

Steep Slope Ordinance



Municipalities use zoning regulations to limit disturbance of steep slopes in order to prevent erosion, reduce the risk of dangerous landslides, and preserve scenic hillsides.

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Introduction

When disturbed, steep slopes are highly susceptible to erosion, landslides, and [subsidence](#), which—in addition to constraining development and resource extraction—can endanger the public, degrade water quality, and damage structures. Furthermore, extensive earthwork or removal of vegetation on steep slopes can transform scenic views into eyesores.

The [Pennsylvania Municipalities Planning Code](#) (MPC) specifically describes steep slopes and grades as natural features that qualify for protection through municipal regulation. Tools employed at the municipal level to regulate steep slopes include [zoning ordinances](#) and [subdivision and land development ordinances](#) (SALDO). This guide focuses on regulating steep slopes via a zoning ordinance, because this strategy generally is the most effective at ensuring that development respects the constraints and issues presented by these slopes. (Zoning regulations enable a municipality to limit land uses to those compatible with the slopes and are usually more difficult to circumvent than SALDO requirements.)

Many municipalities throughout Pennsylvania have some form of steep slope ordinance provisions. For example, within the five counties of southeastern Pennsylvania that are part of the Delaware Valley Regional Planning Commission, only a handful of municipalities—mostly boroughs—do not zone for steep slopes as of 2019.

Defining Steep Slopes

Simply stated, slope is measured as rise over run. A stretch of land 100 feet long that rises three feet in elevation has a slope of 3% (3/100). Topographic maps, such as those prepared by the U.S. Geological Survey, and field surveys prepared by applicants' surveyors during the subdivision and land development process, are the most common sources of slope information available to municipalities. [County soil surveys](#) produced by the U.S. Department of Agriculture also contain valuable topographic information. These surveys categorize soil types, in part, based on slope, with typical classifications occurring in the following ranges: 0–3%, 3–8%, 8–15%, 15–25%, and 25–50%.

Defining what constitutes “steep” for the purposes of slope regulation is at the discretion of each municipality, provided that the definition is reasonable. Some communities regulate slopes starting at 15%, which ties in neatly with soil survey slope classifications. Others start at 25%, another soil survey threshold and a clear benchmark for land-use limitations. Others establish more than one minimum slope threshold based on use (e.g., 25% for residential uses and 40% for non-residential uses). Some municipalities, particularly those in hilly locations, regulate development of specific steeply sloping soil types. For example, Ferguson Township in Centre County specifically regulates the use of colluvial soils—loose, unstable soils that gather in valleys and pose tremendous environmental and safety hazards if inappropriately used.

Municipalities in southeastern Pennsylvania with many steep slopes often use a two-tiered approach to slope regulation, with one set of restrictions tailored to

slopes between 15 and 25% (a “moderate” or “moderately steep” slope) and another more prohibitive set of restrictions for slopes 25% and greater (a “steep” or “prohibitively steep” slope). A municipal ordinance could be drafted to establish more than two tiers, for example, by also restricting slopes in the 8–15% range. Generally, because slopes of 15–25% pose significant limitations to development, 15% is recommended as a minimum starting point for regulation. County soil surveys provide excellent summaries of such limitations.

Mapping Steep Slopes

A mapping inventory of steep slopes may help a municipality define and locate its steep slopes (although this mapping is not required before adopting a steep slope ordinance). Today, through the use of geographic information system (GIS) technology, municipalities can easily obtain inventories through county, regional, or other government or nonprofit sources. Before a conducting GIS inventory, a municipality needs to decide how it will categorize and define steep slopes.

This slope mapping can be a valuable component of a municipality’s comprehensive plan or open space plan, or be displayed along with other natural and cultural resources on a map of primary and secondary conservation lands prepared consistent with the [Conservation by Design](#) tool. If made part of a municipal, regional, or county plan, slope mapping should be accompanied by policies favoring slope protection and a discussion of one or more recommended slope-protection implementation tools.

Zoning Strategies for Steep Slopes

Pennsylvania’s municipalities use various approaches to regulate the use or disturbance of steep slopes; some are more effective than others. Generally, municipalities that limit steep slope disturbance with quantitative thresholds and employ the conditional use process with rigor have the greatest success in protecting steep slopes. In contrast, municipalities that address steep slopes solely by increasing the base zoning district’s required minimum lot size as a site’s slope increases are not necessarily guarding against

steep-slope problems, since disturbance of steep slopes during land clearing or construction can still occur without additional municipal review and oversight.

