those lands in order to receive USDA Farm Program benefits. In Virginia, DSWC has initiated a nutrient management program which offers farmers technical assistance and cost-share incentives for determining optimum use of chemical fertilizers and manure. Some conservation plans also include integrated pest management (IPM). The Extension Service promotes IPM techniques as an alternative to routine application of pesticides and herbicides in a preventive spray program. In addition, the Extension Service promotes the benefits of nutrient and conservation plans to the agricultural community.

Agricultural Requirements of the Regulations

Land upon which agricultural activities are being conducted, including but not limited to crop production, pasture, and dairy and feedlot operations, shall have a soil and water quality conservation plan. Such a plan shall . . . accomplish water quality protection consistent with the Act and these regulations. Such a plan will be approved by the local Soil and Water Conservation District by January 1, 1995. (§ 4.2.9)

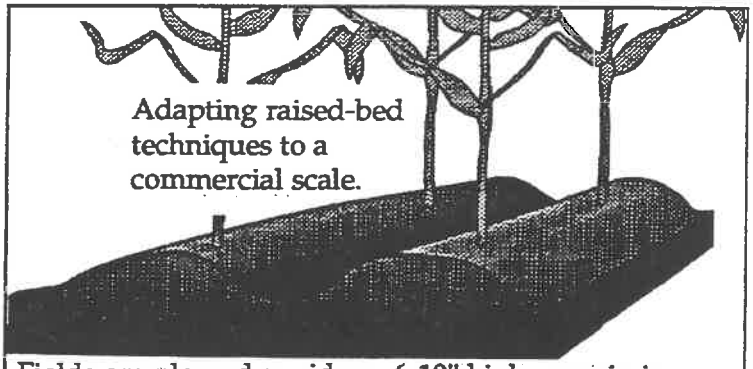
Chesapeake Bay monitoring efforts carried out by the Environmental Protection Agency (EPA) prior to the Chesapeake Bay Agreement identified agricultural lands as a significant contributor of sediment and nutrient pollution. EPA's 1983 Chesapeake Bay Study estimated that runoff and soil erosion from agricultural lands contributed about 37% of the nutrients entering the Bay from the James River basin.[15] During the same period, cropland was estimated to contribute an average of 60% of the nitrogen and phosphorus found in the York River.[16] Figure 4-12 (on the next page) shows that, although there are many sources of nonpoint source pollution in the nation's rivers, agricultural lands contribute a large share.

Because of the adverse impact of pollutants from agricultural lands on water quality, the Regulations require the development of soil and water quality conservation plans for all agricultural lands within Chesapeake Bay Preservation Areas (CBPAs). These plans, which must be approved by the

These levels are called Resource Management Systems and Acceptable Management Systems.

All such conservation systems address five major resource concerns - soil, water, air, plants, and animals - through the use of a combination of conservation practices and management. A Resource Management System will meet a defined minimum level of protection for all five concerns.

RIDGE-TILLAGE *FIGURE 4-14*

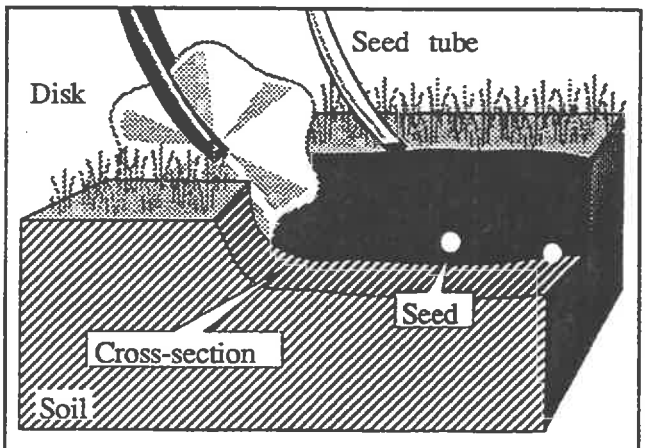


Fields are plowed so ridges, 6-10" high, remain in the same place. All wheeled traffic stays in valleys.

Source: The *Richmond Times-Dispatch*, April 10, 1990

Under certain situations, implementation of a total Resource Management System is not practicable due to the existence of social, cultural, or economic constraints identified for the resource area. Acceptable Management Systems can be developed for such situations. It is important to understand that Resource Management Systems and Acceptable Management Systems address issues beyond the scope of the Regulations, which focus on water quality protection. However, because they are so comprehensive Resource Management Systems and Acceptable Management Systems consistent with SCS policies will be considered in compliance with the Regulation's agricultural criteria provided that the issues of erosion control and nutrient and pesticide management are addressed.

NO-TILL CULTIVATION *FIGURE 4-13*



Minimal soil disturbance and residue from previous crop reduce runoff and erosion.

Source: *Richmond Times-Dispatch*, April 10, 1990

BEST MANAGEMENT PRACTICES

Some of the more prominent agricultural BMPs recommended by conservation plans in the Tidewater area are conservation tillage, streambank stabilization, grass waterways, cover crops, filter strips, critical area planting, nutrient and pest management, and erosion control structures.

The employment of BMPs on farmland or the development of a soil and water quality conservation plan will allow flexibility in the amount of buffer area required for that land as provided by the Regulations. As discussed in greater detail in the section on buffer areas, buffer areas for agricultural lands may be reduced to 50 feet when BMPs are in place on the adjoining land, and to 25 feet when a soil and water quality conservation plan has been implemented on that land. It is

ample, a farmer may reduce fertilizer costs while maintaining or, in some cases, boosting productivity by carefully controlling the rate of application and by applying fertilizer when it will be most efficiently taken up by crops. The farmer can also reduce costs by substituting manure produced on the farm for chemical fertilizers. Such principles are consistent with the concept of sustainable agriculture promoted in recent years by many segments of the agricultural community, including the land grant university system.[18]

Local Governments and Conservation Planning

In order to meet the requirements of the Regulations, local governments must establish an enforceable procedure to track the approval of conservation plans on agricultural lands within Chesapeake Bay Preservation Areas. Once the locality has designated its CBPAs, agricultural lands in those areas can be identified with the aid of the local soil and water conservation district. In local zoning ordinances or other regulations, a requirement could be included that an owner of agricultural lands must provide evidence of compliance with the requirements. The ordinances could specify what constitutes acceptable evidence. For example, the official minutes of the district board could stipulate that the required conservation plan has been approved or implemented.

The Department recommends that a locality develop a "Memorandum of Understanding" with its local Soil and Water Conservation District to take advantage of the technical resources available through the district programs. Such a memorandum could include the following agreements:

- The local government will provide the local district with a map of their designated Chesapeake Bay Preservation Areas;

- The local district will provide the local government with a list of landowners in these areas who already have an ap proved conservation plan which meets the intent of the Regulations, and up date the list of approved conservation plans on a routine basis;

- The local district will prioritize the development of soil and water quality conservation plans for the farms of landowners in CBPAs that do not already have them, and track compliance.

