

Steep Slope and Ridgeline Protection

Use this tool with: habitat protection, erosion and sedimentation controls

I. Background and Purpose

There are a number of issues associated with development on steep slopes, hillsides, and ridgelines. Foremost among them are health, safety, and environmental considerations that arise when planning development in steep areas. Another factor is the aesthetic quality of hillsides and ridgelines that can be lost when they are developed. New Hampshire residents and visitors place great value on the state's natural resources. Protecting hillsides and steep slopes from development helps to preserve those unique environmental qualities that people value. Furthermore, development on steep slopes can have an adverse effect on water quality as a result of increased erosion and sedimentation.

This chapter provides information on regulating both steep slopes and ridgelines. While the two subjects are closely related, the regulations for each usually have different emphasis: steep slope regulations are frequently based on environmental considerations such as erosion and sedimentation controls, while ridgeline regulations have more emphasis on view protection. The model ordinance in this chapter contains a section that deals with steep slopes and one that deals with ridgelines.

II. Appropriate Circumstances and Context for Use

Since the beginning of steep slope regulation in the 1950s, there have been a variety of ways to approach the subject. In 1975, the authors of a report called *Performance Standards for Sensitive Lands* reviewed a total of 35 hillside and grading regulations, and found that the regulations could be classified in the following three categories (Thurow et al):

Slope/Density Provisions. These reduce allowable densities on hillsides: the steeper the slope, the less the allowed density.

Soil Overlays. These provisions key development regulations to soil type, based on maps by the Natural Resource Conservation Service.

The Guiding Principles Approach. This approach creates hillside overlay districts to cover all hillside lands in a jurisdiction. A set of guiding principles is applied to all proposed development in these areas. These regulations are usually flexible, allowing for tailoring of development to the characteristics of each site and encouraging innovative approaches to attain the desired end.

These approaches have all become popular because they reduce the negative impacts of hillside development. These impacts include excessive cuts and fills, unattractive slope scars, and erosion and drainage problems. A logical method for addressing these problems is to reduce the intensity of development as the grade of the slope increases. The implication of

linking density limitations with steep slopes is that steeply sloped hillsides are inherently unsuited for development for reasons of public safety, erosion, aesthetics, or general environmental protection. Because this type of regulation does allow for some hillside development, property owners can retain some use of their land. Pairing slope/density regulations with grading regulations helps to ensure that those sites that are developed are done so as safely as possible.

In most cases, large-scale commercial development is discouraged in areas with steep slopes because of the difficulties associated with trying to provide level building and parking areas as well as safe access to the site. Drainage and stormwater runoff can also cause problems. Some commercial activity may be permitted in the steep slope district as long as it would not cause excessive erosion.

When developing regulations to govern development on steep slopes, hillsides, and ridgelines, it is important to collect as much data as possible to form the basis of the ordinance. In a 1996 publication, Robert Olshansky, an expert on hillside development outlined ten topics that should be considered prior to implementing a regulation. These ten topics, which are outlined below, can be used as a framework to build a solid justification for regulating steep slopes, hillsides, and ridgelines.

1. Topography

Before the location and extent of steep slopes in a community can be determined, it is essential that the definition of a steep slope be determined. Many communities define steep slopes as having a grade of 15% or greater, meaning that the elevation increases by 15 feet over a horizontal distance of 100 feet.

2. Slope Stability

When considering slope stability, it is important to consider not only how stable the slope is prior to development, but also what effect the grading necessary for development would have on slope stability. On steep slopes, any change in the equilibrium, whether it is caused by natural phenomena such as heavy rains or earthquakes or human activities, can cause erosion or landslides. Development on very steep slopes disturbs far more than the building footprint: on a 30% slope, 250 feet would have to be graded in order to create a 100-foot wide pad for construction, assuming a maximum 2:1 (50%) steepness of cut and fill as specified in the Uniform Building Code.