This section describes a variety of regulatory approaches to steep slope protection through municipal zoning ordinances, and also includes a review of select zoning ordinances from across Pennsylvania to illustrate the approaches. See the [Sample Steep Slope Ordinances](#) section of ConservationTools.org these (and more) ordinances.

Include Steep Slopes on Zoning Map?

Steep slopes need not be delineated on a municipality’s zoning map in order to qualify for regulation. While slope mapping at the municipal scale is invaluable for general land-use planning purposes, the data used to do so is ineffective for evaluating the potential slope impacts of a proposed subdivision or land development. Consequently, most municipal SALDOs include the requirement for development applicants to delineate steep slopes on development plans using detailed topographic information.

Overlay Districts and Supplemental Regulations

Zoning Overlay Districts

A common approach in Pennsylvania is to regulate steep slopes through a zoning overlay district. Since steep slopes are often located throughout a municipality, the overlay approach enables their uniform regulation regardless of the municipality’s base zoning-district provisions. For example, the [overlay district](#) in Upper Salford Township comprises all areas of the township with slopes greater than 15%; four categories of slopes are differentially restricted, and a combination of disturbance (e.g., grading and vegetation removal), lot size, and design standards take precedence over the regulations of the underlying districts.

Supplemental Regulations

Some municipalities regulate steep slopes with supplemental regulations rather than using an overlay district. For example, a [separate article](#) of the Kennett Township zoning ordinance sets forth protection

standards for a variety of natural resources, including steep slopes. It classifies steep slopes in two tiers—“moderately steep” (15–25%) and “very steep” (25% and greater)—and limits the amount of disturbance within each slope tier (as well as to other natural resources including floodplains, wetlands, and woodlands). Where steep slopes are present, it requires development plans to include detailed information related to grading and erosion as well as sediment control. Other sections of the zoning ordinance require consideration of the same slope categories in determining, for example, minimum lot sizes and open space requirements.

Comparing the Two

In practice, overlay districts and supplemental regulations have the same effect: they both augment the standards of base zoning districts. The decision to use one instead of the other largely depends on a zoning ordinance’s existing framework. Some municipalities use elements of both, with the overlay district more often controlling for use and supplemental regulations often controlling for disturbance. For example, the [zoning ordinance](#) in Ferguson Township includes both supplemental regulations for steep slopes and an overlay district designed to limit disturbance of colluvial soils.

Use Restrictions and Performance Standards

Use restrictions limit the activities that may occur on steep slopes, while performance restrictions set forth the criteria and conditions under which steep slopes may be disturbed, regardless of use. Either can be incorporated into a zoning overlay district or supplemental regulations. Most municipalities employ elements of both (recommended).

Use Restrictions

The Lehigh Valley Planning Commission’s [model steep slope regulations](#) (discussed in detail in the following section) are primarily use-based in that each slope tier (15–25%, 25% and above) has a series of permitted, prohibited, and conditional uses (e.g., on-lot septic disposal systems are a conditional use on slopes of 15 to 25% and are prohibited on slopes greater than 25%). [Edgmont Township](#) limits uses in a similar way via use restrictions in a steep slope overlay district.

Performance Standards

In contrast, Lower Milford Township takes a more [performance-oriented approach](#) to steep slope regulation. Within its four-tiered steep slope area, disturbance (grading, clearing, construction, etc.) is limited to a percentage of the land area occupied by each tier. Use restrictions (in addition to those imposed by the underlying zoning district) only apply to prohibitive slopes. Like Kennett Township (above), Lower Milford Township contains these regulations in a separate article of its zoning ordinance.

Linking Lot Size to Slope

Some Pennsylvania municipalities link the required minimum lot size within a base zoning district to the percentage of slope measured over the parcel proposed for development. The minimum lot size requirement increases as average slope increases.

For example, the [Upper Dublin Township ordinance](#) includes the following provisions:

1. Every lot hereafter created by subdivision having an average slope of at least 10%, but not more than 15%, shall have the minimum lot area increased by a factor of 1.3 and shall not have impervious surfaces exceeding 30% of the lot area as increased.
2. Every lot hereafter created by subdivision having an average slope of at least 15%, but not more than 25%, shall have the minimum lot area increased by a factor of 1.5 and shall not have impervious surfaces exceeding 20% of the lot area as increased.
3. Every lot hereafter created by subdivision having an average slope of at least 25% shall have the minimum lot area increased by a factor of two and shall not have impervious surfaces exceeding 10% of the lot area as increased.
4. All freestanding structures, buildings and substantial improvements (with the exception of driveways and utilities when no other location is feasible) are prohibited on slopes of 35% or greater and are prohibited on slopes where the soil type is classified [by the county soil survey] as "stony land, steep."