The results of district-conducted spot checks of installed BMPs should be made available to local governments, who could use that information to determine the need for more monitoring or enforcement measures. The spot-check procedure could be similar to the program conducted by districts to determine proper installation of cost-share practices. Before legal measures are implemented to secure compliance, a process of education should be used to motivate the noncomplier. Legal measures may include penalties typical of other zoning violations.

FORESTRY

Silvicultural activities in Chesapeake Bay Preservation Areas are exempt from these regulations provided that silvicultural operations adhere to water quality protection procedures prescribed by the Department of Forestry. (§ 4.2.10)

Silvicultural Best Management Practices for water quality have been carried out as a voluntary program by the Virginia Department of Forestry (DOF) for some years. In July of 1988, DOF resolved that water quality protection would be a priority. A goal was set to reduce sedimentation in the Chesapeake Bay from silvicultural sources by 40% by the year 2000, in accordance with the 1987 Chesapeake Bay Agreement.[19] In 1989, the Department of Forestry published a new handbook, ***Forestry Best Management Practices for Water Quality in Virginia***, which explains the purpose of and provides technical specifications for forestry BMPs.

The Department of Forestry's Best Management Practices program was developed through a cooperative process including organizations such as the Virginia Forestry Association, forest landowners, Virginia Tech, and others. These groups recognized that Best Management Practices are good forestry practices which not only protect water quality, but also save time and money for loggers by reducing maintenance and repair costs to their operations.

The Department of Forestry has held training meetings statewide to acquaint loggers and foresters with Best Management Practices. DOF has also developed a methodology for evaluation of BMP compliance and effectiveness which uses a central computerized database. The results of these BMP inspections will become part of a water quality assessment and monitoring program which will also include baseline data, direct water quality sampling, analysis of forest disturbance trends, and outside research.[20]

In developing management regulations for the Chesapeake Bay Preservation Act, the Local Assistance Board recognized the existence of on-going water quality protection efforts by the forestry industry. The Board believed that elective BMP procedures already in place should be given more time to prove their effectiveness before additional regulations on forestry are instituted; as a result, the Regulations do not **require** the implementation of forestry BMPs. However, a review of existing forestry BMP programs by July 1, 1991, will evaluate their effectiveness at protecting water quality to ensure that they achieving an equivalent level of performance, consistent with the Act and Regulations.

NOTE: The Department is developing a program for wetlands delineation training in coordination with the Corps and SWCB. Training workshops will be conducted for Tidewater local government staff at little or no cost.

Wetlands designated as Resource Protection Areas (RPAs) are generally only eligible for water-dependent development and redevelopment, whether or not a permit can be obtained for a project. The current wetlands permitting processes are different for tidal wetlands than for nontidal wetlands. Highlights of these permitting processes and the jurisdiction of federal, state, and local agencies over wetlands are examined in the following sections.

NONTIDAL WETLANDS

The principal federal agency which administers permits for impacts to wetlands (tidal or nontidal) is the U.S. Army Corps of Engineers. The Corps is currently the **only** permit-issuing agency for impacts to nontidal wetlands within Virginia. The **SWCB must issue or waive issuance of a 401 water quality certificate prior to a Corps permit issuance.** The Corps receives its authority to regulate wetlands under Section 404 of the Clean Water Act of 1977 (33 U.S.C. 1251, as amended). Corps regulations concerning wetlands are found in 33 CFR, Parts 320 through 330. The Corps may issue or deny permits for the discharge of dredged or fill materials into waters of the United States, including wetlands.

The Environmental Protection Agency (EPA), the Fish and Wildlife Service (FWS) under the Department of the Interior, and the National Marine Fisheries Service (NMF) under the National Oceanic and Atmospheric Administration (NOAA) act as federal advisory agencies to the Corps for the issuance and conditions of 404 permits. The Corps is required to solicit and consider the recommendations of these advisory agencies. Of these advisory agencies, EPA has the authority to veto a Corps permit.

Both the Corps and EPA have the authority to take enforcement action against violators of 404 permits. The other advisory agencies may report suspected permit violations. There are both criminal and civil penalties for violations of the conditions and requirements of a 404 permit, and for failure to obtain a permit when required by law.

Where other forms of wetland mitigation, including avoidance and minimization of impacts, have been attempted and the project is considered by the Corps to be in the public interest, compensation (replacement) may or may not be required. The Corps and EPA enacted a memorandum of agreement (MOA) on February 7, 1990. This MOA is "consistent with President Bush's goal of no overall net loss of wetlands and affirms the Corps existing policy of striving to avoid adverse impacts and offset unavoidable adverse impacts to aquatic resources...the MOA expressly recognizes that achieving no net loss of wetlands values and functions is not possible for every permit action. The President's Domestic Policy Council Interagency Working Group on Wetlands is currently developing policy on no overall net loss of wetlands."[22] The decision as to whether to require compensation and the ratio (1:1, 2:1, etc.) of replacement wetlands to impacted wetlands is made on a case by case basis.

- Construction or maintenance of farm or stock ponds, or irrigation ditches, or the maintenance of drainage ditches.

However, even the activities noted above **do** come under the jurisdiction of the Corps if, when conducted, they result in the conversion of a wetland or other waters of the United States to a use or condition to which it was not previously subject. In such cases, a 404 permit may still be required. The Corps should be consulted on a case by case basis when questions arise as to permit requirements for various activities.

Also, Virginia has a Coastal Resources Management Program (CRMP) funded by the federal government through NOAA. The Council on the Environment reviews applicable 404 permit proposals to determine consistency with the CRMP, which is commonly called Coastal Zone Management (see Appendix A). If a proposal is determined to be inconsistent with the goals of the CRMP, the state may object to issuance of a 404 permit. In such instances, NOAA acts as a mediator between the Corps and the Council but only the federal Secretary of Commerce can allow the Corps to issue a 404 permit over the state's objection, if the objection cannot otherwise be resolved.