3. Drainage and Erosion

Collecting data on drainage and erosion entails identifying major watersheds and drainage courses as well as areas that are prone to flooding. In addition, key facilities and structures downstream of hillside drainageways should be identified. Knowing where the water is likely to drain and what impacts changing existing patterns will have on the entire drainage system can help to prevent damage to buildings and loss of life in the event of a landslide. In

addition, changing drainage patterns and increased sedimentation due to erosion can compromise water quality. All highly erodible soils should be identified.

4. Infrastructure

Extending infrastructure to hilltop communities can be very difficult to engineer and construct, especially for water and sewer systems. Individual septic systems are especially difficult to construct and maintain on steep slopes, both because of the slopes and because the soils tend to be shallow and poorly drained. This makes septic systems on steep slopes prone to higher failure rates, which puts ground and surface water supplies at risk. Failed septic systems often pose a health threat to everyone who relies on water resources in close proximity to a failed system. In New Hampshire, no septic system may be placed on a slope greater than 33%; however, individual municipalities may implement stricter regulations, or develop inspection/maintenance programs. Roads, power lines, and telephone wires are also difficult and expensive to extend up steep slopes, and to maintain after construction.

5. Access

Providing access roads and driveways to development on steep slopes can be especially challenging. The New Hampshire Department of Transportation recommends that driveways for commercial activities do not exceed an 8% grade, and that driveways to residences not exceed 15%. Towns may set a lower threshold if they choose. In order to be safe, roads and driveways on steep areas tend to be longer and have more curves and switchbacks than roads and driveways on flatter terrain. This means that there are more impacts on the hillside, such as increased erosion and runoff, a higher potential for accidents, and difficulty for emergency vehicles to access the development.

6. Aesthetics

In many of the steep slope ordinances reviewed during the preparation of this chapter, preserving a view was cited as one of the purposes for enacting the ordinance. Although this chapter treats steep slope and ridgeline/viewshed regulation separately, there is a good deal of overlap. When citing aesthetic reasons for implementing an ordinance, it is important to carefully document the rationale. This includes evaluating the extent and quality of views to the hills. In addition, it is important to identify any peaks or hillsides of special symbolic value to the community, to survey community values regarding appearance of hillsides and ridgelines, and to prepare maps of significant aesthetic resources. Taking photographs of the most important resources is another valuable tool that can be used, especially to convince the community that the ordinance is needed

One method for cataloging visual resources is to use the Visual Resource Management strategy developed by the United States Bureau of Land

Management (BLM) for use on public lands (BLM Manual H-8410-1). This system analyzes the quality of the view, the sensitivity of the resource, and the impacts that development would have at different distances. This comprehensive approach allows resources to be ranked in the context of their surroundings. Individual communities may not want or need to go into the amount of detail described in the BLM manual. However, the process outlined in the manual does provide a good framework that communities can use to build their own natural resource inventories.

7. Natural Qualities

Documenting natural qualities or resources includes identifying and mapping vegetation communities and wildlife habitats, and identifying threats to these resources. Special attention should be paid to rare and endangered plant and animal species. Because of the difficulties associated with steep slope development, hillsides tend to be developed after development has occurred on flatter areas. Wildlife species often take refuge on undeveloped hillsides, even if it is not their native habitat, because their preferred habitats have been overtaken by development.

8. Fire Hazard

Fire can break out in many parts of New Hampshire, especially in the White Mountain National Forest. Since it is more difficult to control fires on hillsides than on flat areas, it is important to evaluate the frequency and causes of hillside wildfires, identify fuel reduction methods, and identify architectural and landscaping factors in fire safety. Attention must be paid to response times and access requirements for fire departments, as well as the evaluation of the tradeoffs between natural habitat preservation and fire hazards.

9. Recreational Values

Hills and mountains provide many popular and important recreational opportunities, including hiking, hunting, climbing, wildlife observation, and skiing. When developing ordinances, consideration of areawide needs and opportunities for wildland recreation as well as identification of possible trail and viewpoint locations are important factors. Locating possible access points to existing and potential recreational opportunities is also important.

10. Open Space

Providing open spaces can be a key component of hillside/steep slope regulations. Possible mechanisms for open space management include creating greenways, wildlife habitat preservation areas, and conservation areas.

III. Legal Basis and Considerations for New Hampshire

In New Hampshire, regulating development on steep slopes is authorized under RSA 674:16, the zoning Grant of Power, RSA 674:21, Innovative Land Use Controls, and 674:21, I (j), Environmental Characteristics Zoning. Although steep slopes and ridgelines are not

specifically named in the RSA, they are generally considered to be environmental characteristics and are frequently found as overlay districts similar to wetland protection. According to the New Hampshire Office of Energy and Planning, there were 27 municipalities in the state that had steep slopes regulations as of January 2006. In addition to regulating steep slopes and ridgelines through zoning, some communities include site-specific standards in their subdivision and site plan regulations.

Master Plan

Communities interested in regulating development on steep slopes, hillsides, and ridgelines should address the subject in the natural resource or land use chapters of their master plans. In developing the plan, it will be helpful to study maps of various slope categories. Using the ten-point framework outlined in Section II, a strong case can be built for protecting steep slopes. If viewshed protection is a high priority, then communities should survey their resources using either the Visual Resource Management strategy developed by the United States Bureau of Land Management, or another, similar tool.

IV. Examples and Outcome of where Technique has been Applied

In the United States, the earliest known example of steep slope regulations was in Los Angeles, California in the early 1950s, when grading regulations were first implemented. These regulations were designed to protect lives and property from unengineered development of hillsides (Olshansky 1995). This type of ordinance has been very successful at addressing engineering problems on hillside developments.

In December 2005, the Lakes Region Planning Commission published *Regulating Development on Steep Slopes, Hillsides, and Ridgelines*, a comprehensive look at the history and rationale behind steep slope regulation, along with several case studies from the state of New Hampshire as well as a few examples from other states. Excerpts from some of the case studies are included below.

Lyme, New Hampshire

The Lyme zoning ordinance has both a Steep Slopes Conservation District and a Ridgeline and Hillside Conservation District. The Steep Slopes Conservation District is defined as all areas where there is an elevation change of 20 feet or greater and the average slope is 20% or greater. The Ridgeline and Hillside Conservation is defined as those ridgeline and hillside areas which are visible from public waters or public roads located within the Town at a distance on the USGS topographic map of 1/2 or more miles (measured in a straight line distance from the proposed area of development).

According to the town planner, the Steep Slopes Conservation District works smoothly for the most part. There are occasional difficulties associated with determining where the district should be applied, which are solved with a site visit. The town has faced some challenges in defining exactly what land falls in the Ridgeline and Hillside Conservation District. The town is working on a map that will show where the district falls.

Sanbornton, New Hampshire

The minimum lot size in the steep slopes conservation district is six acres. However, the planning board can waive that requirement if at least 50% of the lot has a slope of less than 15% and there is at least one contiguous area of 40,000 square feet that has a slope of 15% or less. According to the town planner, this regulation has been in place for several years, and people who plan to subdivide land in the steep slope conservation district are accustomed to the regulations and therefore bring the proposed subdivision plans with lots drawn in accordance with the ordinance.

North Carolina Mountain Ridge Protection Act

Steep slope and hillside regulations are mostly found at the local level as part of either the zoning ordinance or subdivision regulations. One exception to this trend is the North Carolina Mountain Ridge Protection Act of 1983 (NC G.S. 113A-205-214). This state law restricts development on mountain ridges that have elevations of 3,000 feet and higher. As the basis for enacting the law, the North Carolina State Legislature found that:

The construction of tall or major buildings and structures on the ridges and higher elevations of North Carolina's mountains in an inappropriate or badly designed manner can cause unusual problems and hazards to the residents of and to visitors to the mountains. Supplying water to, and disposing of the sewage from, buildings at high elevations with significant numbers of residents may infringe on the ground water rights and endanger the health of those persons living at lower elevations. Providing fire protection may be difficult given the lack of water supply and pressure and the possibility that fire will be fanned by high winds. Extremes of weather can endanger buildings, structures, vehicles, and persons. Tall or major buildings and structures located on ridges are a hazard to air navigation and persons on the ground and detract from the natural beauty of the mountains.

According to a report from the Land-of-Sky Regional Council in North Carolina, this law has been mostly effective in controlling development on mountain ridges. However, many mountain communities in the state are currently searching for ways to protect land at lower elevations from development as well (Houck 2005).

V. Model Language, Illustrations, and Guidance for Implementation

This model ordinance contains two sections: Steep Slopes Protection and a Visual Resource Protection District. Steep Slopes Conservation should be adopted as a component of the zoning ordinance that applies in all districts. The Visual Resource Protection District is an overlay district where the boundaries are determined through a visual resource inventory process.

Statutory Authorization

A. RSA Title LXIV, Chapters 674:16, Grant of Power

- B. 674:21, Innovative Land Use Controls
- C. 674:21 (j), Environmental Characteristics Zoning
- D. 673:16, II; 676:4, I(g); and 674:44,V collectively authorize Planning Boards to collect fees from applicants to cover the costs of hiring outside experts to review subdivision applications and site plans.

A. Steep Slopes

Title: Steep Slopes Protection

Section 1: Purpose

The purpose of this ordinance is to reduce damage to streams and lakes from the consequences of excessive and improper construction, erosion, stormwater runoff, or effluent from improperly sited sewage disposal systems, and to preserve the natural topography, drainage patterns, vegetative cover, scenic views, wildlife habitats, and to protect unique natural areas.

Section 2: Delineation

This ordinance shall apply to all areas with a slope greater than 15%, as shown on the town's steep slopes map, and where the proposed site disturbance is greater than one acre.

Section 3: Definitions

- Erosion: The wearing away of the ground surface as a result of the movement of wind, water, ice, and/or land disturbance activities.
- Sedimentation: The process by which sediment resulting from accelerated erosion has been or is being transported off the site of the land-disturbing activity or into a lake or natural watercourse or wetland.
- Site Disturbance: Any activity which removes the vegetative cover from the land surface.
- Slope: The degree of deviation of a surface from the horizontal, usually expressed in percent or degrees; rise over run.
- Vegetative cover: Grasses, shrubs, trees, and other vegetation which hold and stabilize soils.

Section 4: Application Requirements

- A. Uses that will cause more than one acre of site disturbance must show the area subject to site disturbance in 2-foot contours.
- B. An engineering plan will be prepared by a Professional Engineer that shows specific methods that will be used to control soil erosion and sedimentation, soil loss, and excessive stormwater runoff, both during and after construction.

- C. A hydrology, drainage, and flooding analysis will be included that shows the effect of the proposed development on water bodies and/or wetlands in the vicinity of the project.
- D. A grading plan for the construction site and all access routes will be prepared.

Section 5: Performance Standards

All uses permitted in the underlying district will be a conditional use in the Steep Slope Conservation District and must meet the following conditions for approval:

- A. The grading cut and fill should not exceed a 2:1 ratio.
- B. Existing natural and topographic features, including the vegetative cover, will be preserved to the greatest extent possible. In the event that extensive amounts of vegetation are removed, the site shall be replanted with indigenous vegetation and shall replicate the original vegetation as much as possible.
- C. No section of any driveway may exceed a 10% slope for residential subdivisions or 8% slope for nonresidential site plans.
- D. No structure shall be built on an extremely steep slope (greater than 25% prior to site disturbance).

Section 6: Administration of conditional use permits

In addition to meeting the conditions set forth in this section, Conditional Use Permits shall be granted in accordance with the following pertinent procedures:

- A. A Conditional Use Permit shall be granted by the Planning Board upon a finding that the proposed use is consistent with the intent of the Ordinance and following receipt of a review and recommendation of the Conservation Commission and any other professional expertise deemed necessary by the Board.
- B. The applicant must demonstrate that no alternatives are available for the productive use of areas outside of the steep slopes district, that no practicable alternatives exist to the proposal under consideration, and that all measures have been taken to minimize the impact that construction activities will have upon the District.

Section 7: Costs

All costs pertaining to the consideration of an application, including consultants fees, on-site inspections, environmental impact studies, notification of interested persons, and other costs shall be borne by the applicant and paid prior to the Planning Board's final action.

B. Ridgelines/Hillsides/Viewshed Protection

Title: Visual Resource Protection District

Section 1: Purpose

The purpose of the Visual Resource Protection district is to protect the scenic and ecological resources associated with lands characterized by high elevations, steep slopes, and visual sensitivity in a manner that allows for carefully designed, low-impact development.

Section 2: Delineation:

The Visual Resource Protection District is an overlay district that will be defined by a visual resource inventory dated _____. The results of the visual resource strategy will be shown on the Visual Resource Map, which is hereby incorporated into this ordinance.

NOTE: Each community will have unique visual resources. It is the responsibility of the community implementing this ordinance to complete and document a comprehensive visual resource inventory. A manual detailing the Bureau of Land Management’s Visual Resource Management Strategy is available online: <http://www.blm.gov/nstc/VRM/8410.html#Anchor-49575>

Section 3: Definitions

Design Guidelines: A set of guidelines defining parameters to be followed in a site or building design or development.

Site Disturbance: Any activity which removes the vegetative cover from the land surface.

Visual Impact: A modification or change that could be incompatible with the scale, form, texture or color of the existing natural or man-made landscapes.

Visual Resource Map: The map depicting the visually sensitive areas, as determined by the visual resource inventory.

Visual Resource Inventory: A system for minimizing the visual impacts of surface-disturbing activities and maintaining scenic values. The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones.

Section 4: Application Requirements

- A. Uses that will cause more than one acre of site disturbance must show the buildable area in 2-foot contours.
- B. An engineering plan will be prepared by a Professional Engineer that shows specific methods that will be used to control soil erosion and sedimentation, soil loss, and excessive stormwater runoff, both during and after construction.
- C. A hydrology, drainage, and flooding analysis will be included that shows the effect of the proposed development on water bodies and/or wetlands in the vicinity of the project.

- D. A grading plan for the construction site and all access routes will be prepared.
- E. Architectural plans and renderings clearly depicting all proposed structures to scale and their location on the site in relation to the physical and natural features of the parcel, including the proposed grade of the building area and finished floor elevations. Drawings should clearly display building elevation and architectural design, including building materials, exterior colors and window fenestration. All structures proposed, including outbuildings and garages are to be shown.
- F. A landscaping plan showing existing vegetation and proposed landscaping and clearing plans showing proposed type, size, and location of all vegetation to be preserved and/or installed, along with other landscaping elements such as gazebos, berms, fences, walls, etc. Special attention should be given to existing/proposed vegetation adjacent to buildings for visibility and screening purposes. A species list of existing vegetation and a plan for maintenance of the existing and proposed landscape should be included. Such a plan shall address specific measures to be taken to ensure the protection and survival, and if necessary, replacement of designated trees during and after the construction and/or installation of site improvements.

Section 5: Administration of Conditional Use Permits

Conditional Use Permits shall include the findings of an architectural review in accordance with the following pertinent procedures:

- A. A Conditional Use Permit shall be granted by the Planning Board upon a finding that the proposed use is consistent with the intent of the Ordinance and following receipt of a review and recommendation of the Conservation Commission and any other professional expertise deemed necessary by the Board, such as a licensed architect.
- B. The applicant must demonstrate that no alternatives are available for the productive use of areas outside of the District, that no practicable alternatives exist to the proposal under consideration, and that all measures have been taken to minimize the impact that construction activities will have upon the District.

Section 6: Design Guidelines

In order to reduce the visual impact of development in the Visual Resource Protection District, all proposed structures shall meet the following design guidelines:

- A. Building Envelope: The building envelope permitted in this district is a rectangle with an up-slope boundary 40 feet or less from the building, side boundaries 40 feet or less from each side of the building, and a down-slope boundary 25 feet or less from the building. Accessory structures shall be built within the building envelope. Building envelopes shall be at least 30 feet from property lines.