This approach assumes that a larger minimum lot size will allow for developers to build on more unconstrained land within a lot without disturbing steep

slopes. However, without additional zoning or SALDO provisions that actually guide the placement of a proposed structure or limit steep slope disturbance, the increased-lot-size provision cannot guarantee protection of steep slopes.

Complementary Regulatory Options

A steep slope overlay district or set of supplemental regulations alone may not accomplish the desired resource-protection objectives or yield development patterns appropriate for steeply sloping landscapes. Use of conservation-minded development options and, in special cases, landscape-specific zoning districts can augment standard steep slope regulations by preventing the fragmentation of large steeply sloping areas and ensuring hillside development has a minimal visual impact.

Planned Unit Development and Conservation by Design

The development options prescribed in base zoning districts have a major impact on the number of steep slopes disturbed across a site. Development options such as planned unit development and [Conservation by Design](#) can avoid steep slope disturbance by requiring steep slope preservation and providing flexibility in lot size, building setback, and other zoning components. These design approaches preserve steep slopes by setting them aside in open space areas and through smaller lot dimensions, which allow homes to be clustered in more suitable locations. An increasing number of municipalities now include some version of conservation subdivision design in their zoning ordinances.

Minimum Net Lot and Tract Area Requirements

Minimum net lot and tract area requirements can ensure that a development site has an adequate area of land for building, excluding steep slopes and other sensitive environmental features. Use of this zoning technique reduces the pressure to disturb steep slopes in the first place—though it can also lead to a more dispersed development pattern.

[East Vincent Township](#) excludes steep slopes, floodplains, and jurisdictional wetlands from its definition of net tract area, which is used to establish the maximum number of dwelling units permitted on a tract of

land. Lower Milford Township, mentioned above, also requires all applicants for subdivision or land development approval to show building envelopes for all proposed lots that are free and clear of a property's physical constraints, including steep slopes.

Use of Complimentary Performance or Design Standards

Certain landforms such as ridges, valleys, and hillsides may merit special protection beyond that afforded by traditional slope regulations. Here are a few examples:

- Ferguson Township's [Ridge Overlay District](#) combines use and performance restrictions with rigorous on-site soil investigation requirements and very specific conditional-use criteria to maximize protection of the township's sensitive colluvial soils.
- Lycoming County's [county-wide zoning ordinance](#) includes environmental protection standards for ridges and requires the retention of a vegetated buffer 100 feet downslope when new homes are proposed on or near the tops of ridges. Where little downslope vegetation exists, homes must be set back from the steeply sloped sides of ridges and significant vegetative plantings must be established within this setback.
- Pittsburgh's scenic hillsides play a major role in defining its visual character. In addition to a traditional steep slope overlay district, Pittsburgh's [zoning ordinance](#) has both a Hillside District and a View Protection Overlay District. The Hillside District is a base zoning district with unique hillside-appropriate site-development standards. The View Protection Overlay District enables the planning commission to create supplemental design guidelines for view-protection districts, which may include hillsides.

Anatomy of a Steep Slope Ordinance: The LVPC Model

For municipalities that do not currently zone for steep slopes or have older slope regulations in need of updating, the Lehigh Valley Planning Commission's (LVPC) [Guide and Model Regulations for Steep Slopes](#) provides a good starting point. Key elements of the

guide and model are summarized here (some echo or elaborate on topics described in the previous section).

Purposes

Municipalities should clearly identify the purposes of their steep slope regulations, drawing closely from language from the MPC (see §606). The purposes recommended in LVPC’s model regulations cover several public benefits, including safety, protection of property and water resources, and land-use compatibility. Consider connecting purpose statements to comprehensive plan policies and to the zoning ordinance’s stated community-development objectives

Identification and Establishment

Zoning regulations for steep slopes should clearly identify the slopes subject to regulation in an overlay district or as a resource meriting supplemental regulation. LVPC’s recommended approach is to delineate steep slopes on a map incorporated by reference in the zoning ordinance, though supplemented with more detailed data whenever a subdivision or land development plan is submitted by an applicant for review and approval. In LVPC’s model, the steep slope overlay district is divided into two slope categories: 15–25% and 25% and greater. The municipal engineer determines the adequacy of steep slope mapping on subdivision and land development plans.

General Provisions

In a use-oriented steep slope overlay district, the general-provisions section states the performance criteria for steep slope disturbance, including standards that must be met for cuts, fills, retaining walls, tree removal, site stabilization, roads, and driveways. In LVPC’s model, a minimum one-acre building lot exclusive of slopes 25% and greater (the net-lot area approach mentioned in the section “Minimum Net Lot and Tract Area Requirements”) is also required in this section. If not addressed elsewhere in the zoning ordinance, the general provisions may need to state the threshold at which steep slope disturbance is regulated by the zoning ordinance. In the LVPC model, that threshold is 5,000 square feet of land disturbance to steep slopes.

Permitted, Prohibited, and Conditional Uses

The core of LVPC’s model regulations is the listing of permitted, prohibited, and conditional uses by slope category. If not outright prohibited, most development-related uses are conditional uses, meaning that a municipality’s governing body may impose reasonable conditions on an applicant’s proposed disturbance of steep slopes. The conditional-use process has the advantage of giving a municipality significant discretion over steep slope permitting, though this can require substantial board or council involvement in the public hearing and approval process. Such close involvement and discretion may indirectly act as a deterrent to slope development, or alternatively, may result in disastrously ineffective development restrictions.

On slopes between 15 and 25%, most non-disturbance related uses are permitted by right, as long as forestry, farming, and related uses are done in compliance with “recognized natural resource and soil conservation practices.” The only prohibited uses in this slope category are waste disposal, outdoor storage, and the removal of topsoil except when related to an approved conditional use. Conditional uses include grading, vegetation removal, and virtually all physical improvements, such as roads, buildings, and utilities.

The regulations on slopes greater than 25% replicate the regulations for slopes in the 15– 25% range with one significant exception: the conditional uses allowed in the 15–25% range (e.g., roads, buildings, and utilities) are prohibited.

Standards and Criteria

Standards and criteria for the review of conditional-use applications helps local decision-makers focus attention on the conditions appropriate for and likely to be required of applicants. LVPC’s model regulations set forth eight such standards and criteria, such as the possible need for a woodlot-management plan for wooded steep slope areas.

Definitions

Capitalized terms unique to steep slope restrictions are defined in this section, though many municipalities would simply add to or revise the existing

definitions section of their zoning ordinances. LVPC's list of definitions includes a fairly precise description of the basis on which steep slopes are measured: "five adjacent contour intervals of two feet each." In other words, areas identified on a topographic map where five or more contour intervals (lines) are tightly clustered (i.e., two or less scale-feet apart), are characterized as steeply sloped.

Topographic data of this detail would only be available following a site-level survey. Many of the municipalities mentioned in this guide require steep slopes to be delineated in this manner as part of the plan review process, which underscores the use of a municipality-wide steep slope map for general planning purposes only. If desired, municipalities may allow an applicant the use of publicly available topographic mapping for the purposes of depicting critical slopes during an optional sketch-plan submittal.

Keys to Successful Regulations

Adopt Effective Regulations

Successfully implementing zoning regulations to protect steep slopes starts with the adoption of clear and effective regulations. Review of the aforementioned approaches, examples, and model regulations by a task force comprised of elected and appointed officials, a municipal engineer, or a municipal planner is a valuable first step. (However, wholesale adoption of any particular model or example is not recommended, as each would require customization to mesh with a zoning ordinance's existing provisions, definitions, and general framework.) To draft effective steep slope regulations that comply with existing zoning laws, consult the municipality's attorney as well as professional planners, landscape architects, civil engineers, or geologists. Coordination with county planning staff (the MPC requires that county planning agencies be given the opportunity to comment on zoning ordinances before enactment) is also appropriate.

Technical and financial assistance may be available through county planning departments, state agencies such as the [Department of Community and Economic Development](#), or a [regional land trust](#).

Commit to Enforcement

Successful implementation also requires easily understood administrative procedures and a commitment to enforcement. The terms of the ordinance play a major role in setting the stage for both: Clear mapping requirements ensure that the full extent of steep slopes is presented on submitted plans, and hard-and-fast standards on land disturbance within particular steep slope categories guarantee a minimum portion of steep slopes will be left undisturbed (in most cases, deviating from these quantitative, easily gauged standards requires a zoning variance and demonstration of physical hardship).

