

Steep Slopes



Guide | Model Regulations

Lehigh Valley Planning Commission

November 2008

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Alice J. Lipe, Planning Technician, Layout and Cover Design

Lynette E. Romig, Senior GIS Analyst, Graphics Design

Susan L. Rockwell, Senior Environmental Planner, Editor

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TABLE OF CONTENTS

INTRODUCTION	2
REGULATION	2
DESCRIBING SLOPES	5
FACTORS AFFECTING SLOPES.....	6
DEVELOPMENT ISSUES.....	9
Roads and Driveways.....	9
INFRASTRUCTURE	11
Sewer and Water.....	11
Drainage	12
Grading.....	12
Fire	15
A NOTE ABOUT THE MODEL REGULATIONS	18
MODEL REGULATIONS — STEEP SLOPE OVERLAY DISTRICT	18
BIBLIOGRAPHY	25

LIST OF TABLES

1	Degree of Slope	5
2	Driveway Grades at Intersection with Roadway	10

LIST OF FIGURES

1	Basic Measurement of Slope.....	5
2	Visual Examples of Slope	6
3	Results of Slope Instability	6
4	Slope Shapes	8
5	Example of a Cut and Fill Slope	9
6	Sloped Driveway Diagram	10
7	How Steep Slopes can Affect an On-lot Septic System	12
8	How Level Building Sites are Created on Steep Slopes.....	12
9	Examples of Preferred vs. Not Preferred Grading Techniques	14
10	The Basic Retaining Wall.....	15
11	How Slopes Fuel Fires	15

LIST OF MAPS

1	Steep Slope Map of the Lehigh Valley	3
2	Woodlands of the Lehigh Valley	16

INTRODUCTION

The steepest slopes in the Lehigh Valley are found along the Blue Mountain and South Mountain. These slopes serve as groundwater recharge areas and provide a critical source of high quality water to the headwaters of watercourses throughout the Lehigh Valley. Steep slopes can provide significant benefit to local water supplies. There are sizable areas of steep slope along the hillsides of Weisenberg and Lowhill townships in Lehigh County and in municipalities along the Lehigh and Delaware rivers (Map 1). A notable characteristic of steep slope areas is that they are nearly all wooded; very few steep slopes are used for cropland or pastures due to their lack of suitability for agriculture. However, over the last decade, Lehigh Valley municipalities have seen an increased desire to build on steep slopes. The majority of the development proposed on steep slopes is residential in nature.

Some of the remaining undeveloped land in the Lehigh Valley is on steep slopes. While these steep slope areas may provide great opportunities for home sites, they also present special challenges in designing development that is safe and economical and that maintains the qualities of hillsides that contribute to the Lehigh Valley's natural beauty.

Steeply sloped areas can offer a variety of amenities such as significant views of valleys and hills, proximity to large natural open space areas, and privacy. However, if development is poorly laid out and built, the very amenities that people seek can be destroyed. In addition, the cumulative effects of improper steep slope development can include: significant destruction of the scenic beauty of the area, decreased water quality, increased downstream runoff and flooding problems, loss of sensitive habitats, erosion, slope failures, fire hazards, high utility costs, lack of safe access for emergency vehicles, and high costs for maintenance of public improvements.

REGULATION

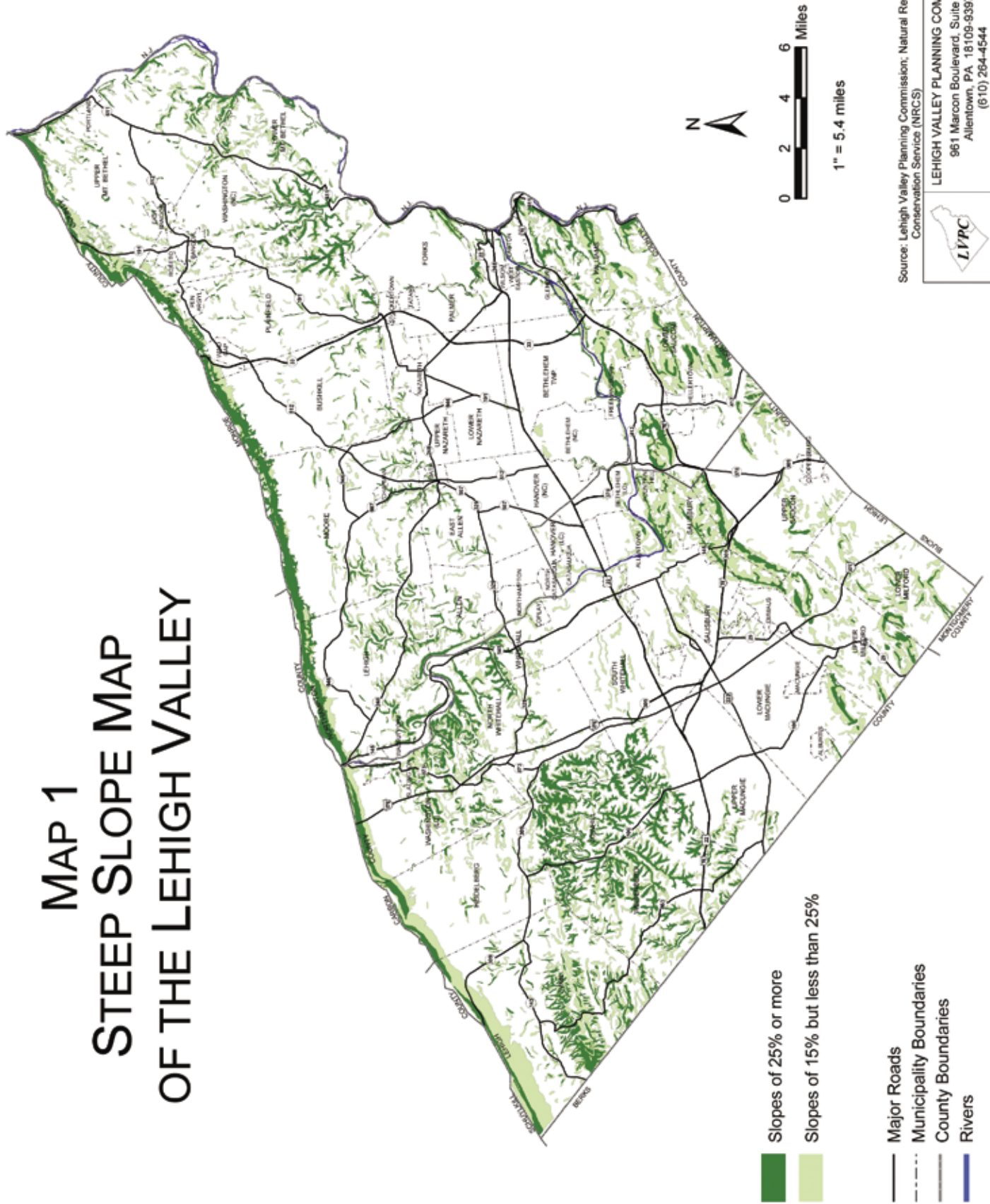
Municipalities use slope steepness as a means to determine how a particular site can be developed. The desire to regulate development on steep slopes emerged after municipalities concluded that, as slopes become steeper, grading and the provision of infrastructure become more difficult and expensive. Further, the extent of site disturbance, loss of the aesthetic appeal of steep slopes, and environmental degradation become greater as well.

The basis for enacting municipal steep slope regulations is found in the federal statutes, the Commonwealth's Constitution and in the Pennsylvania Municipalities Planning Code (MPC). With the passage of numerous pieces of environmental legislation in the 1970s, more communities started regulating steep slope development. The Clean Water Act of 1972 was a catalyst for many local grading, erosion and sedimentation ordinances, and the inclusion of steep slopes as preserved areas in municipal comprehensive plans.

While federal legislation indirectly permits the regulation of steep slopes, the Commonwealth's Constitution, and more specifically, the MPC, clearly authorizes local municipalities to adopt steep slope regulations. The "Environmental Rights Amendment" of the Pennsylvania Constitution (Article 1, Section 27) has been interpreted by the courts as a responsibility equally shared by the Department of Environmental Protection and municipalities. Pennsylvania's municipalities have the responsibility to apply Section 27 in planning and regulation of land use. Section 27 states:

"The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people."

MAP 1 STEEP SLOPE MAP OF THE LEHIGH VALLEY



Section 27 provides a right, in very broad terms, to environmental quality and specifies the Commonwealth as “trustee of these resources.” Because of its broad language, Section 27 has not had important effects in litigation.

The most direct authority, however, can be found in the Pennsylvania Municipalities Planning Code (MPC). The MPC, in effect since 1969 and updated several times since, provides the enabling legislation for municipal land use planning with mechanisms such as the creation of comprehensive plans, and zoning and subdivision ordinances. The general intent of the MPC is to give municipalities police powers to guide coordinated development such as uses of land, structures, streets, and public facilities; and to promote preservation of natural and historic resources. The MPC provides the authority for municipalities to adopt regulations relative to steep slopes. These sections are specifically:

Section 301(a) (6). The municipal comprehensive plan shall include a plan for the protection of natural and historic resources to the extent not preempted by federal or state law. This clause includes, but is not limited to, wetlands and aquifer recharge zones, woodlands, steep slopes, prime agricultural land, floodplains, unique natural areas and historic sites.

