controlling erosion on construction sites

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Left. Uncontrolled runoff damages the construction site and carries the sediment that damages areas downstream.

Right. Grading more land than needed for immediate construction can result in severe erosion and sedimentation.

NEB–2159

controlling erosion on construction sites

Each year more than a million acres of land in the United States are converted from agricultural use to urban use. These changing acres are the sites for the new houses, shopping centers, schools, industrial parks, highways, and airports needed by our growing population.

These changing acres also are the source of much of the sediment that pollutes streams and rivers and fills lakes and reservoirs. Studies show that erosion on land going into use for highways, houses, or shopping centers is about 10 times greater than on land in cultivated row crops, 200 times greater than on land in pasture, and 2,000 times greater than on land in timber.

The amount of erosion that occurs is determined by the kind of soil, the slope, the intensity of rainfall, and the construction methods. Much of the erosion occurs during the construction period, but areas below a construction site may erode more after construction is completed because of the rapid runoff from impervious pavement, parking lots, or compacted soil.

Improvements in earth-moving equipment have made reshaping of land easier and have brought steeper and rougher land into use. Also, the trend toward large subdivisions and developments to meet housing needs has left large cleared and graded areas exposed to erosion for long periods. Because of these factors, an ever-increasing amount of land is undergoing development each year and erosion is becoming a more serious problem in urban areas than ever before.

Damage to the land does not come from erosion alone. The increased runoff erodes stream banks and channels and causes flooding below the construction site. And the sediment pollutes streams, lakes, and reservoirs and damages the area where it comes to rest.

damage to the construction site

Erosion damage to the construction site includes rilled and gullied slopes, gullied waterways and channels, washed-out roads and streets, undercut pavements and pipelines, clogged storm sewers, flooded basements, and debris-laden work areas. Damage of this kind must be repaired. It increases the cost of construction and causes delays in work schedules.

A construction site also can lose fertile topsoil through erosion. This loss could mean that lawns and gardens will be difficult to establish.

VA-W-34

Cutting, filling, excavating, and grading leave a site highly susceptible to erosion.

damage to stream channels

Stream channels below a construction site can become filled with sediment and then flood when the volume of runoff increases during heavy rains. A sediment-filled stream channel can cause stream-bank erosion and can force the stream to meander. Land along the stream may be damaged by sediment, flooding, and erosion, and the esthetic value of the stream may be seriously impaired.

OKLA-11,131

Clearing removes trees and other plant cover that protects the soil.

damage to water

Sediment is the greatest single pollutant of streams, lakes, ponds, and reservoirs. Sediment lowers the quality of water for municipal and industrial uses and for boating, fishing, swimming, and other water-based recreation; it increases the wear on equipment, such as turbines, pumps, and sprinkler irrigation systems. Sediment carries with it pesticides, phosphates, and other chemical pollutants.

damage to property, public and private

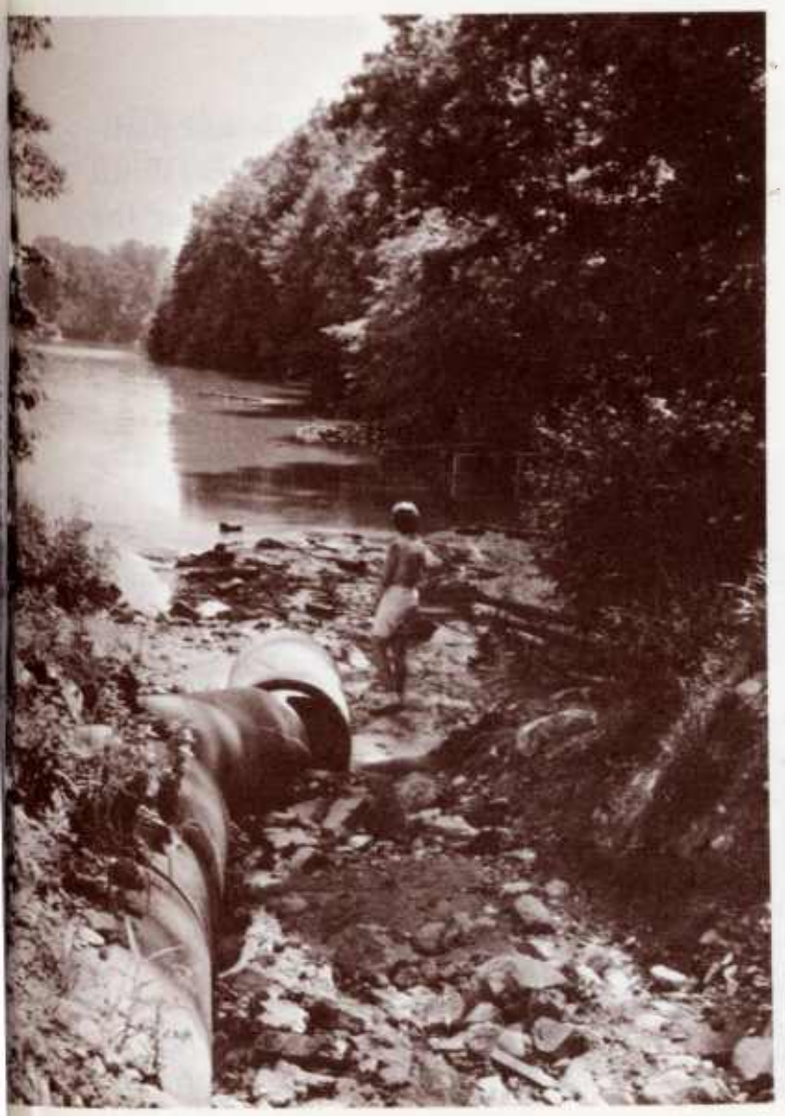
Sediment almost always damages the areas where it is deposited. It buries lawns, fills ditches, and clogs storm sewers, culverts, and drains. It can make an area unsuitable for use as a park or playground. Sediment reduces the storage capacity of reservoirs and may fill small ponds and lakes. It is injurious to both game fish and shell fish. The sediment that reaches major waterways blocks navigation channels, fills harbors, and silts estuaries.

The nationwide damage caused annually by sediment has been estimated at more than $500 million. Much sediment comes from agricultural land, but the amount contributed by land undergoing urban development is high in proportion to the acreage. Some areas may be getting sediment from construction sites only, and the damage may be catastrophic.

public concern

People today want better houses, better shopping centers, and better roads. But they also want pure water, clean air, more open space, and other improvements in the environment that make for pleasant living. People are demanding that natural resources be developed, protected, and improved for use now and in the future.

If our population doubles in the next 50 years as predicted, the acreage of land needed for urban use will increase. And the hazards of erosion and sedimentation will be greater if effective and practical measures for controlling erosion are not adopted and used widely.



VA-W-78

the solution: self-help and cooperation

Many organizations and federal, state, and local agencies can provide leadership and assistance in a program for erosion control. The Soil Conservation Service (SCS) of the Department of Agriculture gives technical help through conservation districts and in cooperation with many other agencies. But programs for erosion control need to be initiated by developers, builders, engineers, planners, architects, public officials—the people responsible for controlling erosion in their community.

This storm sewer proved too small, and the overflow undercut the pipeline. Sediment from higher lying construction sites is destroying the lake.

Today's conservation problems on land undergoing development for urban use follow by nearly three decades the initiation of soil and water conservation work on farmland. Most of what we know about erosion and sediment control has been learned from research, demonstration, and action programs on farmland.

This wealth of information and experience can serve urban areas equally well if properly interpreted. The basic principles of soil and water conservation and resource development can be applied anywhere.

principles of erosion and

Erosion is a process of detachment and transportation of soil particles. Rain falling on bare soil or on soil with sparse cover detaches soil particles, and the runoff carries the detached particles down the slope. Rills and gullies are cut by the force of the moving water. The soil particles are deposited as the water slows down and spreads out. Water moving over the land and in downstream channels carries soil material in proportion to the volume and velocity of the water.

MD-30,472

Top. The sediment in this storm drain, which is less than a year old, is more than 2 feet deep in places. The sediment came from a nearby construction site.

TEX-49,484

Right. The capacity of this culvert is no longer adequate because of sediment.

ediment control

VA-W-140

Sediment from construction sites in the watershed has almost filled this lake.

Erosion and sedimentation can be controlled effectively, and at reasonable cost, if certain principles are followed in the use and treatment of land. These principles are: (1) using soils that are suited for development, (2) leaving the soil bare for the shortest time possible, (3) reducing the velocity and controlling the flow of runoff, (4) detaining runoff on the site to trap sediment, and (5) releasing runoff safely to downstream areas.

In applying these principles various combinations of the following practices have proved effective:

1. Selecting land where drainage patterns, topography, and soils are favorable for the intended use.

2. Fitting the development to the site and providing for erosion control in the site development plan.

3. Using for open space and recreation those areas not well suited for urban development.

4. Developing large tracts in small workable units on which construction can be completed rapidly so that large areas are not left bare and exposed for long periods.

5. Grading at a minimum and removing only undesirable trees wherever possible.

6. Controlling runoff and conveying it to storm sewers or other outlets so it will not erode the land or cause offsite damage.

7. Protecting critical areas during construction with mulch or temporary cover crops and with mechanical measures such as diversions and prepared outlets.

8. Constructing sediment basins to detain runoff and trap sediment during construction.

Choked to death by sediment.

NM-67

9. Providing for safe offsite disposal of runoff, including the increased runoff resulting from construction.

10. Establishing permanent vegetation and installing erosion control structures as soon as possible.

select the right land

Builders and developers can minimize erosion, sedimentation, and other conservation problems by selecting the best site for an intended use. Tracts of land vary in suitability for different uses, so knowing the kind of soil, the topography, and the drainage pattern of the area will help in identifying and evaluating potential problems.

Regional and community planning is guiding land development in much of the rapidly urbanizing areas. Community planners, using information about the soils and about the geology, hydrology, and topography of the area, determine how the different kinds of land in a community can best be used. They make studies to determine future land needs for urban, agricultural, recreational, and other purposes. Other studies project population growth and trends and determine the land needs for schools, transporta-

MICH-61,042

tion, utilities, and other public services. The studies are based on community objectives to meet all necessary needs for land in ways that can protect natural resources, enhance the environment, and provide for both efficient and pleasant communities.

soil surveys can help

Soil surveys can be used in community planning to determine land use suitability. Soil surveys include soil maps, soil descriptions, and soil interpretations. The interpretations serve to point out the hazards and limitations in using the soils for different purposes. With this kind of information developers and builders can select sites that have the fewest limitations for a certain use and know that their selection will be compatible with the community's plans and interests.

IND–60,569

Left. The soil data that a soil surveyor records can help bring about better land-use planning and urban development.

Right. Planning results in orderly development of land.

NC-2037

A pond or reservoir in the right place can bring many benefits to the landowner or the community.

More and more developers and builders are making use of soil and other resource data in selecting land for development and in preparing site development plans.

Soil surveys were first used by farmers and agricultural scientists. They have guided the use and treatment of farmland and rangeland for years. Highway engineers have found soil surveys useful as an aid in designing highways as well as in determining the best routes. Sometimes adjustments in locating the right-of-way to avoid highly erodible soils or steep topography can reduce erosion problems greatly. Bankers are using soil surveys in land appraisal for making loans. Land assessors are using them as one criterion in determining a fair tax base. And land-planning agencies in increasing numbers are using them. The same soil survey can serve many different uses. To date soil surveys have been completed for more than 2,000 counties or other areas and additional surveys are being completed each year.

In making a soil map, the boundaries of the different kinds of soil occurring on a tract of land are delineated on an aerial photograph. The delineations show the location and extent of the different kinds of soil in relation to streams, roads, buildings, and other features of the landscape.

Soil surveys describe the characteristics and properties of each kind of soil—its texture, slope, depth, erodibility, permeability, degree of wetness, presence of impervious or porous layers, and other information useful in construction. The soil descriptions are the basis for interpreting soil suitability for different uses. Many soils are well suited to many uses; others, because of limitations, are suited to only a few uses.

Soil limitations are expressed as slight, moderate, and severe. A severe limitation does not mean that the soil cannot be used for a specific purpose, but rather that the cost of overcoming the limitation for that purpose may be prohibitive.

Soils vary in permeability and in their suitability for use as septic-tank absorption fields. Some soils have impervious layers that cause them to slip when saturated. Wide shrink-swell ratios, flood hazards, and seepage problems impose limitations on other soils for use as construction sites.

Soil surveys published in recent years are useful in urban planning and construction. Older surveys have interpretations only for farming uses of the land. But the soil descriptions in the older surveys contain basic information from which interpretations for urban use can be made. Anyone needing such interpretations usually can get help from the local conservation district or the Agricultural Extension Service.

Soil surveys do not lessen the need for onsite investigation.

include erosion control in the development plan

If a program for erosion control is worked out during the planning and design stages, before plans become fixed and construction begins, the problems brought on by soil erosion, runoff, and sedimentation can usually be avoided or lessened.

Detailed information on the soils, topography, and geologic and hydrologic conditions should be obtained during field examination of the site. Particular attention should be given to identifying and evaluating problems that may cause serious erosion during construction. For example, will disposing of runoff be a problem? Runoff originating on the site and runoff

A well-planned site will include open-space areas. This one is used as an outdoor laboratory.

NJ-40,502

from the watershed above must be controlled and disposed of safely. Consideration should also be given to offsite measures that may be needed to prevent damage to downstream land and property by either erosion or sediment.

Special consideration should be given to fitting developments to the site and the landscape. Street, lot, and building layout can minimize or encourage erosion during construction and complement or detract from the natural environment. Steep slopes and areas of highly erodible soils can be protected or left exposed; clearing and grading can save or destroy trees and can result in limited or excessive soil disturbance; cut-and-fill slopes can be stable or unstable, protected by cover or left bare for long periods. These are the kinds of considerations that need to be weighed and resolved during planning and design to get erosion control into the site development plan.

On sites where the cost of controlling erosion may be high because of the measures needed to overcome the site limitations, alternative uses or a layout that is more compatible with the land should be considered. The cluster method of developing residential areas, for example, fits the buildings and streets to the natural characteristics of the land. In using the cluster method on sloping land, houses can be built only on the more level areas and the steep, more erodible land is left undisturbed. Erosion hazards have been minimized and costs have not been increased.

The problems presented by small areas where erodible soils or steep slopes impose severe limitations may be solved best by using these areas as open space. Perhaps they can be added to public parks or to areas managed by community associations. In some places, schools make good use of them as nature areas or outdoor laboratories for class study.

There are always alternative ways of effectively controlling erosion and sediment production on most sites. The final plan generally is based on such factors as the time of year that construction will take place, the extent of grading, the amount of cover on the land, and the builder's preferences. On most sites a combination of fitting the development to the land, limiting grading, limiting the exposure of bare soil, and applying appropriate erosion control practices will prove the most practical.

erosion and sediment control measures

There are two kinds of erosion and sediment control measures—mechanical and vegetative. The most widely used of these measures are discussed here from the standpoint of their general use and purpose. Detailed information and standards and specifications developed for local conditions can be obtained from the local office of the Soil Conservation Service or from conservation districts. SCS can also give technical advice. Erosion control measures must be properly designed, installed, and maintained if they are to accomplish their intended purpose.

mechanical measures

Mechanical measures are used to reshape the land to intercept, divert, convey, retard, or otherwise control runoff.

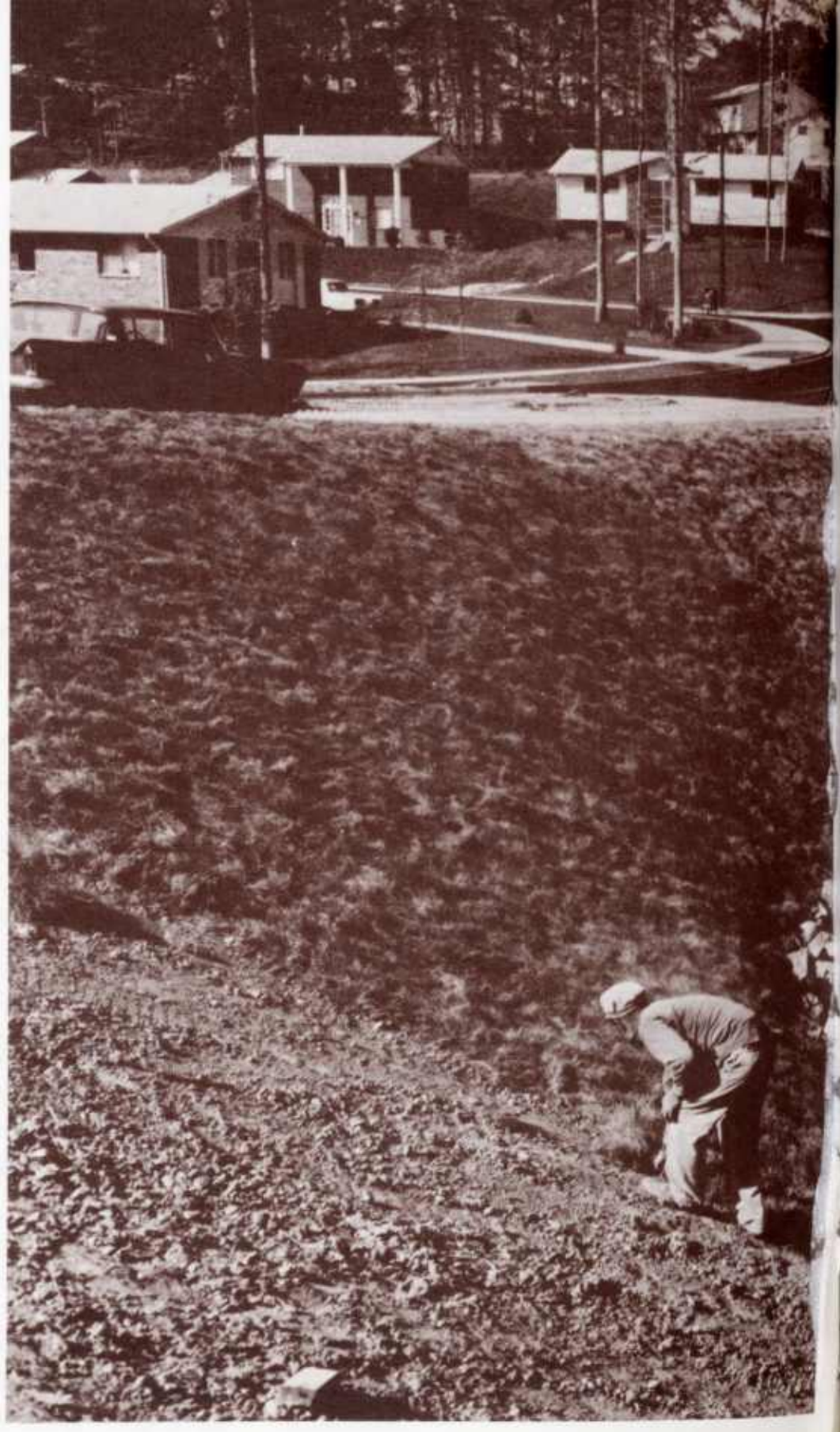
land grading

Grading only those areas going into immediate construction, as opposed to grading the entire site, helps immensely in controlling erosion. On large tracts, to avoid leaving a large area bare and unprotected, units of workable size can be graded one at a time—as construction is completed on one, grading proceeds to another.

On some sites, until storm sewers are installed, only the street rights-of-way are graded. This leaves only limited areas exposed to erosion and usually the adjacent undisturbed areas can be used as temporary outlets for diversions, or berms, built to protect the graded street rights-of-way. After the storm sewers are installed, other areas can be graded and the runoff can be directed to the streets and storm sewers.

As a general rule, grading should be held to the minimum that makes the site suitable for its intended purpose without appreciably increasing runoff. Only undesirable trees should be removed wherever possible.

In some areas heavy cutting, filling, or reshaping of the natural topography is needed to increase the percentage of usable land. Heavy grading almost always increases erosion hazards and should be accompanied by the maximum use of appropriate erosion control measures.



The conservation measures applied here have stabilized this critical area.

VA-W-113

The grading plan should show location, slope, and elevation of the areas to be graded and the measures to be used for disposing of runoff and for erosion control. Constructed slopes should be limited to a degree of steepness that will provide stability and allow easy maintenance. Retaining walls may be required.

Stumps and other decayable material should not be used in fills. Soft, mushy soil material is not suitable for fills that are to be used to support buildings or other structures.

bench terraces

Bench terraces constructed across the slope of the land and fitted to the natural terrain are used to break long slopes and slow the flow of runoff. In some areas the terraces are constructed wide enough to be used as residential sites. The cut-and-fill slopes of the bench terraces are always steeper than the natural slope of the land, so land slides may be a threat. Engineering studies should always be made to guide the design of the slopes and insure a reasonable degree of slope stability and safety.

Small bench terraces are sometimes used on the face of cut-and-fill slopes to help control runoff and erosion and establish vegetation.

subsurface drains

Subsurface drains are sometimes required at the base of fill slopes to remove excess ground water. In heavy grading, it may be necessary to fill natural drainage channels; subsurface drains may have to be installed below the newly filled areas to prevent accumulation of ground water.

Subsurface drains may be needed in vegetated channels to lower a high water table that prevents establishing an effective plant cover.

diversions

Diversions intercept and divert runoff so it will not cause damage; they consist of a channel and a ridge constructed across the slope. Diversions need a stable outlet to dispose of water safely.

In many places diversions are placed above critical slopes to divert runoff. Runoff over such slopes would cause serious erosion. Diversions can be used in this same way to protect construction areas. Also, they can be used on long slopes, in a series if needed.

BN-36,430

A diversion protects a steep cut slope by diverting runoff to a safe outlet.

Permanent diversions should be seeded to the same grasses that cover the surrounding areas. If built to protect open spaces, they should blend into the landscape for both better appearance and ease of maintenance.

berms

Berms are a type of diversion. They are compacted earth ridges on a slight grade and have no channels. They may be permanent or temporary.

Berms can be used to protect newly constructed slopes until the slopes are stabilized with permanent vegetation. They can be constructed across graded rights-of-way in a series and at intervals needed to intercept runoff. The side slopes of the berms are made flat enough to allow work vehicles to cross over them.

Berms too must have stable outlets. Well-stabilized ungraded areas adjacent to the street rights-of-way are often used as temporary outlets. In many places half-channel flumes, sod, or other material can be used to make temporary outlets.

storm sewers

Storm sewers dispose of runoff from the streets and adjacent lots. Temporary diversions may be needed to control runoff on the lots and convey it safely to the streets and storm sewers.

The use of storm sewers for runoff disposal does not prevent sediment from being deposited downstream. To reduce the sediment load carried by runoff through storm sewers during construction, some developers have improvised small sediment basins adjacent to sewer inlets. The sediment collected in the basins is removed following each runoff-producing rain.

Storm sewers should discharge where the grade is stable. Generally an energy dissipator is needed to slow the force of the flow at the point of discharge.

outlets

Most outlets are grassed waterways, either natural or manmade, and serve to dispose safely of water from diversions and from parking lots, highways, and other areas.

Natural waterways, or swales, can be improved by grading, reshaping, and revegetating. Manmade outlets should have flat side slopes and a wide bottom so they can be easily maintained. They should have adequate capacity.

This newly sodded channel will dispose of runoff safely. The slope has been planted to honeysuckle and mulched with tanbark. Note riprapping at critical points.

MD-30,542

Grass protects a channel against erosion by reducing the velocity of flow. The most suitable grass species are those that produce a dense uniform cover near the soil surface, are long lived, are able to withstand small amounts of sedimentation, and provide protection during all seasons of the year. The species selected should be adapted to the locality and the site.

Jute netting or fiber glass can be used as channel liners to protect the channel from erosion until vegetation becomes established. Liners may not be needed if runoff can be diverted from the channel during the establishment period.

waterway stabilization structures

A waterway needs a stabilizing structure if its slope is so steep that the velocity of runoff exceeds the limit of protection that the vegetation alone gives. Grade stabilization structures, special culverts, and various kinds of pipe can be used in combination with vegetation. Energy dissipaters may be required. The structures should be designed and constructed to provide permanent stabilization.

lined channels

The alternative to using vegetated waterways with grade stabilization structures is using lined channels. Such channels, paved ditches and valley gutters for example, have many uses in urban areas where slopes are too steep or soils too unstable for control by vegetation alone. Fiber-glass mats can be used as temporary lining for ditches and channels.

sediment basins

The function of a sediment basin is to detain runoff and trap sediment, thus, preventing damage to areas downstream. By detaining runoff, sediment basins also reduce peak flows. Basins can be excavated or formed by a combination of dam and excavation. Earth dams can be constructed across waterways to form basins. Under some conditions a highway embankment can serve as a dam. Sediment basins are almost always temporary structures. They are graded into the surrounding landscape after construction has been completed and the area has been stabilized. But they can be designed as permanent structures if there is a permanent need for them. Some industrial firms

This concrete-lined channel will carry runoff from the road surface and road shoulders. The shoulders have been mulched and seeded.

NC-2016

have preferred permanent basins that can be used later to protect downstream areas from accidentally released materials that would cause pollution.

The location, design, and construction of a sediment basin should be such that serious damage to areas downstream would be avoided should the basin fail. If the minimum storage requirement cannot be met, excavation to enlarge the basin and periodic cleanout may be necessary.

Sediment basins are constructed to discharge on stable ground below the dam. Emergency spillways should be added to increase safety. Exposed areas of the embankment and the emergency spillway should be protected by mulching and seeding.

stream channel and bank stabilization

The increased runoff from construction sites may make it necessary to stabilize the stream channel below.

Stream channels can be stabilized by installing grade control structures or by paving. Undercutting of banks can be controlled by measures that withstand the flow, such as concrete structures or rock riprap built along the toe and lower facing of the bank, or by measures that dissipate the energy of the flow, such as jetties, piling, and fencing built into or along the channel. Realining the channel may be desirable or necessary in many places, but it creates the risk of starting a new erosion cycle.

Stabilizing stream channels and streambanks is usually complex and costly. Control measures should be undertaken only on the basis of thorough engineering studies and plans. If a stream runs along or through a flood plain that is to be developed for parks and recreation, for example, esthetic values may determine the methods of improvement.

vegetative measures

Vegetative measures provide temporary cover to help control erosion during construction and permanent cover to stabilize the site after construction is completed. The measures include the use of mulches and temporary and permanent cover crops.

Erosion can be controlled with less difficulty on some sites than on others during construction, and permanent cover is easy

to establish on some sites and difficult on others. Establishing and maintaining good plant cover is easy in areas of fertile soil and moderate slopes. Usually such areas can be stabilized by using the plants and cultural methods that are common in the community.

Sites that are difficult to stabilize, because of exposed subsoil, steep slopes, a droughty exposure, and other conditions, require special treatment. Such sites are called critical areas because they erode severely and are the source of much sediment if they are not well stabilized.

This vegetated channel and drop structure dispose of runoff safely.

IND-60,509

mulch

Straw mulch can be used to protect constructed slopes and other areas brought to final grade at an unfavorable time for seeding. The areas can be seeded when the time is favorable without removing the mulch.

Mulch is essential in establishing good stands of grasses and legumes on steep cut-and-fill slopes and other areas where it is difficult to establish plants. By reducing runoff, mulch allows more water to infiltrate the soil. It also reduces the loss of soil moisture by evaporation; holds seed, lime, and fertilizer in place; and reduces seedling damage from heaving of the soil caused by freezing and thawing.

The materials most widely used in mulching are small-grain straw, hay, and certain processed materials. Grain straw is easily applied and generally is more readily available than hay, and it costs less. In some places, certain hays are preferred because they are a source of seed of plants that can be used for stabilization. Straw and hay mulches are usually applied at the rate of 1½ tons per acre.

PA-41,030

Paper netting helps secure straw mulch on a newly seeded waterway.

A number of processed mulches are available, and some show promise of greater use under specific conditions. Hydromulching, in which seed, fertilizer, and mulch are applied as a slurry, is a fast, all-in-one operation that requires little labor. Hydromulching may not be successful if done during a period of high-intensity storms.

Straw and hay mulches must be anchored to keep them from blowing or washing away. Anchoring methods include spraying the mulch with asphalt, tucking the mulch into the soil with a straight-blade disk, stapling netting over the mulch, and driving pegs into the mulched area at intervals of about 4 feet and interlacing them with twine.

temporary cover

Temporary cover crops can be used where cover is needed for a few months or a year or two. If construction is delayed on a site that has been cleared and graded, temporary cover crops can be used to protect the site against erosion. And they can be planted at a time of year that is unfavorable for seeding and establishing permanent cover.

Rapidly growing plants, such as annual rye grass, small grain, sudangrass, and millet, are most often used for temporary cover. Plants that are adapted to the locality and the season of the year during which protection is needed should always be used.

permanent cover

Special care should be taken in selecting plants for permanent cover. There are many grasses and legumes, trees, shrubs, vines, and ground covers from which to choose in most humid areas of the country but only a few in most dry regions. Final choice should be based on adaptation of the plants to the soils and climate, ease of establishment, suitability for a specific use, longevity or ability to self-reseed,

MD-30,543

The asphalt-paved apron and drop chute will carry runoff into the sediment basin.

maintenance requirements, esthetic values, and other special qualities.

The best plants are those that are well adapted to the site and to the purpose for which they are to be used. For example, grasses used for waterway stabilization must be able to withstand submergence and provide a dense cover to prevent scouring of the channel. In playgrounds, grasses must be able to withstand trampling. In some places, such as south-facing cut-and-fill slopes, the plants needed are those that are adapted to droughty areas. In other places, plants must be able to tolerate shade. Some plants can beautify as well as stabilize an area.

Maintenance may be the most important factor in selecting plants for permanent stabilization. Most tame grasses and legumes require much maintenance, and they gradually give way to native grasses, shrubs, and weedy plants if they are not mowed and fertilized regularly. In some areas native plants are preferred. On steep slopes and other inaccessible areas, it is preferable to select plants that require little or no maintenance. Sericea lespedeza, crownvetch, and honeysuckle, for example, are long lived and provide good erosion control with a minimum of main-

MD-30,488

This temporary sediment basin has a perforated riser to make easier the gradual drawdown of impounded runoff.

tenance. Most native grasses, trees, and shrubs grow well with little or no maintenance.

fibrous materials

A number of fibrous materials have special uses in erosion control.

Jute netting, a coarse, open-mesh, web-like material, can be applied directly on the soil to protect newly seeded channels until vegetation becomes established. It can also be used in repairing outlets and diversions where gullies have cut the channel. In some places it can be used to hold down straw mulch.

Cotton netting and paper netting are both lightweight; they can hold straw mulch in place and prevent it from blowing or washing away.

Solid heavy-duty fiber-glass matting can be used as a temporary channel liner where water velocity is too high for the use of vegetation or where vegetation is not wanted. