CHAPTER II

CHESAPEAKE BAY PRESERVATION AREAS

DEFINITIONS AND VALUES

INTRODUCTION

The purpose of this chapter is to assist local officials in the identification of the components of Chesapeake Bay Preservation Areas through an understanding of the role these features play in the protection of water quality. Dealing with the effects of nonpoint source pollution is especially challenging because the origins of these pollutants are so diverse that they cannot be easily measured or regulated. An understanding of natural processes enhances the ability of local officials to better address water quality problems and develop effective solutions.

The chapter is divided into two sections. The first section presents the components of Chesapeake Bay Preservation Areas and how these features are defined in the Criteria Regulations. The second section provides basic information about the natural processes that are important to water quality protection. It further describes the functional role the components of Chesapeake Bay Preservation Areas have in protecting the quality of the Bay and its tributaries.

CHESAPEAKE BAY PRESERVATION AREAS

Section 10.1-2109 of the Act requires each local government to designate Chesapeake Bay Preservation Areas encompassing those land features which, if improperly developed, would contribute to the significant degradation of the water quality of the Bay and its tributaries. Some land features within the shoreline environment, such as wetlands, serve an important and direct water quality function in their own right by removing excess sediment, nutrients and potentially harmful or toxic substances from the runoff entering the Bay and its tributaries. Other features, such as floodplains, have a great potential to degrade water quality if they are improperly disturbed or developed. Thus, in developing the Regulations the Board recognized the functional difference between two types of lands.

On the one hand, lands which have intrinsic water quality benefit will be designated Resource Protection Areas (RPAs). Those lands which have the potential of degrading water quality or diminishing the functional values of the Resource Protection Area, if not properly managed, are to be designated Resource Management Areas (RMAs).

All tidal wetlands, tidal shores and non-tidal wetlands hydrologically connected by surface flow and bordering on tidal wetlands or tributary streams, as well as a 100-foot buffer area landward of wetlands, shores and tributary streams must be designated as Resource Protection Areas. These lands perform important water quality protection functions by absorbing wind and wave energy, stabilizing soils, and filtering sediment and nutrients running off the land. The RPA constitutes the last barrier to the overland flow of runoff before it reaches surface waters. Because of their vital ecological importance, RPAs will be the most stringently regulated portion of Chesapeake Bay Preservation Areas.

Land features which should be **considered** for inclusion in the designation of Resource Management Areas include isolated non-tidal wetlands, floodplains, highly erodible soils and highly permeable soils. A Resource Management Area must be designated contiguous to the entire inland boundary of the Resource Protection Area. General performance criteria will apply in the RMA to ensure that land use and development will not impair water quality.

The lands to be considered for designating RMAs are not likely to be evenly distributed in each locality, nor will they necessarily have the same water quality impacts. It is for this reason that the RMA boundary should be based on an inventory of these features, as well as an analysis of their connection and proximity to the stream network and RPA features.

Inappropriate land use and development practices in the RMA may have an adverse impact on the water quality protection function of the RPA. It is therefore critical that the RMA encompass an area large enough to provide significant water quality protection through the employment of the performance criteria. Options for determining the geographic extent of the RMA are discussed in greater detail in the next chapter.

Resource Management Areas shall include land types that, if improperly used or developed, have a potential for causing significant water quality degradation or for diminishing the functional value of the Resource Protection Area. A Resource Management Area shall be provided contiguous to the entire inland boundary of the Resource Protection Area.

Floodplains

"...all lands that would be inundated by flood water as a result of a storm event of a 100-year return interval."

Highly Erodible Soils

"...soils (excluding vegetation) with an erodibility index (EI) from sheet and rill erosion equal to or greater than eight. The erodibility index for any soil is defined as the product of the formula RKLS/T, as defined by the "Food Security Act (F.S.A.) Manual" of August, 1988 in the "Field Office Technical Guide" of the U.S. Department of Agriculture Soil Conservation Service, where K is the soil susceptibility to water erosion in the surface layer; R is the rainfall and runoff; LS is the combined effects of slope, length and steepness; and T is the soil loss tolerance."

Highly Permeable Soils

"...soils with a given potential to transmit water through the soil profile. Highly permeable soils are identified as any soil having a permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches (permeability groups "rapid" and "very rapid") as found in the "National Soils Handbook" of July, 1983 in the "Field Office Technical Guide" of the U.S. Department of Agriculture Soil Conservation Service."

Nontidal wetlands

"...those wetlands other than tidal wetlands that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, as defined by the U.S. Environmental Protection Agency pursuant to Section 404 of the federal Clean Water Act, in 33 C.F.R. 328.3b dated November 13, 1986, as amended."

Other lands

"...such other lands...necessary to protect the quality of state waters."

tion, undrained hydric soils, and wetland hydrology—must be satisfied in order to classify an area as nontidal wetlands. Unfortunately, there has often been the mistaken conclusion that hydric soils alone constitute nontidal wetlands and that large expanses of such soils in certain Tidewater localities would mean that land development in these areas would effectively cease. Since the Regulations' definition is the same as that used by the U.S. Army Corps of Engineers, most of the wetlands included within Chesapeake Bay Preservation Areas are likely to be regulated by the federal government anyway.

Floodplains

The 100-year storm return interval is used to define floodplains in the Regulations since this is the return interval used in the federal flood insurance program in which most local governments participate. Further, 100-year floodplain maps are relatively common as a result of that program. It should be noted that floodplains are land areas that are inundated by the overflow of streams and rivers, not drainage ditches. A regulatory floodplain is frequently defined by state and local regulations to include all land within reach of a 100-year flood, that is, a flood with a one percent probability of occurring in any given year.

Highly Erodible Soils

The Regulations define highly erodible soils by the incorporation of a formula that accounts for most of the characteristics that actually result in excessive soil erosion including, the effects of the interaction of rainfall, the erodibility factor, slope gradient, and slope length. This formula is familiar to soil scientists and soil conservationists. Using this definition will also permit areas of highly erodible soils to be easily mapped from digital soil data. Also important is the fact that the definition is consistent with the definition used in Virginia to identify highly erodible agricultural soils for determining compliance with requirements of the 1985 federal Food Security Act (Farm Bill).

Highly Permeable Soils

The definition of highly permeable soils is based upon recommendations by the U.S. Department of Agriculture - Soil Conservation Service and is consistent with SCS's classification system. Again, the use of this definition will allow highly permeable soils to be easily mapped from digital soil data.