Section 503(2) (v). A subdivision and land development ordinance may include provisions for ensuring that land, which is subject to flooding, subsidence, or underground fires, either shall be safe for the proposed use or that these areas shall be set aside for uses that do not endanger life or property.

Section 603(c) (7). Zoning ordinances may contain provisions to promote and preserve prime agricultural land, environmentally sensitive areas, and areas of historic significance.

Section 605(2) (ii), (iii), and (vii). Where zoning districts are created, all provisions shall be uniform for each class of uses or structures, within each district, except that additional classifications may be made within any district for the regulation, restriction, or prohibition of uses or structures at, along, or near natural or artificial bodies of water, places of relatively steep slope or grade, or other areas of hazardous geological or topographical features, floodplain areas, agricultural areas, sanitary landfills, and other places having a special character or use affecting or affected by their surroundings.

Section 606. The zoning ordinance shall include or reference a statement of community development objectives relating to the need for protecting natural resources.

Section 609.1(c) (3) and (4) and Section 916.1(c) (5) (iii) and (iv). In evaluating a substantive challenge to the validity of a zoning ordinance by a landowner, the governing body or the zoning hearing board shall determine the suitability of the site for the intensity of use proposed by the site’s soils, slopes, woodlands, wetlands, floodplains, aquifers, natural resources, and other features. It shall also evaluate the impact of the proposed use on the site’s soils, slopes, woodlands, wetlands, floodplains, natural resources, and natural features, the degree to which these are protected or destroyed, the tolerance of the resources to development, and any adverse environmental impacts.

Many municipalities have regulated steep slope development since enactment of the first generation of zoning ordinances during the 1960s. Today, forty-two Lehigh Valley municipalities have regulations pertaining to steep slope development. Local municipalities typically include a goal of steep slope protection in a comprehensive plan and specifically address slope development by regulation through the zoning ordinance, subdivision ordinance or a stand alone ordinance. The *Comprehensive Plan Lehigh Valley ... 2030* has a goal of minimizing the adverse environmental impacts of steep slope development. To implement that goal, the LVPC has created model regulations that limit steep slope development.

DESCRIBING SLOPES

Slope is the relationship of vertical rise to horizontal run, expressed as a percentage from the “toe” to “top” of a slope (Figure 1). For example, as shown in Figure 1, a 50% slope has 100 units of vertical rise for 200 units of horizontal distance. Most local municipalities use this method of calculating slope. However, slopes can be measured in degrees (Figure 2).

There are several ways that can be used to measure slope. Some low-tech methods include using a compass or calculating slopes by looking at topographic maps. For most subdivision and land development plans, however, licensed surveyors and engineers do the slope calculation as part of the survey of the site.

Municipalities generally measure slope in the form of a percentage and classify steep slopes in a range of 12-33%. The County Comprehensive Plan classifies 15% slopes or over as steep and are derived from the Soil Conservation Service’s soil survey classifications (Table 1). Local municipalities use the average slope of a site in regulating steep slopes. The footprint of proposed development typically must be outside the areas of slope that are defined as steep by the municipality.

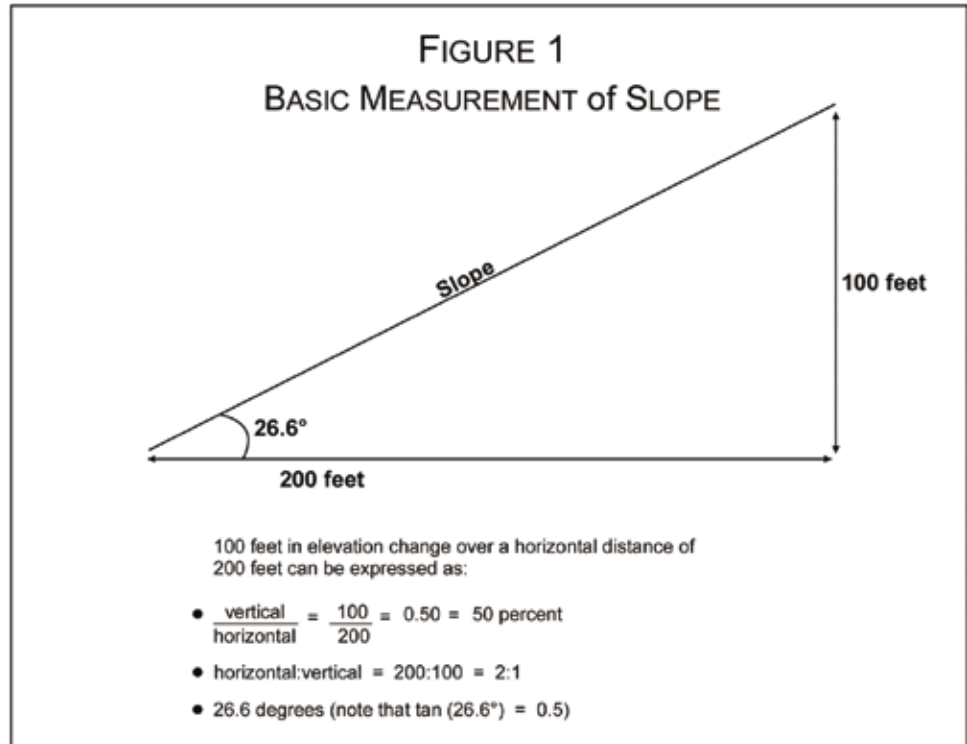
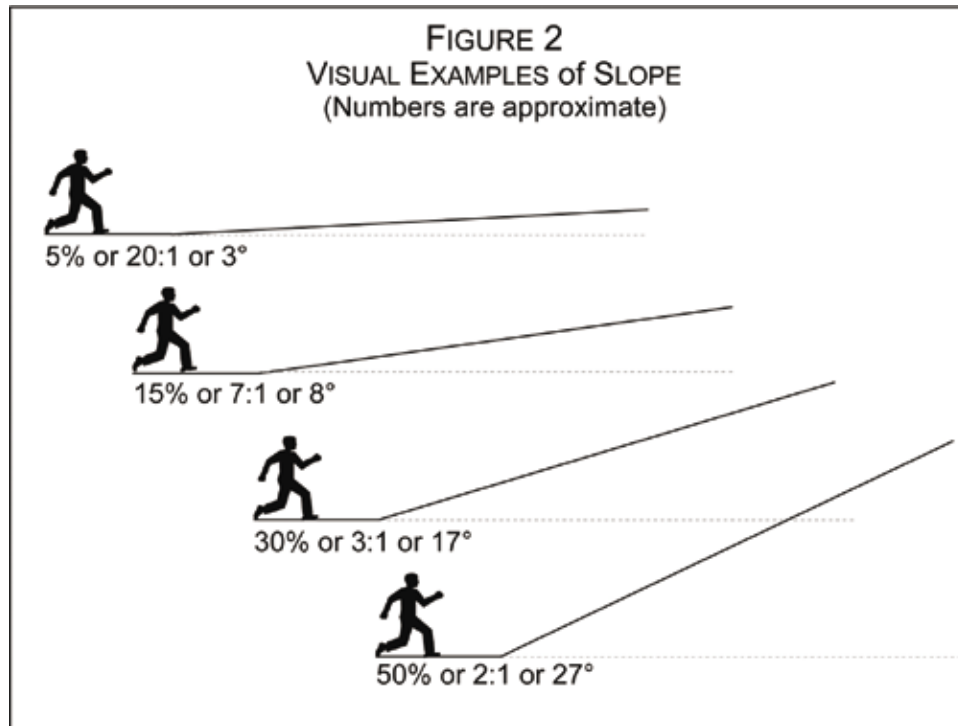


TABLE 1

Degree of Slope

Degree of slope	Development Potential
0% to 3%	Generally suitable for all development and uses.
3% to 8%	Suitable for medium density residential development, agriculture, industrial and institutional uses.
8% to 15%	Suitable for moderate to low-density residential development, but great care should be exercised in the location of any commercial, industrial or institutional uses.
15% to 25%	Only suitable for low-density residential, limited agricultural and recreational uses.
Over 25%	Only used for open space and certain recreational uses.

Source: Soil Surveys of Lehigh/Northampton Counties, Pennsylvania, Soil Conservation Service. 1963, 1974.