Tidal Wetlands

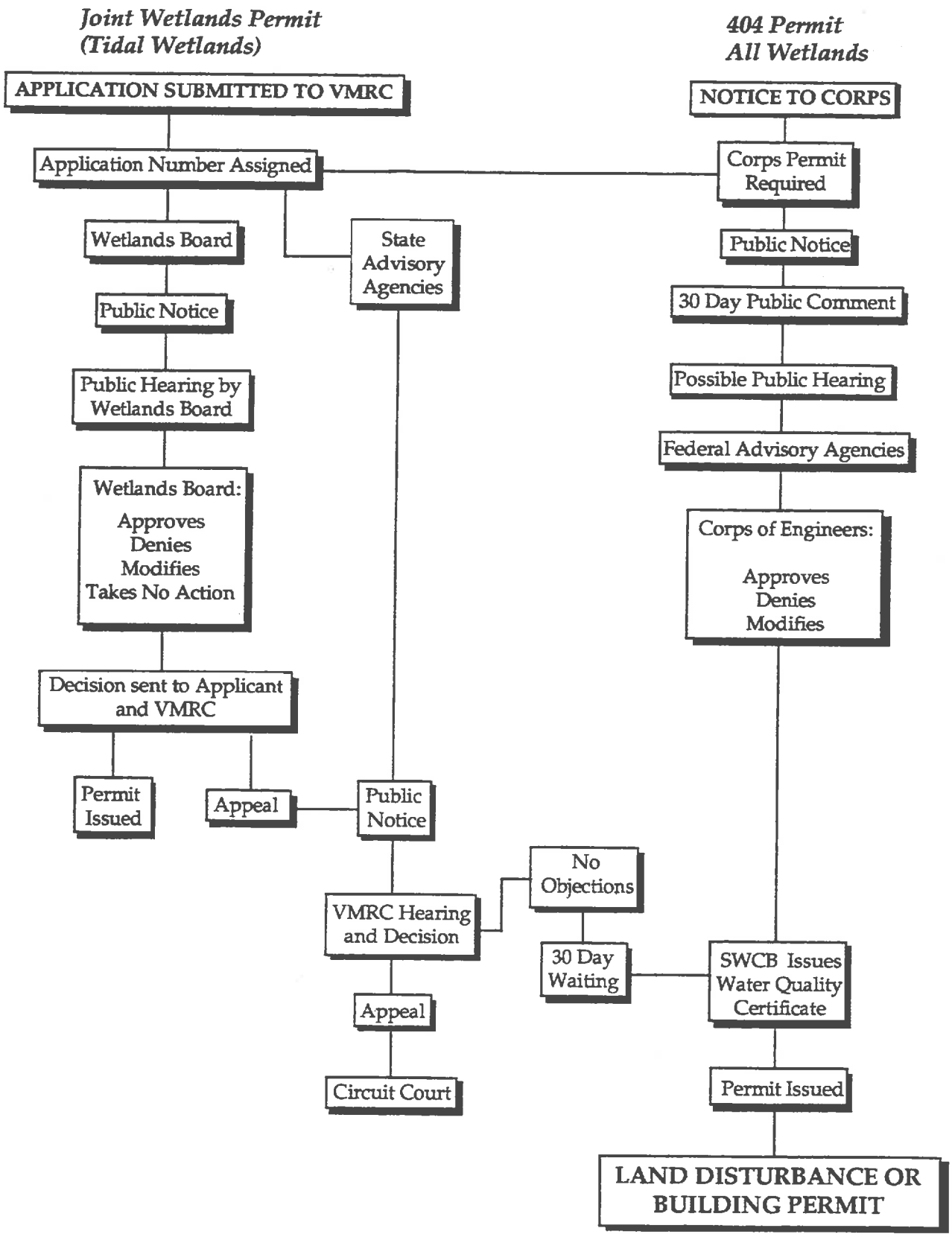
If an area has tidal wetlands, an applicant would normally use the joint permitting process through the Virginia Marine Resources Commission (VMRC). VMRC is the state agency which regulates activities within tidal wetlands. VMRC derives its authority to issue permits for activities in or **over** tidal wetlands and state-owned stream (subaqueous) bottoms from Title 62.1 of the Code of Virginia. The state has ownership of most stream bottoms as well as aerial rights over those stream bottoms. VMRC receives comments from state advisory agencies prior to issuance of a permit. These advisory agencies are: the Virginia Institute of Marine Science; the Departments of Game and Inland Fisheries; Conservation and Recreation; Historic Resources; and Health. The SWCB, the Virginia Department of Transportation, and the Council on the Environment also comment on applications for some tidal wetlands permits.

VMRC also acts as a clearinghouse for **joint** permits, which require the approval of VMRC, the Corps, and/or local wetlands boards. Joint applications should be submitted to VMRC who will, in turn, forward copies to the local wetlands board if the locality has one. This joint permit application saves time and ensures some consistency in permit conditions. The authority of local wetlands boards has to date been limited to tidal wetlands under §§ 62.1-13.5 and 62.1-13.6, Code of Virginia. An applicant can appeal denial by a local wetlands board of a tidal wetlands permit to VMRC. VMRC may also review permit approvals by a local wetlands board when any of the following occur:

- The local government requests it;
- The Commissioner of VMRC believes that the policies, guide lines, or standards of Title 62.1 have not been achieved; or
- 25 or more property owners from where the site will be located properly petition VMRC.

WETLANDS PERMIT PROCESS

FIGURE 4-16



BUFFER AREAS

INTRODUCTION

As discussed in Chapter II, vegetated buffer areas or filter strips have been found to reduce sediments in surface stormwater runoff, as well as nutrients and other pollutants that adhere to these sediments. While filter strips provide for the physical control of runoff and pollutant loadings, buffer areas are considered to be more comprehensive in character. Studies indicate that wooded buffer areas are more effective than grassed strips in terms of stormwater runoff control. In situations where a wooded buffer area cannot be preserved on site, a grassed filter strip should be managed to gradually become wooded by intentional plantings.[24]

Wooded buffer areas combine the physical control of filter strips with an added aesthetic component through a mixture of plant species that replicate the natural forest edge condition. In situations where buffer areas must be created, the initial provision of a variety of plant species and forms allows the buffer to mature over time until the forces of plant succession nurture a naturalized forest edge condition.

Research has shown that creatively landscaped filter strips and buffer areas can become a valuable community amenity, providing wildlife habitat, screening, and stream protection, in addition to stormwater runoff control.[25] Natural buffer areas have been shown to provide excellent wildlife habitat, particularly for "edge" species of songbirds and mammals. The judicious planting of selected indigenous trees, shrubs, and grasses can result in the enhancement of the quality and quantity of food and cover necessary for the maintenance of wildlife habitat which further adds to the human livability of an area.[26]