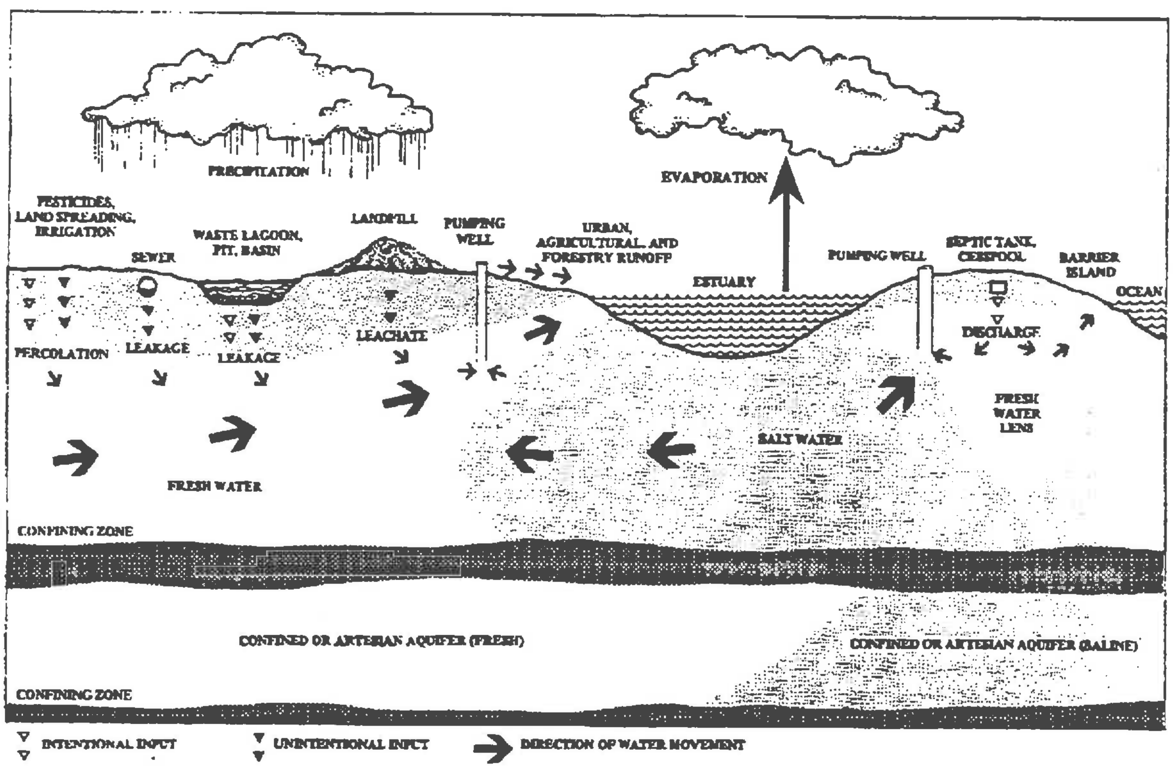
The SCS estimates that this definition (six inches per hour) describes approximately 30 percent of coastal plain soils, whereas, the next lower mapping break-point – moderately rapid (two inches per hour) -- describes approximately 75-80 percent of the land in Tidewater Virginia.

Resource Protection Areas perform natural pollution control functions. Biological activities in these areas are specially adapted for controlling runoff, trapping sediment, and recycling nutrients and pollutants. By virtue of their proximity to water courses, Resource Protection Areas provide the last line of defense before pollutants enter the Bay and its tributaries.

The second class of lands, Resource Management Areas, are prone to amplifying the impacts of pollutants. Highly erodible soils, steep slopes, highly permeable areas, floodplains, and certain wetlands accelerate the process of pollutants reaching ground water and surface water. Their characteristics cause them to have a greater potential for pollution as a result of improper development practices.

The types of lands which have been identified as Chesapeake Bay Preservation Areas are important features in the hydrologic cycle and, as such, have direct and substantial links to water quality. The Regulations have been designed to recognize this relationship as a means to achieving enhanced water quality in the Bay.

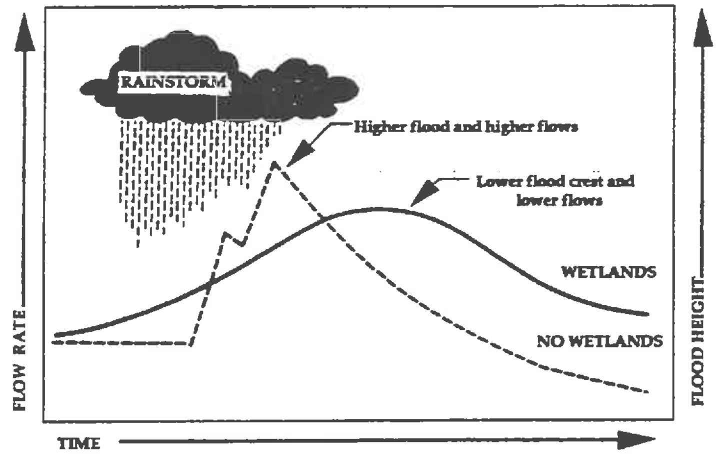
HYDROLOGIC CYCLE *FIGURE 2-1*



Source: Adapted from North Carolina Department of Natural Resources and Community Development, Division of Coastal Management, *A Guide to Protecting Coastal Waters Through Local Planning*, 1986

FLOOD REDUCTION VALUE OF WETLANDS

FIGURE 2-3



Wetland value in reducing flood crests and flow rates after rainstorms.

Source: Adapted from Burke, et al., ***Protecting Nontidal Wetlands***, 1988

WETLANDS' ROLE AS A SPONGE

Wetlands also act as a sponge by slowing down fast-moving erosive water, absorbing the energy of it for flood control and storm-damage protection, and acting as a buffer against coastal erosion from wave action. (See Figure 2-3.) Water is stored in the highly absorptive soils of wetlands, which serve as reservoirs from which groundwater can be replenished during dry seasons.[3]

SENSITIVITY TO POLLUTION

Wetlands are more sensitive than deeper water to pollution because the exposure of their larger relative surface area to wind movement and the sun's warmth speeds up the chemical processes taking place in the water. Development overloads and degrades the natural filtering system by accelerating the natural process of silting, often adding pollutants as well. Wetlands have a threshold of tolerance for what they can effectively assimilate; beyond that threshold, they will no longer have the same filtering and water-storing capacity. Wetlands cannot function as bottomless settling basins and must be protected from pollution and sediment flow in order to maintain their value. The ecology of wetlands is also disturbed by exaggerated high and low water levels caused by increased stormwater runoff and pumping for irrigation and water supplies.[4]

Wetlands are either tidal or nontidal depending on their proximity to tidal waters, such as bays and oceans. Tidal wetlands include marshes and salt ponds, and nontidal wetlands are generally inland areas such as forested swamps.

Tidal wetlands, which include vegetated marshes and nonvegetated sandflats or mudflats, are the most easily recognized of the wetlands in the coastal area. They are dominated by tidal action which regularly floods them. Typically, these wetlands are found along the coast but they may also be found along creeks and rivers which are influenced by tides although they are distant from the coast. Thus, tidal wetlands may be either salty or fresh depending on their proximity to the coast and the amount of freshwater entering them.[5]

Both vegetated marshes and non-vegetated mudflats protect the shoreline and adja-

Buffer Areas

> ***Buffer areas***
> "...an area of natural or established vegetation managed to protect other components of a Resource Protection Area and state waters from significant degradation due to land disturbances."

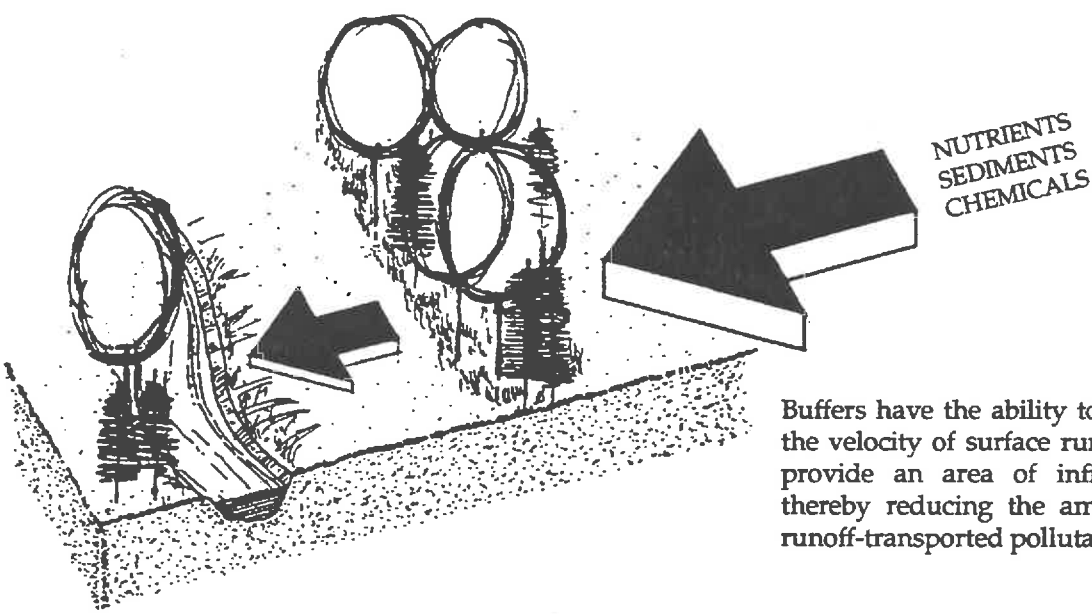
Recent developments in land use planning techniques have recognized the benefits that arise from the use of vegetative buffers in screening or separating incompatible land uses. Such buffers are most commonly associated with screening wind, noise or unsightly views, but buffers can be particularly effective as well, in filtering stormwater runoff from disturbed sites.

Buffer areas are zones of undeveloped, vegetated land that are managed to reduce the impact on water quality of land disturbing operations in adjacent areas. The buffer area can either be spatially arranged as a linear strip or as a free-form mass of vegetation, depending upon the desired use for which the buffer is intended. Similarly, buffer areas can be naturally existing zones of vegetation or planted zones of vegetation, depending upon the character of the site and the extent of site disturbance.

Vegetated buffer areas provide a wide variety of environmental, aesthetic, and recreational benefits. Benefits that can be derived from the implementation of buffer areas include the following:

- **Sediment control**
- **Nutrient assimilation**
- **Streambank stabilization**
- **In-stream temperature maintenance**
- **Outdoor recreation**
- **Flood control/protection**
- **Groundwater recharge area protection**
- **Aesthetics protection**
- **Runoff volume reduction**

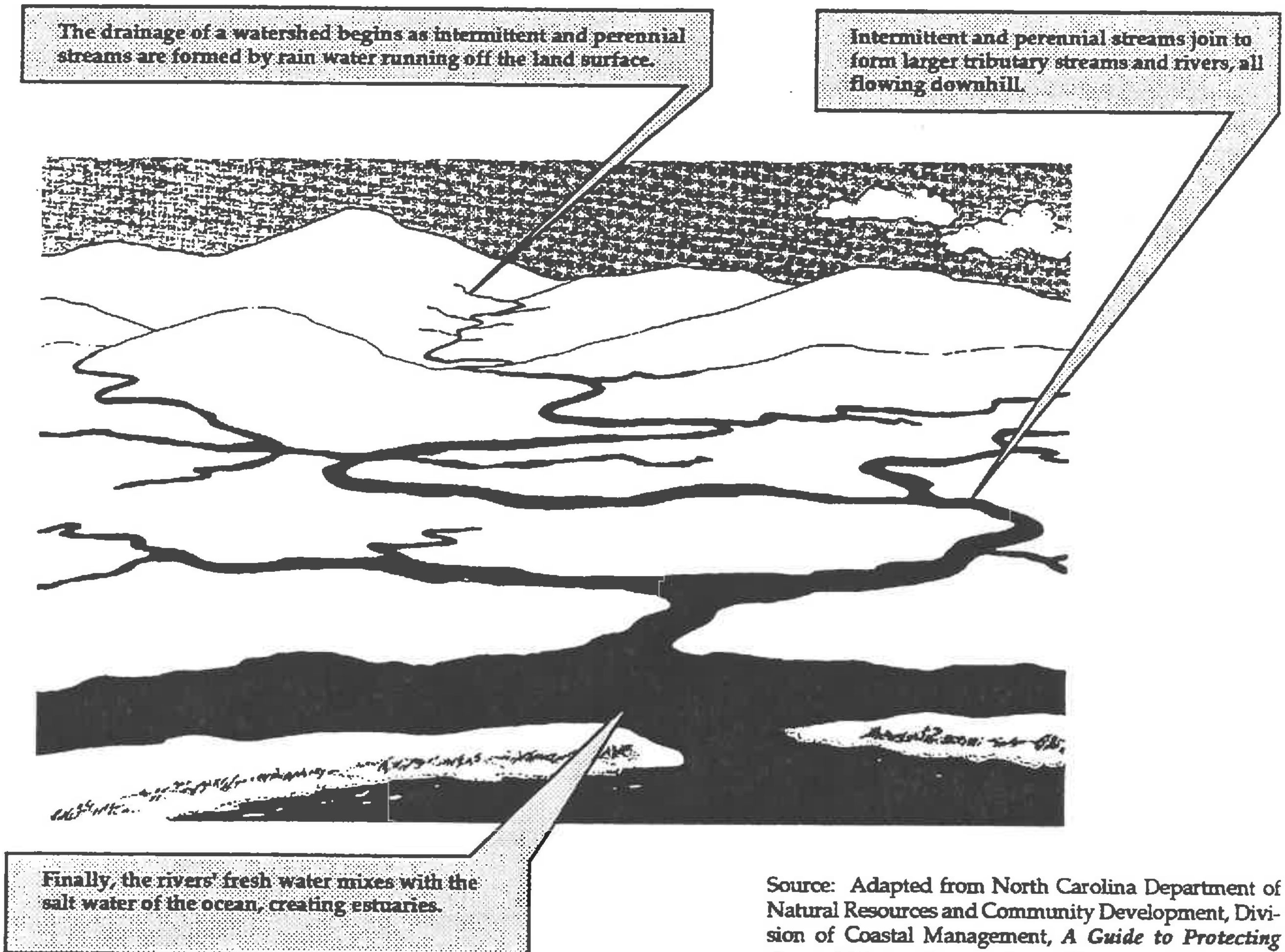
RUNOFF REDUCTION ASSOCIATED WITH BUFFER AREAS *FIGURE 2-4*



Buffers have the ability to reduce the velocity of surface runoff and provide an area of infiltration, thereby reducing the amount of runoff-transported pollutants.

Water System

Figure 2-5



Source: Adapted from North Carolina Department of Natural Resources and Community Development, Division of Coastal Management, ***A Guide to Protecting Coastal Waters Through Local Planning***, 1986

Other Lands

> *Other lands*
>
> "...such other lands...necessary to protect the quaity of state waters."

There are a number of other natural features that may have the potential to impact water quality if not afforded special protection and may be considered worthy of inclusion in RPA's.

These include:

- **Drainage swales and basins**
- **Reservoirs**
- **Intermittent streams**
- **Groundwater recharge areas**
- **Floodplains for storms less frequent than the 100 - year storm**
- **Canals under tidal influence**

Sensitive Soils

> ***Highly Erodible Soils***
>
> "...soils (excluding vegetation) with an erodibility index (EI) from sheet and rill erosion equal to or greater than eight. The erodibility index for any soil is defined as the product of the formula RKLS/T, as defined by the "Food Security Act (F.S.A.) Manual" of August, 1988 in the "Field Office Technical Guide" of the U.S. Department of Agriculture Soil Conservation Service, where K is the soil susceptibility to water erosion in the surface layer; R is the rainfall and runoff; LS is the combined effects of slope, length and steepness; and T is the soil loss tolerance."

> ***Highly Permeable Soils***
>
> "...soils with a given potential to transmit water through the soil profile. Highly permeable soils are identified as any soil having a permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches (permeability groups "rapid" and "very rapid") as found in the "National Soils Handbook" of July, 1983 in the "Field Office Technical Guide" of the U.S. Department of Agriculture Soil Conservation Service."

The information generally found in soil surveys can be broadly applied in the initial planning phase to indicate certain areas that may need special attention in relation to potential soil problems. This information can be used in determining: soil drainage properties; wetland potential; suitability for basements, foundations, roadways, septic systems, etc; flood hazard potential; suitability for specific crops and vegetation along with probable yields that may be expected; and soil erosion potential. Such information, along with other factors such as percent of slope, length of slope, infiltration rate, and the depth to groundwater, can identify the potential for the soil itself to become a pollutant to surface waters, as well as its potential to transmit pollutants through the soil into groundwater.

The proper application of soil information is especially important in planning in order to ensure that the use or development of land does not add to the pollution of water resources. The significance of this information becomes more apparent in view of the fact that different uses or activities on the land generate vastly different sediment loads.