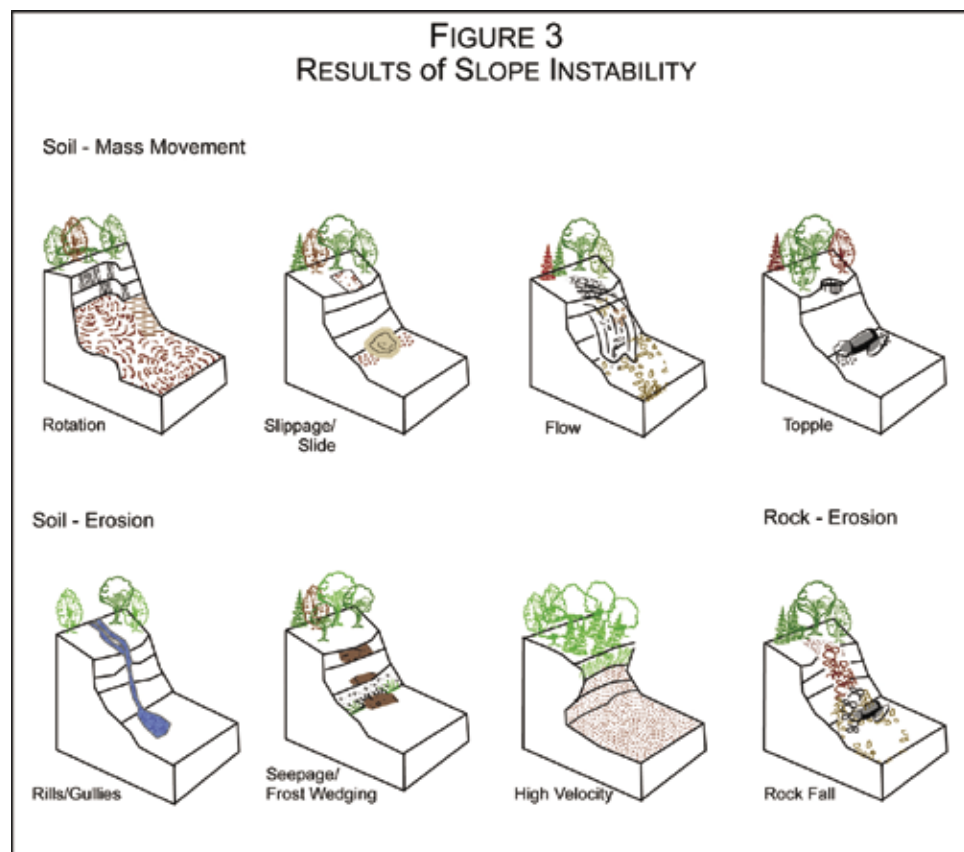


FACTORS AFFECTING SLOPES

Slopes are naturally unstable. Gravity, wind, water or disturbance, either natural or man-made, can cause mass movement, erosion, slippage or slide. Figure 3 shows the results of slope instability. The characteristics that influence the stability of slope include geology, slope drainage, slope topography (shape and steepness), soil type and changes to the slope (placing soil or removing soil from the slope).

Slopes are vulnerable to damage resulting from site disruption, primarily related to soil erosion. Damage is likely to spread to areas which were not originally disturbed. Development of steep slopes, especially adjacent to stream corridors, can increase erosion of stream banks resulting in decreased water quality.

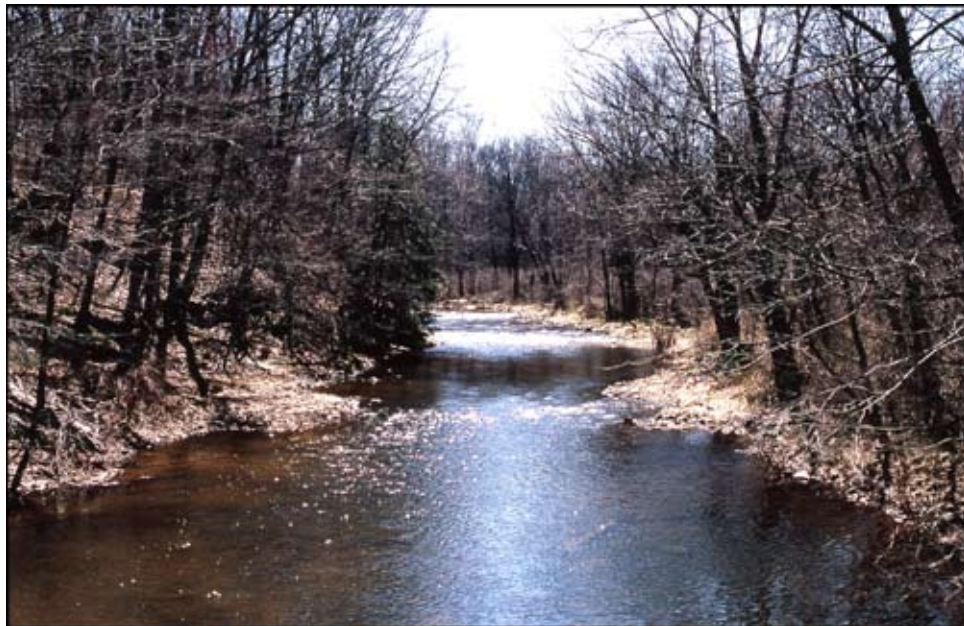
Water movement is the most common mechanism



of slope instability. The greater the steepness of the slope, the more likely it is that rain will run off rather than infiltrate. In addition, the steeper the slope, the faster the water will travel. Water with more speed has greater erosive power.

There are a variety of other mechanisms that can create an unstable slope and trigger erosion or substantial slippage:

- Removal of vegetation. The roots of shrubs and trees, especially, keep soil in place. Removing vegetation can increase the amount of sediment traveling down the slope by a factor of 1,000 to 10,000. It can take several years for the effects of tree removal to show up because the tree roots can still provide support for many years. Once the roots die, failure is more likely.



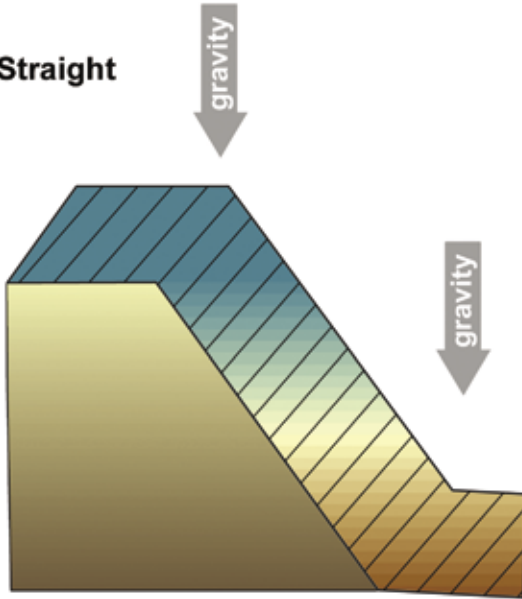
The roots of the mature trees keep the soil from sliding down the hillside into the creek. If the trees were removed, the hillside would be susceptible to substantial sheet erosion from heavy rains. Sheet erosion is the unconfined flow of water across the surface.

- Removal of support. Excavating or undercutting compromises the load-bearing parts of the slope.
- Excessive weight. Placement of structures or fill on a slope in excess of what the slope can handle.
- Redirection of water. Concentrating the flow of runoff or otherwise changing the natural drainage pattern.
- Introduction of excessive water. Landscape irrigation, septic systems on the sloped area.

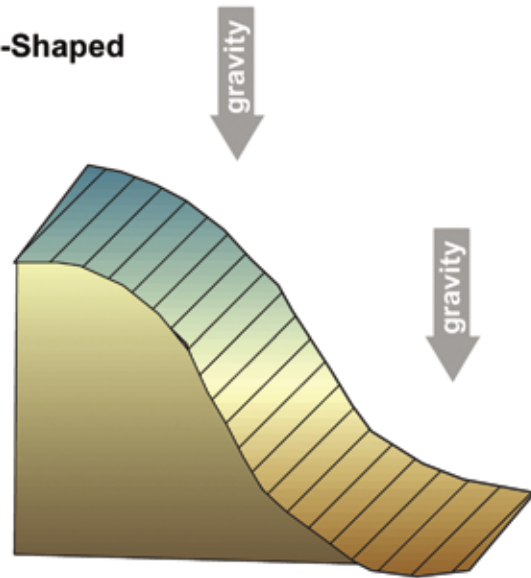
The shape of a slope is a good sign of how stable it is. Straight and S-shaped slopes tend to be more stable than concave or convex slopes (Figure 4). A concave slope is rounded inward like the inside of a bowl, i.e. goes from more steep to less steep. A convex slope is curved or rounded like the exterior of a circle, i.e. goes from less steep to more steep. The steeper the slope, the more in line its material components (sediment and/or rock) are