Once these standards are in place, it is crucial that municipal leaders enforce them. The Kilbuck Township case study below is a cautionary tale of what can happen when they fail to do so.

Use Discretion Responsibly

Where discretion comes into play, like in the case of a conditional-use approval, there is significant opportunity to limit the disturbance of steep slopes.

However, this opportunity depends largely on the rigor with which boards and councils, often based on recommendations from their appointed planning commissions and municipal consultants, impose protection-minded conditions on applicants. Discretion also leaves open the possibility for lax enforcement should officials or consultants not pay close enough attention to potential problems or err on the side of flexibility in favor of applicants.

Many municipalities successfully blend quantitative standards and discretion into their zoning ordinances. Lower Milford Township, for instance, allows for modifications of steep slope protection standards when applicants can demonstrate that such modifications will result in the same, if not better, resource protection. The modification provision also serves as a safety valve by addressing unintended situations where compliance with multiple ordinance requirements essentially prevents the reasonable use of land.

Case Study: Kilbuck Township Landslide

In the mid-2000s, Kilbuck Township supervisors were anxious to accommodate Kilbuck Properties' proposal to build a superstore on a 75-acre site situated above a highway, railroad, and the Ohio River. The site was once the location of the Dixmont State Hospital, and historical documents portray at least part of the site experiencing significant slope failures, land subsidence, and dramatic uplifting of lands.

Kilbuck Properties proposed development plans that included a topographic survey showing slopes ranging from 25% to 50% in the area where the landslide occurred. The zoning ordinance provisions required subdivision and land development applicants planning to build on slopes of 25% or greater to notify the township, and where determined appropriate by the zoning officer, submit geotechnical studies. The grading ordinance limited the stripping of vegetation or disturbance of slopes between 25% and 40% to a quarter of the total area, and prohibited any development or disturbance of slopes exceeding 40%. The township engineer raised numerous concerns about ordinance-compliance issues during initial development plan review, including several on-site grading concerns.

The township planning commission recommended approval of the development plan, pending appropriate resolution of the engineer's documented concerns. Without a public meeting or hearing process, the township supervisors subsequently amended their grading ordinance, appointed a new ordinance administrator, and gave the administrator the ability to grant modifications or waivers of ordinance provisions when such provisions were found to be "impractical" to meet or achieve. Following these changes, Kilbuck Properties work was granted the necessary approvals and permits to begin building on the site. Necessary permits were also issued by the Pennsylvania Department of Transportation (PennDOT) and Pennsylvania Department of Environmental Protection (DEP).

During the review and approval process, the Allegheny County Office of Economic Development (specifically referred to in the grading ordinance as a

credible source of soil-stability information) submitted comments to Kilbuck Township warning of the property's history of landslides, and a citizens group attended hearings and offered qualified testimony opposing the development. This group also filed numerous appeals of various township and state permits and approvals, but was unsuccessful each time in halting the project.

In April of 2006, a small landslide occurred on the site without raising the concern of local, county, or state approval authorities. PennDOT inspected the site and landslide area a couple months later. Then, in late September, after a day of significant blasting, the entire hillside, estimated at over 500,000 cubic yards of earthen material, flowed downward toward the Ohio River, covering the four-lane highway and the three rail lines before stopping at the river's edge. The rail lines, which accommodated 100 freight trains per day, were completely blocked for 24 hours, causing incredible tie-ups and re-routing challenges. The highway, which transported 22,000 vehicles per day, took two weeks to completely reopen, causing massive amounts of traffic and congestion.

The landslide so significantly disrupted the flow of goods and people that it created a national security concern. The Pennsylvania House of Representatives directed the Joint State Government Commission to conduct an in-depth investigation into the landslide, including a thorough review of the applicable state and local permit and approval processes. In 2008 the commission published a [report](#) detailing its investigation, findings, and recommendations.

Wal-Mart Real Estate Trust, which became the full owner of the 75-acre site after the landslide, had difficulty reaching agreement with DEP on appropriate site-restoration measures that would allow the supercenter development to proceed. As a result, the Trust elected to drop its commercial-development proposal and restore the site for outdoor recreation. The site was not stabilized until 2014, and its return to open space is still ongoing. Altogether, the process has cost tens of millions of dollars.

This case study demonstrates the disastrous consequences that can occur when a municipality fails to

protect its steep slopes from disturbance, even a municipality that has previously adopted appropriate regulatory ordinances.

The most recent version of this guide and related resources can be found online at <https://conservationtools.org/guides/59>

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