In addition, it is important to understand that other pollutants generated from human-induced activities, such as phosphorous, adsorb or attach themselves to sediment particles and are transported into water resources through overland runoff and subsurface leaching.

Soil erosion is the process by which the land surface is worn away by the action of water, wind, ice, and gravity. Water generated erosion or runoff is unquestionably the most damaging problem, particularly in areas under development. The erosive action of water has both a vertical component, the energy developed by rain as it falls, and a horizontal component, the energy derived from its motion as it runs off the land. Both of these components are equally important when viewed in terms of water quality protection.

Infiltration

As rain strikes the surface of the soil, or as snow melts, a certain amount infiltrates or moves down through the soil, a certain amount runs off the land, and the remaining portion is absorbed by vegetation. The amount of water that infiltrates the soil varies de-

Vegetative cover plays an extremely important role in controlling erosion by shielding the soil surface from the impact of falling rain, holding soil particles in place, maintaining the soil's capacity to absorb water, slowing the velocity of runoff, and removing subsurface water between rainfalls through the process of evapotranspiration. Soil erosion can be significantly reduced through the careful control and phasing of the removal of existing vegetation, as well as by limiting the area and duration of raw soil exposure.

The topography of a drainage area--its size, shape and slope--exerts a great amount of influence on the volume and rate of runoff. As both slope length and gradient increase, the rate of runoff increases and the potential for erosion is magnified. Theoretically, a doubling of the rate or velocity of runoff enables water to move particles 64 times larger, allows it to carry 32 times more material in suspension and makes the erosive power four times greater.[15]

Slope orientation can also be a factor in determining erosion potential in relation to potential heat gain and associated soil heating. For example, a south-facing slope containing droughty soils may exhibit poor growing conditions that would inhibit the reestablishment of vegetative cover.

Climatic factors, including frequency, intensity and duration of rainfall, are fundamental factors in determining the volume of runoff produced in a given area. As both the volume and velocity of runoff increase, the capacity of runoff to detach and transport soil particles increases. Correspondingly, where storms are frequent, intense, or of long duration, erosion potential is high.

Sedimentation/Siltation

Sedimentation typically occurs following the time when runoff reaches its peak velocity. Excessive quantities of runoff generated by erosion during periods of high velocities are deposited downstream during periods of lower velocities, only to be picked up and carried further downstream by later peak flows. In this manner, sediments are progressively carried further downstream or downslope from their source or point of origin.

Sediments alter the existing aquatic environment by screening out sunlight, thereby changing the rate and amount of heat radiation within the water. Particles of finer silt that settle to the bottom of water bodies create an adverse environment for the organisms that inhabit such areas by essentially smothering the organisms and their eggs. Coarser-grained sediments also suppress bottom-dwelling aquatic life and, where currents are sufficiently strong, exhibit abrasive qualities that accelerate channel scour, thereby, exerting an even more damaging effect upon aquatic life.

The principle effect land development activites have on the soil erosion process consists of exposing disturbed soils to precipitation that leads to surface storm runoff and sedimentation. Uncontrolled erosion and sedimentation resulting from land disturbing activities often cause considerable economic damage to individual properties and society in general.

ally transports soil particles lower in the strata until they potentially end up in the groundwater system.

The end result of this leaching process is significant for two major reasons. Minerals and nutrients important for plant and micro-organism growth can be removed from the upper soil horizons where they are needed for plant growth and become deposited in a lower part of the horizon where they are essentially unavailable for root uptake. Additionally, pollutants discussed in the previous section can adhere to the soil particles and be leached lower into the soil horizon until they reach an area of groundwater storage. These pollution-charged particles can then be transported through the groundwater system into other water systems adding further to the problem of water resource pollution. Generally, in areas where percolation and infiltration are high, the potential for leaching is also high.

[13] Ibid.

[14] Ibid.

[15] Nyle C. Brady, ***The Nature and Properties of Soils*** (New York, NY: MacMillan Publishing Company, 1974).