FIGURE 4
SLOPE SHAPES

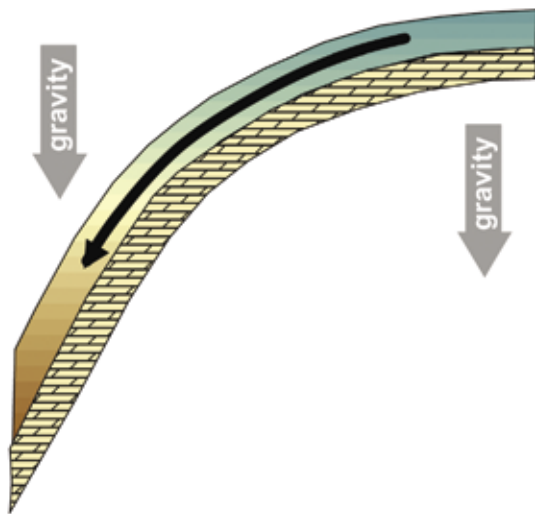
Straight



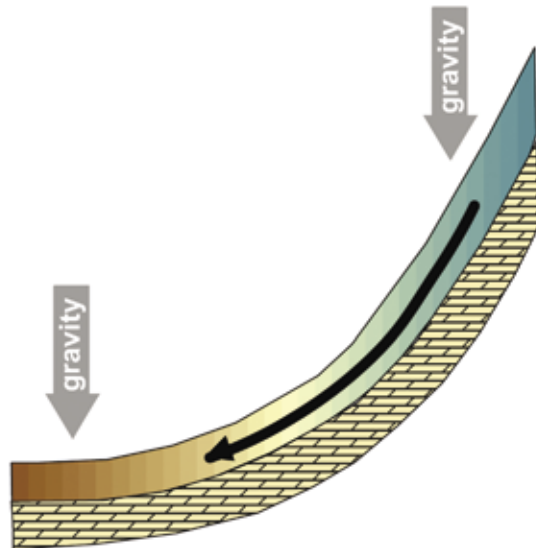
S-Shaped



Effects of convexity on small slopes:



Effects of concavity on small slopes:



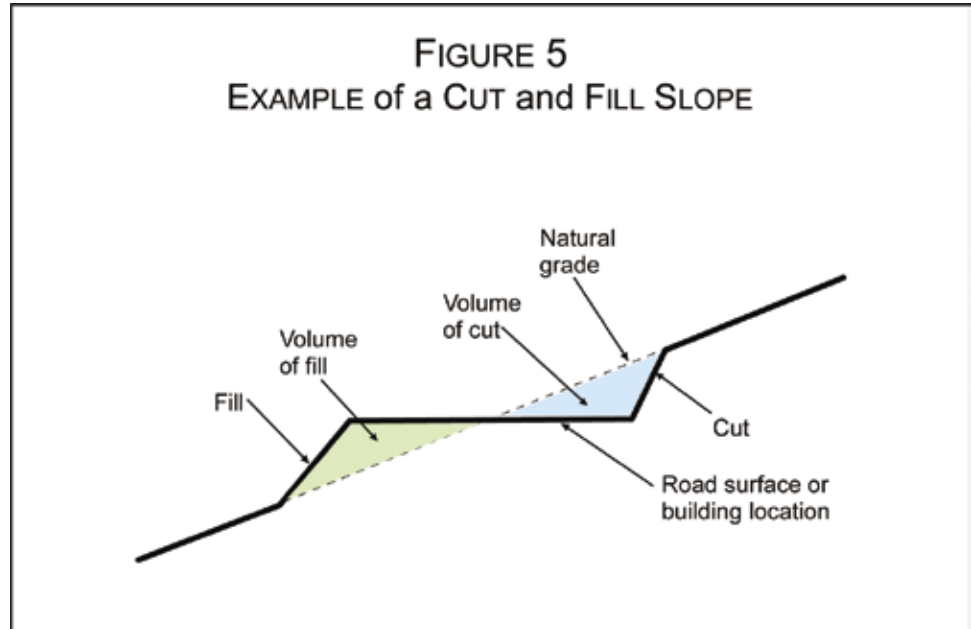
with gravity, the more likely the slope will erode or fail. Concave and convex slopes are more prone to instability because the slope is more in line with the force of gravity.

DEVELOPMENT ISSUES

Often, slopes are altered to create level areas for the placement of buildings or roads. This process is known as “cut and fill.”

To cut a slope, a section perpendicular to the natural slope is excavated so that a flat area can be created below the natural terrain (Figure 5). A fill slope is the opposite, where it is desired to raise the level area above the natural terrain. Soil is added, and retaining walls are generally used. Cuts are preferable to fills as they are more stable and have generally less impact on surrounding

vegetation and off-site views. The problem with fill is that it has a tendency to return to the natural grade. A house built on fill is generally less stable than one placed on natural soils. Unless proper compacting and retaining practices are followed, fill will continue to compress on its own. Fill around a house tends to settle or wash into the surrounding vegetation eventually smothering it.



ROADS AND DRIVEWAYS

Steep slopes impact the development of driveways and roads in two distinct ways.

Environmental Impact. Driveways and roads should be designed to follow the natural topography of the site, with gentle horizontal and vertical curves. If there is potential for a shared driveway, it should be explored, as it reduces the amount of disturbance to the site by eliminating the need for an additional driveway. However, there is often a tradeoff between reducing the environmental impact and safety concerns. It is a challenge to provide access for emergency vehicles and minimize the impact of development. Emergency vehicles, due to their size, need room to turn around and navigate. In addition, municipalities generally require more than one access point to a subdivision. This ensures a degree of access to an area should one access point become unavailable and also permits the staging of emergency vehicles along one access point while the residents can leave using the other access point. In steeply sloped areas, the addition of another access point increases the amount of disturbance to the site since additional grading is required and more impervious coverage is added to the site.

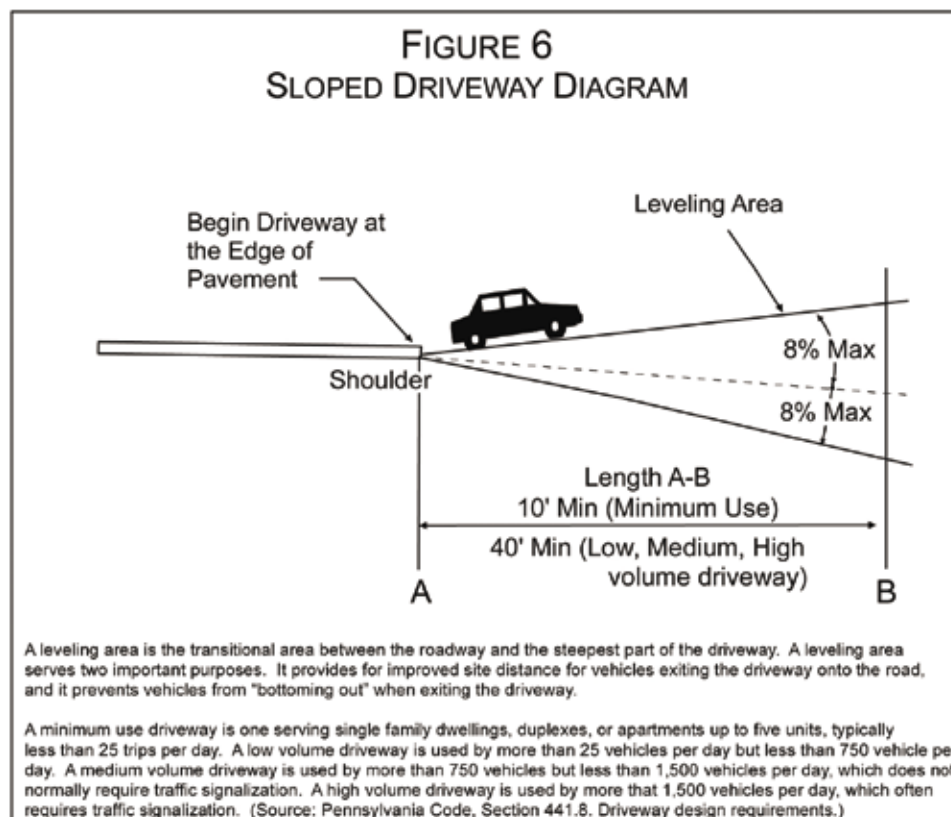
Access management. Turning vehicles must slow appreciably to enter a driveway. The steeper the driveway, the greater the reduction in speed required to prevent “bottoming out.” A driveway’s vertical profile should allow a smooth transition to and from the roadway. The National Highway Institute’s course workbook on access management recommends the initial driveway grade angles as shown in Table 2.

TABLE 2
Driveway Grades at Intersection with Roadway

Roadway Classification	Desirable Change in Grade (Percent)	Maximum Change in Grade (Percent)
Major Arterial	Less than 3	5
Minor Arterial	Less than 4	5
Collector	Less than 5	6
Local	Less than 6	8

Source: National Highway Institute, *Access Management, Location and Design Workbook*

The Pennsylvania Department of Transportation (Access Management Model Ordinances for Pennsylvania Municipalities Handbook, February 2006) recommends that the driveway grade not exceed 8% at its intersection with a roadway for a minimum of 10 feet for minimum use driveways and a minimum of 40 feet for low, medium and high volume driveways. Municipalities can also choose to minimize the severity of the slope at the intersection by requiring a leveling area, which serves as a transition between a driveway and roadway (Figure 6).





An example of a road constructed on a steep slope.

INFRASTRUCTURE

Steep slope development is typically at a low density; the per unit cost of utilities is generally higher than for developments constructed on flatter land. Developing on steep slopes is expensive. There are initial expenditures for improvements such as roads and utilities. The construction of roads on steep slopes often calls for substantial grading, extra-wide rights-of-way to accommodate road slopes, retaining walls, and steeply sloping embankments, which can also require expensive long-term maintenance.