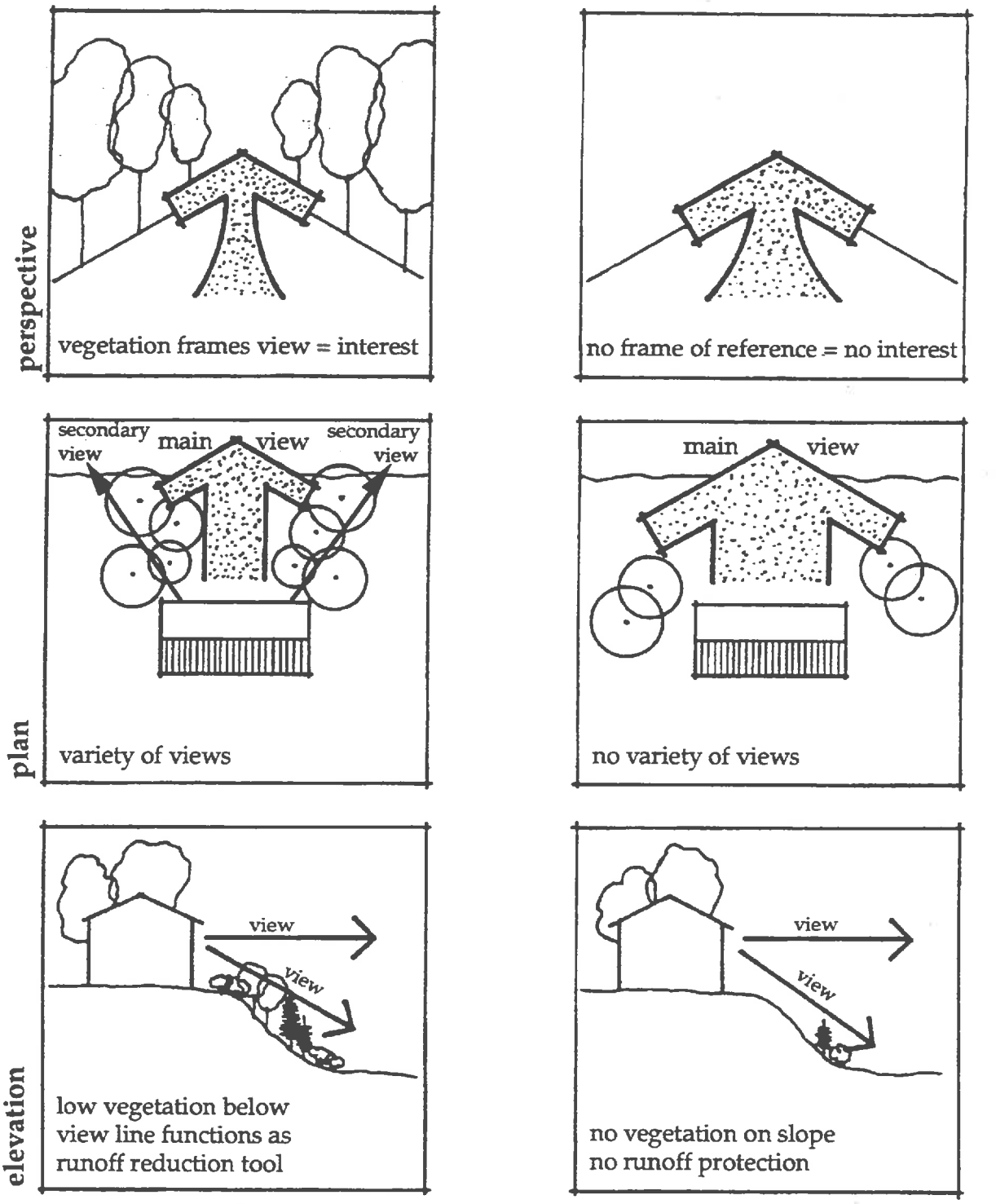
Traditional land planning has attempted to utilize the site in the most "efficient" manner possible, where "efficient" was considered to be the provision of the largest number of lots or the greatest building floor area allowed by zoning. Trends in zoning and land use regulations have emphasized the inclusion of buffer areas into the site development process essentially as an instrument to screen or "buffer" incompatible land uses. However, recent regulatory programs focused on water quality protection recognize the role buffer areas play in the reduction of off-site stormwater runoff and pollutant loading.[27]

Buffer areas are an important and requisite element of the Regulations. As stated in the Regulations, buffer areas are required:

To minimize the adverse effects of human activities on the other components of the Resource Protection Area, state waters, and aquatic life, a 100-foot buffer area of vegetation that is effective in retarding runoff, preventing erosion, and filtering nonpoint source pollution from runoff shall be retained if present and established where it does not exist. The 100-foot buffer area shall be deemed to achieve a 75% reduction of sediments and a 40% reduction of nutrients. (§ 4.3.B)

This language in the Regulations that pertains to specific sediment and nutrient removal rates attributable to the use of a 100-foot buffer area essentially creates a quantifiable level of performance, a performance standard, that all buffer areas must achieve.

PROVISION OF REASONABLE SIGHT LINES *FIGURE 4-17*



FILTERED VIEWS vs. UNRESTRICTED VIEWS

SILVICULTURAL THINNING

Dead, diseased, or dying trees or shrubbery may be removed at the discretion of the landowner, and silvicultural thinning may be conducted based upon the recommendation of a professional forester or arborist. (§ 4.3.B(1)c)

The removal of dead, diseased and/or dying trees or shrubbery is allowed in the buffer so long as the removal process does not contribute to the degradation of adjacent water resources. In fact, the removal of diseased or dying plants would likely result in the rejuvenation of the remaining plant species since more nutrients, water, and sunlight, would be available for remaining plant species.

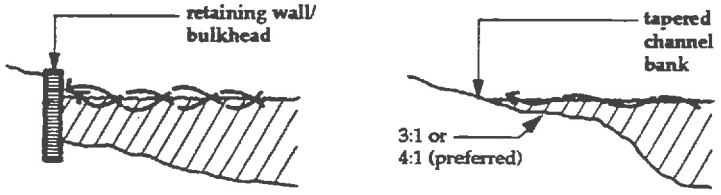
Silvicultural thinning is a method of species rejuvenation utilized by many forest management agencies where undesirable species are removed so other more valuable species can develop to their full potential. In buffer areas, shallow-rooted species may be removed to allow the establishment of more deeply-rooted species that offer a more significant contribution in terms of runoff reduction. However, care must be taken when thinning so that site erosion is not accelerated through the removal of too much valuable soil cover at one time, since such removal may result in the buffer area not meeting equivalency performance provisions.