Graphic: Building Envelop

- B. Clearing for views: In order to develop a view, trees may be removed beyond the building envelope for a width of clear cutting not to exceed 25 feet and extending outward therefrom at an angle of 45 degrees or less on both sides. The 25 foot opening may be at any point along the down-slope boundary.

Graphic: Clearing for Views

- C. Natural/neutral colors will be used.
- D. Reflective glass will be minimized.
- E. Only low level, indirect lighting shall be used. Spot lights and floodlights are prohibited.
- F. No portion of any structure shall extend above the elevation of the ridgeline.
- G. Structures shall use natural landforms and existing vegetation to screen them from view from public roads and waterways to the extent practicable.
- H. Cuts and fills are minimized, and where practical, driveways are screened from public view.
- I. Building sites and roadways shall be located to preserve trees and tree stands.

Section 7: Costs

All costs pertaining to the consideration of an application, including consultants fees, on-site inspections, environmental impact studies, notification of interested persons, and other costs shall be borne by the applicant and paid prior to the Planning Board's final action.

VI. References

Bureau of Land Management. Manual H-8410-1 - Visual Resource Inventory. Washington, DC: U.S. Department of the Interior, Bureau of Land Management

www.blm.gov/nstc/VRM/8410.html#Anchor-49575

This manual provides a process for inventorying and prioritizing important visual resources. This, or another methodology, should always be employed when a community is contemplating a visual resource protection district.

Lakes Region Planning Commission. *Regulating Development on Steep Slopes, Hillsides, and Ridgelines*. December 2005. www.lakesrpc.org/steep%20slopes%20final.pdf

The report explores the historical importance of steep slope regulation, outlines key development issues, and provides a variety of case studies designed to address safety, aesthetics, preservation of wildlife habitat, water quality protection and more.

Olshansky, Robert. "Planning for Hillside Development" in *Environment & Development*, American Planning Association, September/October 1995

A short article that introduces the themes found in the 1996 PAS report of the same name.

Olshansky, Robert. *Planning for Hillside Development: Planning Advisory Service Report No. 466*, American Planning Association, Chicago, 1996.

A comprehensive study, building on the themes published in the 1995 article that discusses in depth the history and challenges of regulating hillside and steep slope development. The PAS report also provides excerpts from several of the ordinances and regulations reviewed for the study.

Thurrow et al. *Performance Standards for Sensitive Lands*, Planning Advisory Service Nos. 307/308, American Planning Association, 1975

This report was one of the first comprehensive looks at steep slope regulations.

Zoning Ordinances Reviewed:

Links to all of the New Hampshire ordinances listed here are available online from the Steep Slope Protection section of the New Hampshire Office of Energy and Planning Reference Library, nh.gov/oep/resourcelibrary/referencelibrary/s/steepslopeprotection/index.htm

Town of Antrim, NH

Town of Bath, NH

Town of Dublin, NH

Town of Enfield, NH

Town of Frankestown, NH

Town of Hancock, NH

Town of Harrisville, NH

Town of Loudon, NH

Town of Lyme, NH

Town of New Ipswich, NH

Town of New London, NH
Town of Newbury, NH
Town of Northwood, NH
Town of Roxbury, NH
Town of Sanbornton, NH
Town of Sandwich, NH
Town of South Hampton, NH

Town of Stowe, Vt

www.townofstovevt.org/images/photos/stowe_regs_8-29-05.pdf

City of Park City, UT

www.parkcity.org/government/codesandpolicies/title_15_c_2_21.html

City of San Rafael, CA

ordlink.com/codes/sanraf/ DATA/TITLE14/Chapter_14_12_HILLSIDEDEVELOP.html

Town of Cortlandt, NY

law.wustl.edu/landuselaw/ssprotection.htm

Sonoma County, CA

municipalcodes.lexisnexis.com/codes/sonomaco (Article 26, Section 64)

Model Steep Slope Ordinance, Ten Towns Committee, New Jersey

www.tentowns.org/10t/ordsteep.htm

North Carolina Mountain Ridge Protection Act of July 1983

www.cals.ncsu.edu/wq/lpn/statutes/nc/mountainridgeprotection.htm