In addition, simple activities, such as trash pickup or mail delivery, are often more expensive in steep slope areas due to the increased time it takes for trucks to move along steep roadways.

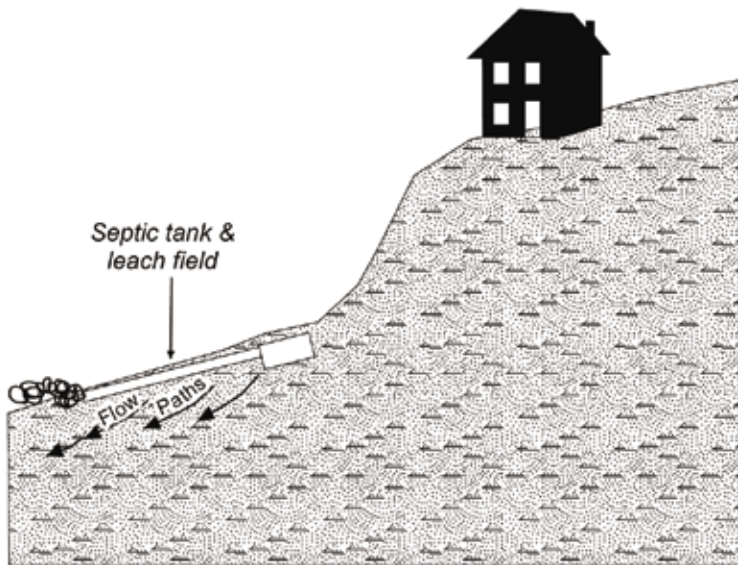
The poor soils often found on steep slopes can impact buildings and driveways. Shifting foundations, cracked walls, and cracked pavement and roadways are some of the potential problems associated with slope instability. These problems often result in increased development and maintenance costs or, in extreme cases, structural failure.

SEWER AND WATER

Running public utilities up a slope may require additional expense as pumping stations may be required to maintain adequate pressure in the system.

Constructing on-lot septic systems on steep slopes can be a considerable financial and construction challenge and risk. On-lot systems must be properly installed according to State regulations. Certain systems cannot properly function or be installed on steep slopes. Otherwise, effluent will run too quickly to the low end of the drainfield line and gravel trench where it is likely to simply break to the surface. There is a possibility that untreated effluent may move laterally from the leach line and emerge on to the ground surface (Figure 7). The effluent then could move down slope onto adjacent property, pond at the base of a cut slope, or run into a body of water. In Pennsylvania, on-lot sewage disposal systems can be placed on slopes of 25% or less. Conventional seepage beds

FIGURE 7
HOW STEEP SLOPES can AFFECT
an ON-LOT SEPTIC SYSTEM



can be placed on slopes up to 8%, sand mounds up to 12%, in-ground trenches up to 25% and spray irrigation on up to 25% slope. (*Title 25, Pennsylvania Code, Chapter 73.*)

DRAINAGE

Steep slope development has the potential to start a cycle of erosion and flooding. Water that falls on forests, grass and other natural areas has a relatively high infiltration rate into the soil. Roofs, concrete, pavement and other impervious surfaces increase the amount of rainwater that runs off the land surface. On a developed slope, this runoff is often

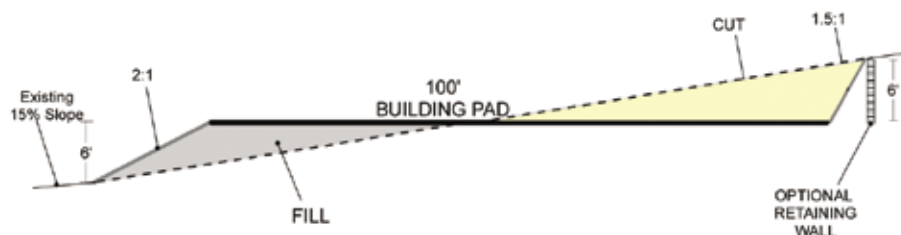
placed onto steep slopes below the house and driveway. Without appropriate measures to control the velocity or volume of the water, excessive soil erosion and increased flooding can potentially occur. The increased volume and velocity of runoff can result in erosion of stream banks as the stream begins to form a larger channel to dissipate the energy of the water. Sediment from eroding stream banks can be deposited or transported directly in the stream. Runoff from steep slopes moves at high velocity and reaches downstream areas quickly, which can result in increased flash flooding.

GRADING

Most types of construction require natural land surfaces to be altered in some way. Typically, this involves grading to create a level area on sloping land or using retaining walls.

Structures, driveways and roads are situated on “pads” that have been carved out of the landscape (Figure 8).

FIGURE 8
HOW LEVEL BUILDING SITES are
CREATED on STEEP SLOPES



The size of cut and fill slopes is determined primarily by the slope of the land and the size of the bench cut into the hillside. Steep natural slopes require large amounts of grading to achieve the proper grade on cut and fill slopes. Soils also vary considerably in their makeup and some can be graded steeper than others. Soil properties should be evaluated prior to determining the proper slope on graded areas. In many cases, site designers and contractors attempt to make the graded area smaller by making cut and fill slopes steeper.



Examples of retaining walls used to provide flat areas for houses.

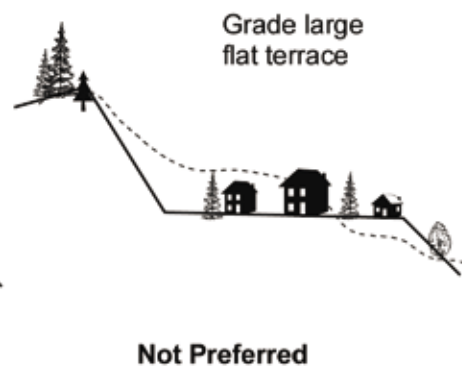
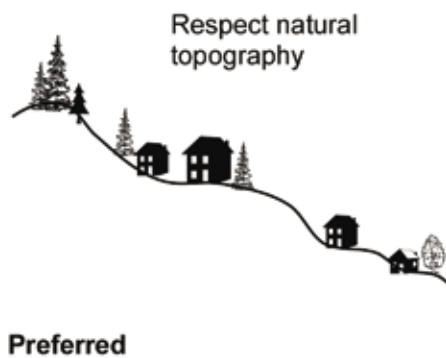
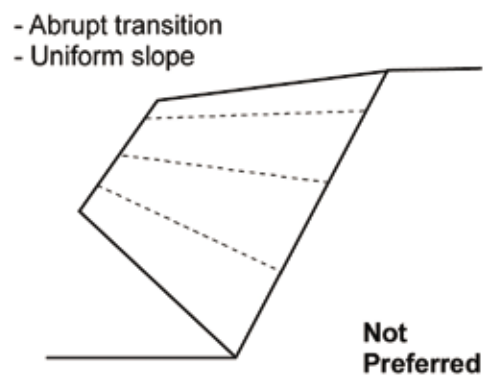
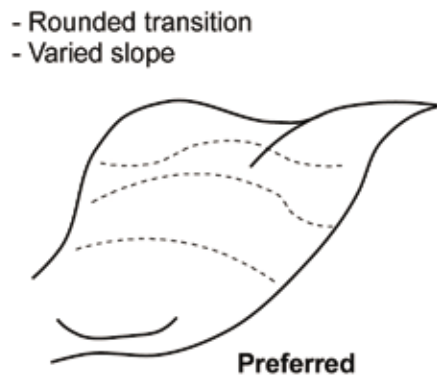
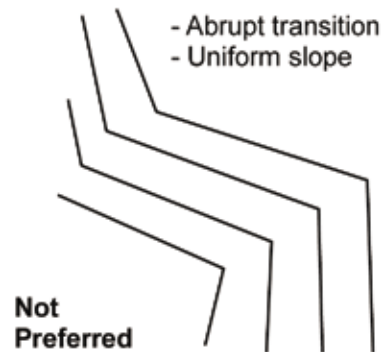
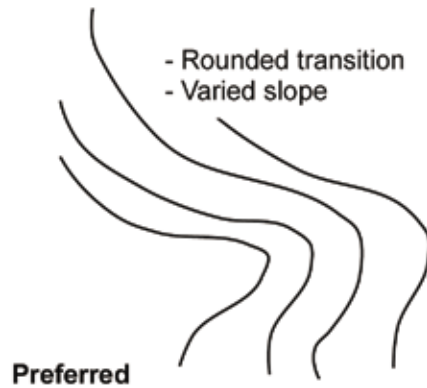
The desire to manipulate steep slopes is usually driven by residential lot size and the desire to create as many lots as possible on a given area of land. In some cases, the natural slope of the hillside is steeper than what the grade on the cut or fill slope should be, making it impossible to cut the slopes to the proper grade. Cut and fill slopes that are graded too steeply, or situated in unstable soils, usually collapse over a period of time. These slopes can suffer from slow, prolonged erosion along their surface or slide down the hillside. Figure 9 shows examples of preferred and not preferred grading techniques.



Examples of how sloped topography can affect the location of buildings. Notice how, in each example, the buildings are terraced to provide a flat building pad for the house.



FIGURE 9
EXAMPLES OF PREFERRED/NOT PREFERRED
GRADING TECHNIQUES



Another method used in making a sloped area ready for development is the use of retaining walls (Figure 10). These walls provide lateral support to vertical slopes of soil. They hold back a vertical or near vertical face of soil that would otherwise cave, slump or slide. Retaining walls are the most common way to deal with steep slopes and can be constructed from many materials including boulders, fieldstone, concrete, treated wood, railroad ties or landscaping timbers, self-stacking precast concrete blocks, and bricks.

FIRE

Map 2 shows the location of woodlands in the Lehigh Valley. The majority of these woodlands are located on steep slopes. Fires can start almost undetected and undeterred with plenty of fuel at its disposal. Fire is a particular hazard to houses on steep slopes.

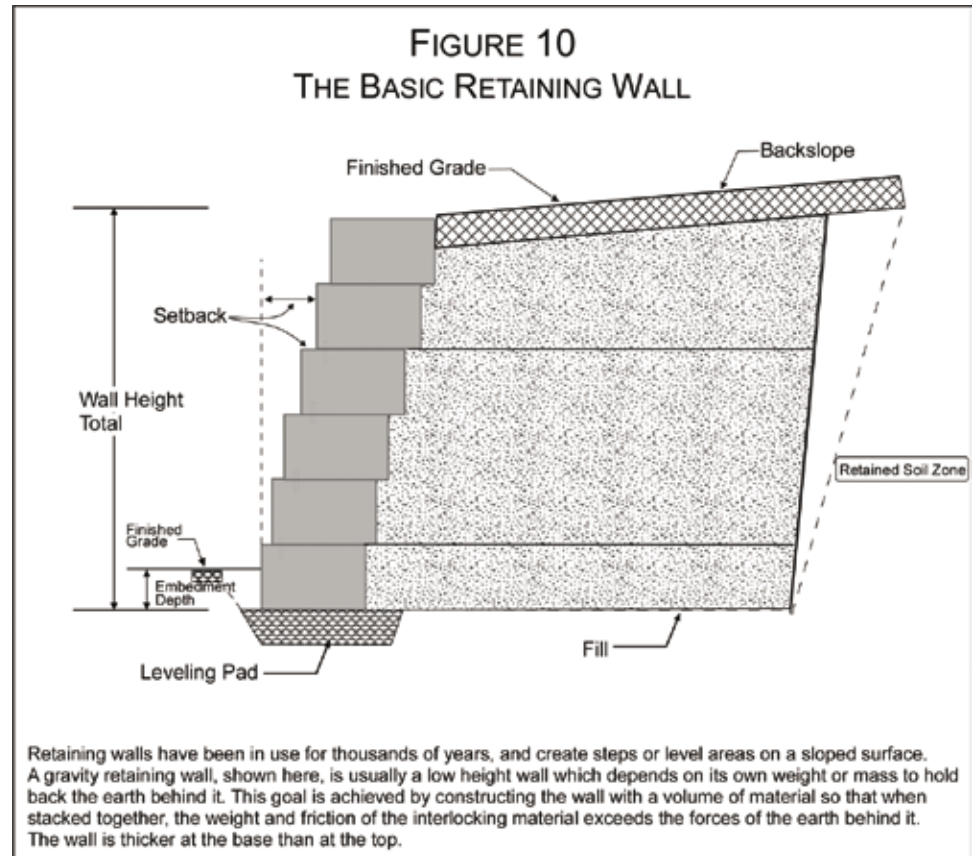
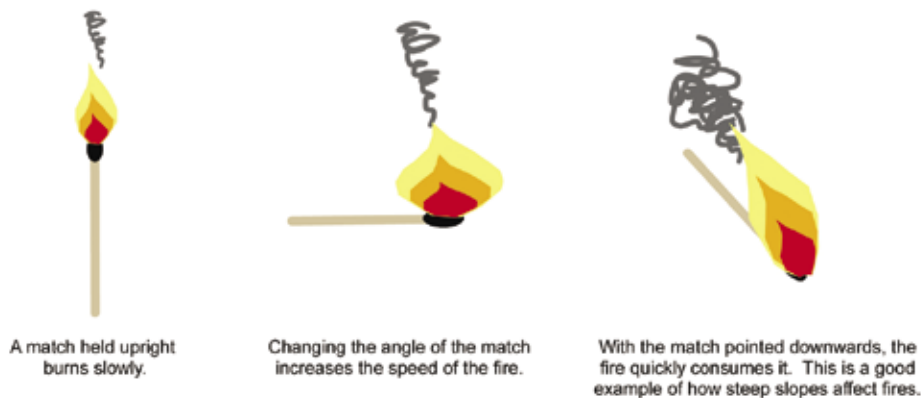


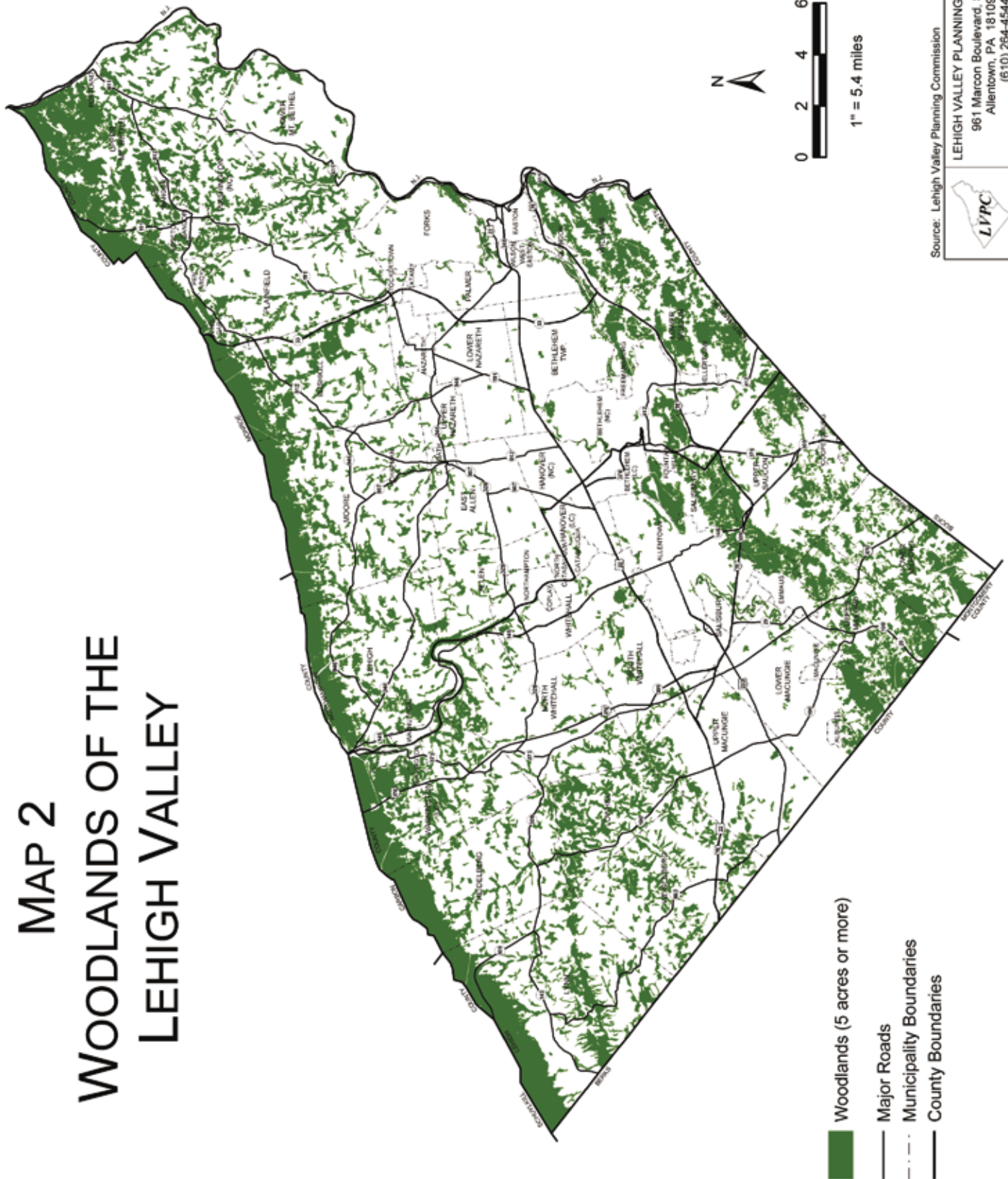
FIGURE 11
HOW SLOPES FUEL FIRES

Regular matches can be used to get a better idea of how slope affects the speed of fire.



Three factors influence a fire: weather, topography and vegetation. Slopes that face south, southwest and west tend to be warmer and drier because they receive more sun. Fires on these slopes will burn more readily than fires on north-facing slopes. Fire will burn up a steep slope more rapidly than on level ground because the fire and heat move up more quickly and dry out the vegetation. Figure 11 is a simple example of how changing the slope affects the speed of fire.

MAP 2 WOODLANDS OF THE LEHIGH VALLEY



Development on wooded steep slopes increases the number of structures that could be impacted by fire. Fire has an effect on development, yet development can also influence fire. Houses are usually sited on lots that are secluded or have a view. These lots can be far from public roads, or accessed by a steeply sloped, narrow driveway. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.

Fighting a fire on steep slopes is a challenge. It is difficult, slow and dangerous to fight fire on steep slopes. The combined effects of terrain and wind often create thick smoke. Steeply sloped roads and driveways can make access and response time slow and difficult for firefighters and for heavy fire trucks and other equipment.

A NOTE ABOUT THE MODEL REGULATIONS

The model regulations are designed as a section in a zoning ordinance. Applicants or developers proposing development on steep slopes would be required to obtain a conditional use permit. We chose the conditional use permit process because it allows the governing body, and not the zoning hearing board, the opportunity to thoroughly examine the proposal and to impose any reasonable safeguards necessary to implement the purposes of the ordinance and to protect the public's general welfare.

The model regulation is constructed as an overlay district. The overlay zoning technique is a modification of the system of conventionally mapped zoning districts. An overlay zone applies a common set of standards to a designated area that may cut across several underlying zoning districts. The standards of the overlay zone apply in addition to those of the underlying zoning district.

Municipalities can adopt laws separate from their zoning ordinance or as sections in the ordinance, instead of overlays, to protect specific environmental features. Although the model regulation is constructed as an overlay district to be inserted in an existing zoning ordinance, with a few revisions, it could be adopted as a stand-alone ordinance or chapter in the zoning ordinance.

MODEL REGULATIONS STEEP SLOPE OVERLAY DISTRICT

ARTICLE ____

SECTION 100. PURPOSES

The purpose of this Article is to provide for the reasonable use of steep slopes while ensuring development will not induce soil erosion, require excessive grading, increase slope instability, or create sewage disposal problems and shall be in conformance with the following objectives:

- A. Guard against property damage and personal injury, and minimize the potential for erosion, slope failure, stream siltation, increased runoff, flooding and contamination of surface waters caused by the adverse effects of site preparation and construction on steep slopes.
- B. Conserve existing woodlands for air and water quality benefits.
- C. Permit land uses by right that are compatible with protection of steep slope areas, and encourage the use of steep slope areas for open space and conservation uses.
- D. Require development to avoid steep slope areas wherever possible, and require all land use, clearing, grading, and construction to satisfy development standards.
- E. Regulate expansion of land use or development that existed on steep slope areas prior to enactment of these requirements.
- F. Protect adjoining properties from harmful consequences of development permitted under these requirements.

SECTION 200. IDENTIFICATION AND ESTABLISHMENT OF THE STEEP SLOPE OVERLAY DISTRICT

- A. The Steep Slope Overlay District is defined and established as those areas having slopes of 15% or greater as delineated on a map(s) prepared for (Municipality).
- B. The boundaries shown on the Steep Slope Overlay District Map may be supplemented or modified by examination of one or more of the following sources by (Municipality) whenever a subdivision or land development plan is submitted for review:
 - 1. Soil Survey of Lehigh/Northampton counties, Pennsylvania, USDA Soil Conservation Service.
 - 2. Contour maps prepared from aerial photography.
 - 3. On-site survey prepared by a Registered Professional Engineer or Surveyor.
- C. The Steep Slope Overlay District shall be further divided into the following two categories:¹
 - 1. Slopes of 15% but less than 25%. Slopes of fifteen (15) percent or greater slope (e.g., sloping fifteen (15) feet or more vertical per one hundred (100) feet horizontal) when there are five (5) adjacent contour intervals² of two (2) feet each such that, in aggregate, they delineate a slope of at least fifteen (15) percent.
 - 2. Slopes of 25% or more. Slopes of twenty-five (25) percent or greater slope (e.g., sloping twenty-five (25) feet or more vertical per one hundred (100) feet horizontal) when there are five (5) adjacent contour intervals of two (2) feet each such that, in aggregate, they delineate a slope of at least twenty-five (25) percent.
- D. The (Municipality) Engineer shall decide whether or not the Steep Slope Overlay District has been shown with sufficient accuracy on the applicant's plans. Based on the Municipal Engineer's advice, (Municipality) may require applicants to revise the boundaries shown on the plans.
- E. The burden of proving the correct boundary shall be on the applicant, supported by engineering and/or surveying data or mapping, testimony of a soil scientist, or other acceptable evidence.

SECTION 300. GENERAL PROVISIONS

- A. The Steep Slope Overlay District shall be an overlay on all zoning districts. For any lot or portion thereof lying within the Steep Slope Overlay District, the regulations of the overlay district shall take precedence over the regulations of the underlying district.

¹ The model regulations use the classifications as specified in the *Comprehensive Plan The Lehigh Valley ... 2030*.

² A contour interval is the change in elevation represented by the space between two adjacent topographic "rings" on a topographic map. For example, if there is a contour interval of 20 feet, each topographic line on the map represents going either up or down by 20 feet of elevation. Most maps include numbers every four or five lines to tell you what elevation is represented by that line.

- B. These regulations apply to lots where the proposed land disturbing activity is greater than 5,000 square feet³.
- C. All uses, activities and development occurring within any Steep Slope Overlay District shall be undertaken only in strict compliance with the provisions of this Article, with all federal and state laws, and with all other applicable (Municipality) codes and ordinances.
- D. No building lot shall be created unless it contains at least one (1) acre of area with slopes less than 25%.⁴ If it is infeasible to provide this area in accordance with the setbacks required by the underlying district, the lot area shall be increased as necessary to provide a minimum area equal to one (1) acre of area with slopes less than 25%.
- E. Finished slopes of all cuts and fills shall not exceed thirty three (33) percent, unless the applicant can demonstrate that steeper slopes can be stabilized and maintained adequately to the satisfaction of (Municipality).
- F. All cuts shall be supported by retaining walls or other appropriate retaining structures when, depending upon the nature of the soil characteristics, such structures are approved by the Municipal Engineer in order to prevent erosion.
- G. Any fill placed on the lot shall be properly stabilized and, when found necessary depending upon existing slopes and soil types, supported by retaining walls or other appropriate structures as approved by the Municipal Engineer.
- H. No retaining wall shall exceed the height prescribed in Section __ (Section of Municipal Ordinance regulating fences and walls) of the Zoning Ordinance, and there shall be at least 10 feet between stepped retaining walls. All retaining walls require a certification by a professional engineer that the wall was constructed in accordance with approved plans and applicable building codes.
- I. Any disturbance of steep slopes shall be completed within one construction season, and disturbed areas shall not be left bare and exposed during the winter and spring thaw periods. Permanent vegetative cover shall be planted within three days after completion of grading.
- J. No trees with a diameter at breast height (DBH) of eight (8) inches or more shall be removed from steep slope areas unless in accord with Section __ (Section of municipal zoning ordinance regulating forestry).⁵
- K. The alignment of roads and driveways shall follow the natural topography, minimize regrading and comply with design standards for maximum grades set forth in (Municipality) Subdivision and Land Development Ordinance.

³ The square footage of a land disturbing activity is variable. If the square footage is smaller, the regulations apply to more projects, and vice versa. We chose 5,000 square feet because State law requires that an E&S Plan, which meets the requirements of Chapter 102 (Erosion and Sediment Control Regulations), be properly designed, implemented and available on site for all earth disturbance activities that disturb 5,000 square feet or more.

⁴ This regulation aims to prevent the creation of lots that likely would require a request for relief from the steep slope regulations.

⁵ The model regulations use the DBH as specified in the Lehigh/Northampton County Subdivision and Land Development Ordinance. Section 603(f) of the Municipalities Planning Code (MPC) permits forestry activities as a right in all zoning districts in every municipality.

- L. The maximum grade of a road or driveway shall not exceed ten percent (10%).⁶
- M. The degree of steep slope protection sought by the provisions of this Article is considered reasonable for regulatory purposes. This Article does not imply that areas outside the Steep Slope Overlay District or permitted uses within the zoning district will be free from erosion or slope instability. This Article shall not create liability on the part of (Municipality) or any officer or employee thereof for any damages that result from reliance on this Article or any administrative decision lawfully made hereunder.

SECTION 400. PERMITTED USES AND DEVELOPMENT ON SLOPES OF 15% BUT LESS THAN 25%

- A. Open space and conservation uses are permitted by right on steep slopes, provided that they shall not include any structures, roads, driveways, parking areas, construction, or other development, or grading, or clearing of vegetation.
 - 1. Wildlife sanctuary, woodland preserve, arboretum, and passive park and recreation areas.
 - 2. Forestry and reforestation in accordance with recognized natural resource and soil conservation practices, and as permitted by municipal and state regulations.
 - 3. Pasture and grazing land in accordance with recognized natural resource and soil conservation practices.
 - 4. Outdoor plant nursery or orchard in accordance with recognized natural resource and soil conservation practices.
 - 5. Cultivation and harvesting of crops in accordance with recognized natural resource and soil conservation practices.
 - 6. Front, side, or rear yards, and required lot area for any underlying zoning district, subject to the requirements of Section 300 General Provisions, herein, and provided such yards shall not be used for any use prohibited under Section 500, herein.
 - 7. Non-structural accessory uses necessary to the operation and maintenance of the above permitted uses.

SECTION 500. PROHIBITED USES AND DEVELOPMENT ON SLOPES OF 15% BUT LESS THAN 25%

- A. The following uses are specifically prohibited on slopes of 15% but less than 25%:
 - 1. Removal of topsoil except when related to an approved conditional use.
 - 2. Solid waste disposal, recycling uses, junk yards, or other outdoor storage uses.

⁶ Appendix D of the International Fire Code limits driveway grades to 10%. This portion of the International Fire Code has not been adopted by Pennsylvania and cannot be enforced. However, since emergency access to steeply sloped lots is an important consideration, we recommend municipalities consider adopting the 10% maximum in any regulation of steep slopes.

SECTION 600. CONDITIONAL USES AND DEVELOPMENT ON SLOPES OF 15% BUT LESS THAN 25%

- A. The following uses and activities may be permitted by Conditional Use provided that they are in compliance with the provisions of the underlying district and are not prohibited by any other Ordinance:
1. Structures, roads, driveways, parking areas, construction or other development.
 2. Clearing of vegetation or grading, including the addition of fill.
 3. Sealed public water supply wells⁷ with approval of the Pennsylvania Department of Environmental Protection.
 4. Sanitary or storm sewers and stormwater detention basins with the approval of the (Municipality) Engineer and the Department of Environmental Protection.
 5. On-lot sewage disposal systems, when approved by the (Municipality) Sewage Enforcement Officer and/or the Pennsylvania Department of Environmental Protection.
 6. Utility transmission lines and above ground utility line structures unless upon petition of a public utility corporation, the Pennsylvania Public Utility Commission shall, after a public hearing, decide that the present or proposed situation of the lines or structures in question is reasonably necessary for the convenience or welfare of the public.⁸
 7. Extractive uses in accordance with recognized conservation practices and regulations of the state Department of Environmental Protection.
- B. Applications for conditional uses shall provide the following information and documentation:
1. A plan by a Registered Professional Engineer or Surveyor which accurately locates the proposed use with respect to the Steep Slope Overlay District boundaries, with all pertinent information describing the proposal, and a topographical survey with contour elevations at no greater than 2-foot intervals, where feasible.
 2. A plan of proposed development or use of the site, conforming to the preliminary plan requirements of the Subdivision and Land Development Ordinance, with contours shown at 2-foot intervals, where feasible, throughout the steep slope areas proposed for development or use. Contours shall be accurately drawn from on-site survey or aerial photographic sources.

⁷ A sealed well has design features that prevent contamination of groundwater.

⁸ Electric transmission line permitting has been exclusively a state function to date, and construction of transmission lines ordinarily requires a utility or private transmission developer to obtain a “certificate of public convenience and necessity” from each state or states in which the lines would be located. The Federal Energy Regulatory Commission (FERC) has no authority to approve transmission siting.

Section 619 of the MPC provides an exemption from municipal zoning regulation for “any existing or proposed building, or extension thereof” of a public utility (i.e., the limited extent to which municipal zoning regulation by law applies to the placement of public utility facilities), upon a finding and determination by the Public Utility Commission (PUC) “that the present or proposed situation of the building in question is reasonably necessary for the convenience or welfare of the public.” A utility company must request that the PUC enter an order granting it an exemption from local zoning regulation.

3. Proposed modifications to the existing topography and vegetative cover, as well as the means of accommodating stormwater runoff.
4. Specifications for building construction and materials, including filling, grading, storage of materials, and water supply and sewerage facilities.
5. Documentation of any additional engineering and/or conservation techniques designed to alleviate environmental problems that may be created by the proposed activities, in compliance with municipal sedimentation and erosion control regulations.
6. Written confirmation from (specific name of local fire department) that emergency access is satisfactory to provide adequate fire protection.

SECTION 700. PERMITTED USES AND DEVELOPMENT ON SLOPES OF 25% OR MORE

- A. Open space and conservation uses are permitted by right on slopes of 25% or more, provided that they shall not include any structures, roads, driveways, parking areas, construction, or other development, or grading, or clearing of vegetation.
 1. Wildlife sanctuary, woodland preserve, arboretum, and passive park and recreation areas.
 2. Forestry and reforestation in accordance with recognized natural resource and soil conservation practices, and as permitted by municipal and state regulations.
 3. Pasture and grazing land in accordance with recognized natural resource and soil conservation practices.
 4. Outdoor plant nursery or orchard in accordance with recognized natural resource and soil conservation practices.
 5. Cultivation and harvesting of crops in accordance with recognized natural resource and soil conservation practices.
 6. Front, side, or rear yards, and required lot area for any underlying zoning district, subject to the requirements of Section 300 General Provisions, herein, and provided such yards shall not be used for any use prohibited under Section 800, herein.
 7. Non-structural accessory uses necessary to the operation and maintenance of the above permitted uses.

SECTION 800. PROHIBITED USES ON SLOPES OF 25% OR MORE

- A. The following uses are specifically prohibited on slopes of 25% or more:
 1. Removal of topsoil.
 2. Solid waste disposal, recycling uses, junk yards, or other outdoor storage uses.
 3. Structures, roads, driveways, parking areas, construction or other development.

4. Clearing of vegetation or grading, including the addition of fill.
5. Sealed public water supply wells.
6. Sanitary or storm sewers and stormwater detention basins.
7. On-lot sewage disposal systems.
8. Utility transmission lines and above ground utility line structures.
9. Extractive uses.

SECTION 900. CONDITIONAL USE STANDARDS AND CRITERIA

- A. In considering a conditional use application, the (Municipal Governing Body) shall consider the following:⁹
1. Relationship of the proposed use to the objectives set forth in Section 100.
 2. Adverse effects on abutting properties.
 3. The need for a woodland management plan on wooded steep slope areas.
 4. Proposed roads, driveways and parking areas are designed so that land clearing and/or grading will not cause accelerated erosion. Both vertical and horizontal alignment for such facilities shall be so designed that hazardous conditions are not created.
 5. Alternative placements on non-steep slope areas were carefully evaluated for structures, including buildings, retaining walls, swimming pools, roads, access driveways, parking facilities and other development, and can be shown to be inappropriate or infeasible to the satisfaction of (Municipality).
 6. Proposed on-lot sewage disposal facilities are properly designed and constructed in conformity with applicable regulations.
 7. Proposed non-agricultural displacement of soil is for purposes consistent with the intent of this Article and will be executed in a manner that will not cause erosion or other unstable conditions. The applicant shall provide an erosion and sediment control plan and supporting evidence.
 8. Surface runoff of water will not create unstable conditions, including erosion, and appropriate storm-water management facilities will be constructed as necessary.

SECTION 1000. DEFINITIONS

Diameter at Breast Height (DBH). The diameter of a tree trunk measured at a point four (4) feet above ground level.

⁹ A conditional use is a discretionary use specifically provided for in a given district in a zoning ordinance. Conditional uses are to be approved upon demonstration that the specific standards contained in the ordinance pertaining to the use have been met. Conditional uses are acted upon by the elected officials of a municipality after a public hearing has been held.

Disturbance. Any physical activity which results in the modification of topography by cutting or filling, striping of topsoil, and/or placing of physical structures or improvements thereon.

Drip Line. An imaginary circular line on the soil around a tree that mirrors the circumference of the tree's canopy. The tree's roots usually extend well beyond this line.

Fill. Any clean soil or rock materials (sand or clay) used to raise the ground elevation.

Forestry. The management of forests and timberlands when practiced in accordance with accepted silvicultural principles, through developing, cultivating, harvesting, transporting and selling trees for commercial purposes, which does not involve any land development.

Land disturbing activity. Any change of the land surface including removing vegetative cover, excavating, filling, grading, and the construction of any structure. An agricultural activity such as the planting, growing, cultivating and harvesting of crops is exempt from this definition.

Open space. An area of land or water, or a combination of land and water on a parcel of land that is free of improvement and impervious surfaces.

Slopes of 15% but less than 25%. Slopes of fifteen (15) percent but less than 25% (e.g., sloping fifteen (15) feet or more vertical per one hundred (100) feet horizontal) when there are five (5) adjacent contour intervals of two (2) feet each such that, in aggregate, they delineate a slope of at least fifteen (15) percent but less than 25%.

Slopes of 25% or more. Slopes of twenty-five (25) percent or greater slope (e.g., sloping twenty-five (25) feet or more vertical per one hundred (100) feet horizontal) when there are five (5) adjacent contour intervals of two (2) feet each such that, in aggregate, they delineate a slope of at least twenty-five (25) percent.

Woodland. A plant community where tree species are dominant or co-dominant and the branches of the trees form a complete or nearly complete aerial canopy. Any area, grove or stand of mature or largely mature trees (larger than six inches DBH) covering an area of one-quarter acre or more, or consisting of ten (10) individual trees larger than eight (8) inches DBH, shall be considered a woodland. The extent of any woodland shall be measured from the outer-most drip line of all the trees in the community.

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