SHORELINE EROSION CONTROL

For shoreline erosion control projects, trees and woody vegetation may be removed, necessary control techniques employed, and appropriate vegetation established to protect or stabilize the shoreline in accordance with the best available technical advice and applicable permit conditions or requirements. (§ 4.3.B(1)d)

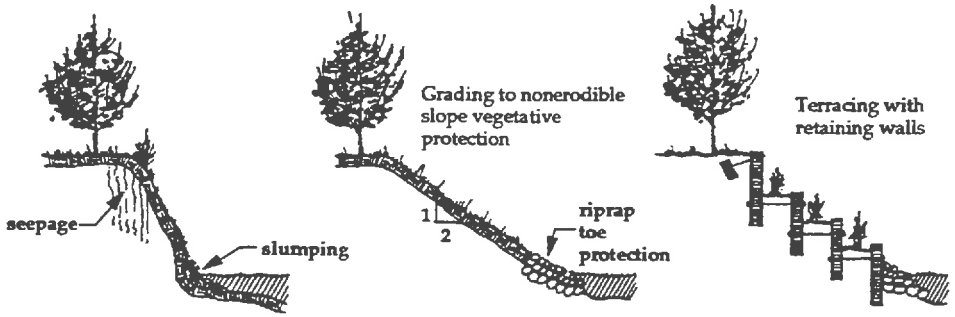
Non-structural shoreline measures are preferred over structural measures where structural measures are not absolutely necessary to control the erosion problem. Structural measures can aggravate erosion problems at adjacent properties.

SHORE STABILIZATION EXAMPLES FIGURE 4-20



Vertical bulkheads reflect a large percentage of wave energy and agitate the water surface, and can result in erosion damage to adjacent properties.

Tapered channel banks, with or without rock facing, absorb and dissipate the force of the waves.



flexibility for purchasers of lots where the buffer area was reduced. In such a situation, the developer should ensure several things:

1 BMPs placed within the buffer area should discharge in sheet flow or in some other manner that prevents the discharge from channeling through the buffer;

2 The buffer area equivalency criteria mentioned above should be satisfied for the parcel or parcels in question;

3 The BMP must be included in the long-term maintenance plan provided for the entire system by the developer; and

4 The reduced options of the parcel purchaser should be disclosed in the parcel purchase transaction.

Furthermore, in designing BMP systems that treat runoff from an entire development, the buffer itself may **not** be included as a BMP in the overall system. To do so would have the effect of allowing double credit for buffer area pollutant removals, as follows: (1) credit in the pre-development runoff loading equation, since the buffer area is undeveloped, vegetated land; and (2) credit in the summary of BMP pollution removal rates used to match the pre-development loading.

NOTE: The Department will prepare a procedure for local government use in determining buffer area equivalency. The procedure will be available as an appendix in the next installment of the Manual.

In the second circumstance, where the BMP system for the entire development is in place but the lot or parcel owner needs more building or yard space, the owner must ensure that appropriate BMPs are located **on the subject lot or parcel** in a manner that ensures equivalency with buffer area pollutant removal efficiencies required by the Regulations.

Buffer width modification should only be considered for situations where available site area is at such a minimum that it would preclude site development.

Examples of appropriate BMPs for the homeowner include directing impervious driveway and parking area runoff into an infiltration trench or directing roof drains into a dry well or french drain. Again, it is important that the BMPs used in such cases infiltrate the water into the ground or discharge it in a manner that prevents erosion and protects the functional integrity of the buffer area.

Loss of a Buildable Area

When the application of the buffer area would result in the loss of a buildable area on a lot or parcel recorded prior to the effective date of these regulations [October 1, 1989], modifications to the width of the buffer area may be allowed in accordance with the following criteria:

a. modifications to the buffer area shall be the minimum necessary to achieve a reasonable buildable area for a principal structure and necessary utilities;

b. where possible, an area equal to the area encroaching the buffer area shall be established elsewhere on the lot or parcel in a way to maximize water quality protection;

c. in no case shall the reduced portion of the buffer area be less than 50 feet in width. (§ 4.3.B(2))

Modifications to the buffer area in agricultural lands are allowed in the Regulations, as follows:

The agricultural buffer area may be reduced as follows:

a. to a minimum width of 50 feet when the adjacent land is enrolled in a federal, state, or locally-funded agricultural best management program, and the program is being implemented, provided that the combination of the reduced buffer area and the best management practices achieve water quality protection, pollutant removal, and water resource conservation at least the equivalent of the 100-foot buffer area. (§ 4.3.B(4))

Ultimately landowners are responsible for ensuring that the farmland lying within Chesapeake Bay Preservation Areas complies with the requirement of a conservation plan in § 4.2.9 of the Regulations and the buffer area requirements, discussed here. If the land is being leased to another operator, it is advisable to include language in the lease agreement to require the lessee to comply with these requirements.

The buffer area reduction criteria were crafted to allow for continued productivity from most of the land involved, as long as equivalent water quality protection is provided. To qualify for a reduction of buffer width to 50 feet, the farmland in question must be *"enrolled in a federal, state, or locally-funded agricultural best management program, and the program . . . [must be] implemented. . . ."*. Implementation of one or more best management practices that satisfy requirements of the highly erodible lands provisions of the 1985 farm bill would satisfy this buffer reduction criterion. If a farmer has implemented one or more BMPs on his field without any involvement of the local SWCD, SCS or ASCS, it would be necessary to show that the implemented BMPs are consistent with local, state or federal BMP program criteria in order to qualify for the buffer reduction (in other words, enroll retroactively).

Furthermore, in combination with the remaining 50 foot buffer area, the BMPs used on the field must result in sediment and nutrient removals from runoff at least the equivalent of performance standards for the full 100-foot wide buffer area (75 percent of sediment and 40 percent of nutrients removed). The SCS is currently studying pollutant removal efficiencies for agricultural BMPs.[28]

The agricultural buffer area may be reduced:

To a minimum width of 25 feet when a soil and water quality conservation plan, as approved by the local Soil and Water Conservation District, has been implemented on the adjacent land, provided that the portion of the plan being implemented for the Chesapeake Bay Preservation Area achieves water quality protection at least the equivalent of that provided by the 100-foot buffer area in the opinion of the local Soil and Water Conservation District Board. (§ 4.3.B(4)b)

Traditionally, Virginia SWCDs have approved soil and water conservation plans for farmers. Those plans have stressed implementing conservation practices and systems focused on soil erosion control, to protect the fragile base of topsoil so important to agricultural productivity.

To qualify for a reduction of buffer width to 25 feet, the farmland in question must have *"a soil and water **quality** conservation plan, as approved by the local Soil and Water*

planner can minimize soil exposure and the need for expensive controls during site development. Through the careful preservation of existing indigenous vegetation and the coordination of new plantings, the site planner can create attractive and cost-effective landscapes that minimize erosion during the site construction process and beyond, thus ensuring the protection of water quality.

At a minimum, buffer areas should incorporate grasses as vegetative filters that exhibit the following characteristics:[30]

1. Deep root systems to resist scouring during high velocity runoff;

2. Dense, well-branched top growth;

3. Resistance to flooding;

4. Ability to recover growth subsequent to inundation by flooding; and

5. Suitability for climatic and sun exposure conditions of the region.

Slope

Even after representative grasses have been chosen based on the above criteria, several other factors must be considered in terms of buffer efficiency. The slope of the vegetated buffer area directly affects buffer efficiency. Studies indicate that buffer area performance is best on slopes of 5% or less.[31] As slope increases, runoff velocity increases in such a manner that sediment volumes are greatly increased due to erosion. In such cases, the width of the buffer area may need to be extended in order to offset the increased sediment flows. Although research efforts have reached varying conclusions, it is generally accepted that a slope of 15% is the upper limit for effective runoff control.[32]

On slopes greater than 15%, vegetated buffer areas should be protected from off-site runoff through a combination of diversions and BMPs designed for such flows. Where such slopes exist, the 100-foot buffer width requirement set forth in the Regulations is considered a minimum for local government designation, aside from the conditions outlined in the buffer modification section. Local governments should consider the protection and/or creation of wider buffers in view of the research related to the detrimental effect of steep slopes on buffer efficiency. (See page IV-66.)

Height Of Vegetation

The height of vegetation also has a considerable effect on the efficiency of the buffer in terms of filtering sediment. Research has shown that taller grasses have a higher retardance to runoff, and when grasses are cut, their filter efficiency declines to zero.[33] Therefore, as a general rule grasses within buffer areas should remain uncut, except on those occasions needed to control troublesome insects and/or noxious weeds. When cutting is necessary, a high blade setting should be used.

Soil Conditions

Soil conditions also have a significant effect on the ability of the buffer area to absorb water and thus reduce the amount of pollutants reaching adjacent water bodies. In cases where the soils are so restrictive that

capacity of water to hold oxygen decreases. Since the presence of oxygen is necessary in the decomposition of organic matter, elevated water temperatures reduce the ability of streams and smaller rivers to assimilate organic wastes without oxygen depletion, resulting in a build-up of organic matter in the water system. Also, as water temperatures increase, the release rate of nutrients attached to sediment particles increases resulting in greater amounts of soluble nutrients in the water system. As a consequence, nutrients become more readily available for consumption by plants and humans.[36]

When stream temperatures are controlled in the upper reaches of drainage basins (smaller streams), temperature problems in downstream areas will be controlled as well, resulting in a decreased pollution load throughout the water resource system.[37]

Buffer Area Plants

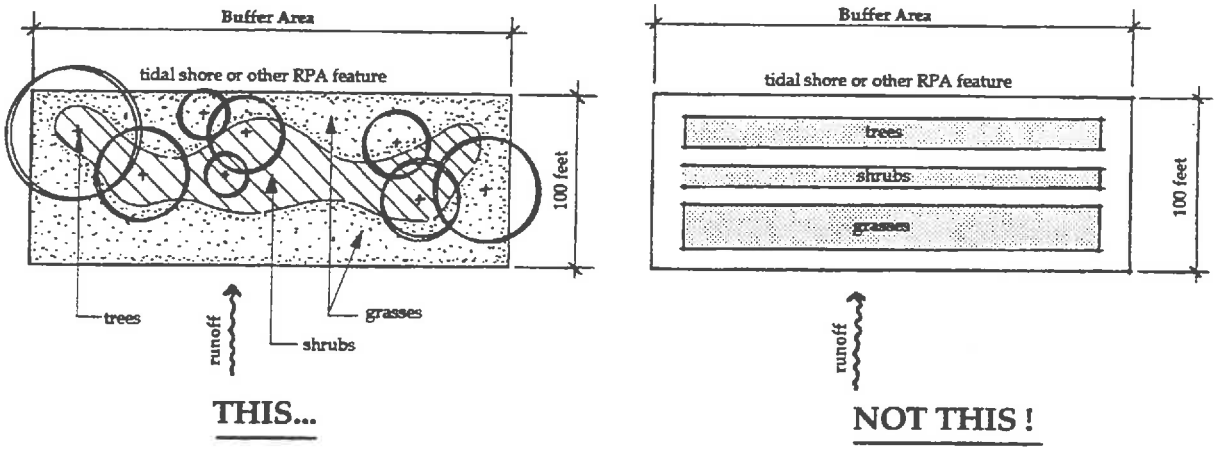
The ultimate decision on the type of vegetation that should be used in the buffer area should be based on the following considerations:[38]

1. Suitability for providing specific control of runoff and pollution;
2. Adaptability to site conditions and climate;
3. Compatibility with surrounding landscape;
4. Level of maintenance required;
5. Hardiness and durability; and
6. Life span.

The hierarchy of plant species to be considered for inclusion in buffer areas falls roughly into three main zones as illustrated in Figure 4-24. The first zone is composed of grasses, generally up to three feet in height, that intercept and filter the first rush of stormwater runoff. These grasses must be of the deep-rooted variety in order to effectively respond to the potential high velocities of runoff. Although there are many "structural" grasses that have proven to be generally effective due to their tendency for quick establishment in adverse site conditions, numerous native and ornamental grasses/groundcovers should also be considered either for use in conjunction with structural grasses, or for use on their own.

The second zone of buffer vegetation consists of deciduous and evergreen shrubs that generally occupy an area greater than three (3) feet in height but less than twenty (20) in height and may contain both indigenous and exotic species. This zone is especially important in providing protection of the buffer floor beneath the tree canopy where sensitive feeder roots may be growing. The relatively shallow, lateral roots of shrubs act to anchor the soil beneath the canopy and aid in the formation of the humus layer which is composed of dead and decaying vegetation. It is this humus layer, referenced earlier in terms of its ability to retard runoff, that acts as the "second zone of defense" against runoff that flows through the initial grass zone. Although runoff velocities should be minimal in this area, severe storms and extremely adverse site conditions may create overland flow situations that prove to be of too great a magnitude for the grass zone to effectively handle. It is also in this shrub zone that the greatest landscape aesthetic effect may be realized, given the diversity and availability of ornamental shrubs.

BUFFER AREA LAYOUT COMPARISON *FIGURE 4-25*



through the movement of surface runoff.[39] In summary, using shrubs and trees in the composition of buffer areas may result in the following benefits on a site:[40]

- Assist in stabilizing the soil and preventing erosion;
- Decrease stormwater runoff through canopy interception and root zone absorption;
- Moderate temperature changes and provide shade to small streams;
- Moderate the effects of sun and wind;
- Provide buffers and screens against noise;
- Filter pollutants from the air;
- Provide a haven for animals and birds, which help to control insect populations;
- Enhance property values; and
- Provide psychological and aesthetic counterpoints to the human-made urban setting.

BUFFER AREA PLANT REFERENCE INFORMATION

Plants Lists

The following lists of plants have been compiled from several reference publications. The plants that comprise these lists do not represent the only plants the Department recognizes as acceptable for use in the buffer. Rather, the lists should be viewed as an offering of representative plant materials that could initially be considered when selecting plant materials for use in the buffer area. The plant lists reflect a predominance of indigenous plant species. This is important, since the use of indigenous plant species is encouraged in order to provide a buffer condition that best replicates the "natural" buffer condition found in existing vegetated areas. Again, the use of indigenous plants in the buffer area promotes better plant survival since these plants are more tolerant of indigenous pests, local soil conditions, and local climatic factors.

SIZE

This category provides information on the projected mature height and width of a species. This information may show the highest degree of variability of all the categories, since growth is affected by a wide array of micro-site conditions. However, the information can be considered to represent an average mature growth condition based on acceptable micro-site conditions.

PRIMARY USE

The information in this category pertains to the primary benefit of the particular species in terms of water quality protection. A summary of each primary use subcategory is provided as follows:

disturbed areas: The protection of disturbed areas pertains to those areas where land cover has been altered, as a result of land grading, land clearing, mineral extraction, or natural disaster. Since the nutrient availability in these areas tend to be very low, only a few specialized plants can adapt to such limiting conditions. Species that adapt to such conditions act to improve the nutrient holding capacity of the soil while stabilizing the soil particles so that erosion and further site disturbance is minimized.

stabilize streambanks: The stabilization of streambank areas concerns the addition of plant species that act to reduce the structural breakdown of streambank soils, control the temperatures of streams, and promote the development of plant groups that are representative of streambank environments. The streambanks addressed in this subcategory are generally associated with tributary streams.

wildlife habitat: The maintenance of wildlife habitat is both directly and indirectly related to the protection of water quality. For instance, the normal biological activities of wildlife promote the maintenance of fertile soils through the conversion of animal and plant wastes into organic materials necessary for proper plant growth.

stabilize shores: The stabilization of shoreline areas concerns the addition of plant species that act to reduce the impact of wave action that leads to the structural breakdown of shoreline areas. The shoreline areas addressed in this category are generally associated with saltwater rivers and bays.

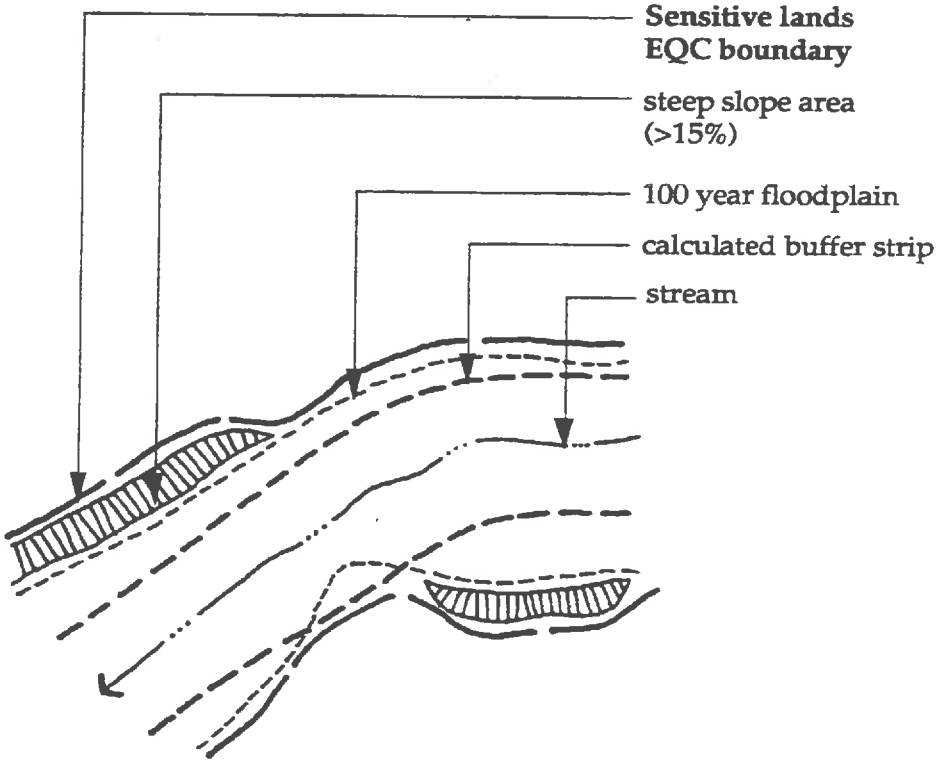
wind barrier: The reduction of wind velocities can be a very important facet of water quality protection especially when viewed in terms of the presence of loose soil particles that may be carried by the wind and deposited in water systems. The presence of wind-controlling plant species can have a significant effect on young, growing plants that have not become structurally established in their environment.

erosion control: The provision of erosion-controlling plant species is inherent to the protection of water quality since sediment transported in site runoff is a primary pollutant of water systems. The presence of erosion-controlling plant material is of major importance in the reduction of site runoff and the subsequent release of soil particles into water systems.

floodplain, wetlands, and steep slope areas extend beyond this minimum buffer strip, they should be used to determine the boundary of the sensitive lands EQC.

The county determined that the minimum buffer provides not only protection from sedimentation of streams, but also serves to preserve enough streamside vegetation to provide the shading needed to prevent wide fluctuations in water temperature and thereby provides a more healthy environment for aquatic wildlife.

ENVIRONMENTAL QUALITY CORRIDOR *FIGURE 4-26*



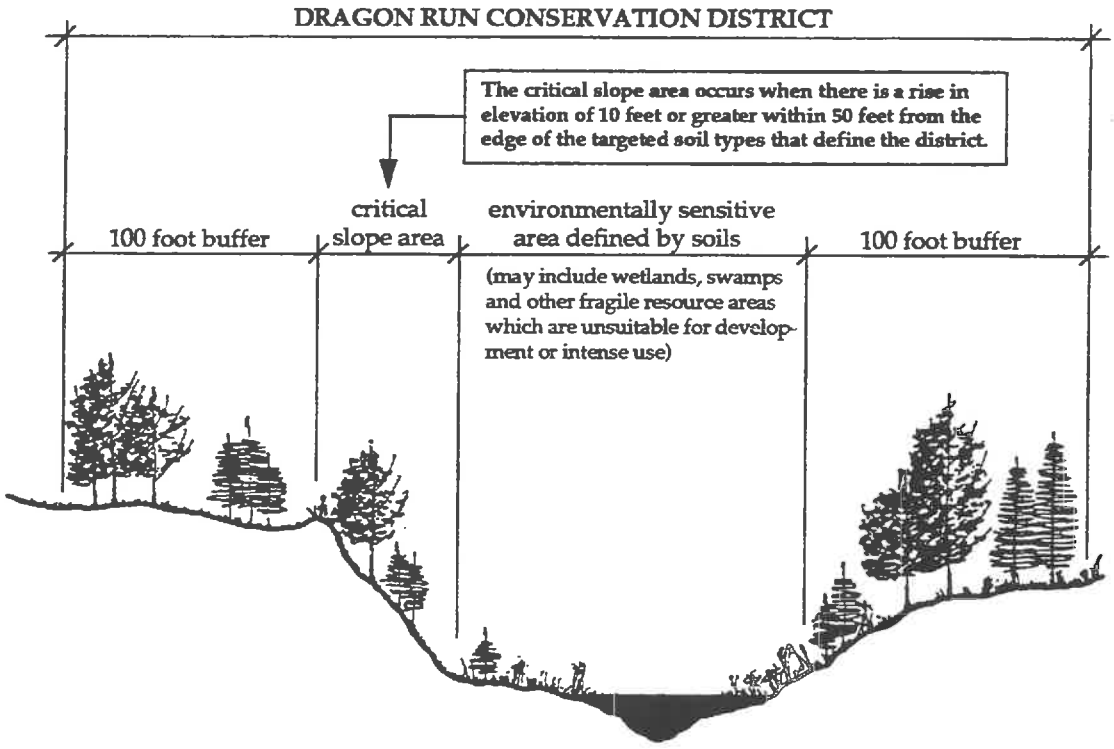
plan

Dragon Run Conservation District

The Middle Peninsula Planning District Commission in 1987 proposed the creation of the Dragon Run Conservation District (DRCD) in an effort to protect and conserve fragile resource areas which perform valuable functions in their natural state and which are unsuitable for development and intense use.[43] Areas to be designated within the DRCD included primarily wetlands and swamps, but also could include other areas deemed to be important for floodplain management, aquifer recharge, water storage, critical wildlife habitat, or the protection of other resources that perform similar functions.

The boundary of the DRCD was determined based on certain soil types plus an additional 100-foot buffer strip measured horizontally from the inland boundary of these certain soil types. An important component of the buffer strip requirement was compensation for the effect of steep slopes on buffer performance. Additional buffer requirements stated that when there is a rise in elevation of 10 feet or greater, within 50 feet measured horizontally, from the edge of the targeted soil types, then the 100 foot buffer strip should be measured from the highest point of elevation within said 50 feet. It is important to note that the 50 foot parameter was chosen in this case because the environmental inventory of the Dragon Run resource indicated that all steep slope areas were confined in a horizontal distance of 50 feet or less. The implication of the critical slope area requirement is illustrated in the Figure 4-28.

DRAGON RUN CRITICAL SLOPE AREA *FIGURE 4-28*



ENDNOTES

[1] For additional information or to obtain copies of these publications, contact the following:

(a) ***Controlling Urban Runoff: A Practical Manual For Planning and Designing Urban BMPs* (July, 1987),** Metropolitan Information Center, Metropolitan Washington Council of Governments, 1875 Eye St., N.W., Suite 200, Washington, D.C. 20006, (202) 223-6800.

(b) ***BMP Handbook for the Occoquan Watershed*** (August, 1987), Northern Virginia Planning District Commission, 7630 Little River Turnpike, Annandale, Va. 22003, (703) 642-0700.

[2] Virginia Department of Forestry, ***Forestry Best Management Practices for Water Quality*** (Charlottesville, Va.: Department of Forestry, 1989).

[3] Researchers at the American Forestry Association calculated the value of an "average" 50-year old urban tree at $57,151. The Association calculated the **annual** contribution of one shade tree in four areas: air conditioning, $73; controlling erosion and stormwater, $75; wildlife shelter, $75; controlling air pollution, $50. These values were then compounded at 5 percent for 50 years to derive the total value. See "Our Cities' Trees: An Investment in the Future," by Candace Allen in ***Virginia Town and City***, July, 1989.

[4] See York County's "Tree Preservation and Landscaping Design Ordinance," Henrico County's proposed "Landscape Ordinance," and Fairfax County's "Vegetation Preservation and Planting" section of the Fairfax County Public Facilities Manual.

[5] See Metropolitan Washington Council of Governments, Department of Environmental Programs, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, by Thomas R. Schueler, (Washington, D.C.: Metropolitan Washington Council of Governments, 1987), 2.13.

[6] For a variation of this, see the Model Ordinance, Chapter V, page 11. Open space ratios and impervious cover thresholds are fundamental to the concepts of "performance zoning" and "carrying capacity." See Lane Kendig, ***Performance Zoning***, (Chicago: American Planning Association, 1980) and Kendig's more recent ***New Standards for Nonresidential Uses***, Planning Advisory Service Report Number 405 (Chicago: American Planning Association, 1987.)

[7] Virginia Polytechnic Institute and State University, Virginia Water Resources Center, ***A Homeowner's Guide to Septic Systems***, by Forster D. Sponenburg, Jacob H. Kahn, and Kathryn P. Sevebeck, (Blacksburg, Va.: Virginia Water Resources Center, 1985), 1.

[8] Ibid.

[20] Virginia Department of Forestry, ***A Proposal for the Assessment of Forest Water Quality in Virginia: Overview and Implementation Details***, by Sam Austin, (Charlottesville, Va.: Department of Forestry, 1989), 4-7 passim.

[21] U. S. General Accounting Office, Resources, Community and Economic Development Division, ***Wetlands: The Corps of Engineers' Administration of the Section 404 Program***, Report to the Chairman, Subcommittee on Investigations and Oversight, Committee on Public Works and Transportation, U. S. House of Representatives, RECD-88-110, (Washington, D.C.: General Accounting Office, July, 1988).

[22] U. S. Army Corps of Engineers, ***"Section 404 Mitigation Memorandum of Agreement,"*** 7 February 1990, Washington, D.C.

[23] Bruce Williams, Environmental Scientist, U.S. Army Corps of Engineers, Norfolk District Office, Regulatory Branch, telephone conservation with Darryl M. Glover, Chesapeake Bay Local Assistance Department, January, 1989.

[24] Schueler, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, 9.8.

[25] Ibid., 9.7.

[26] Ibid., 9.9.

[27] See for example state water quality protection/land use programs in Maryland, New Jersey, Oregon, Delaware, North Carolina, Florida, and New York.

[28] This study, entitled "A Handbook for Designing Vegetative Filter Strips," is being carried out by SCS under a research contract with Virginia Polytechnic and State University and Clemson University. Publication is expected in January, 1991. For more information, contact Kenneth Carter, Water Quality Specialist, Soil Conservation Service, Richmond, Virginia (see Appendix of Government Resources.)

[29] Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, ***Basic Urban Erosion and Sediment Control in Virginia: Training Notebook*** (Richmond, Va.: Division of Soil and Water Conservation, 1980), 69.

[30] Maryland Department of Natural Resources, Coastal Resources Division, ***The Buffer Area Study***, by Raymond Palfrey and Earl Bradley, (Annapolis, MD: Coastal Resources Division, 1982), 5.

[31] Schueler, ***Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs***, 9.9.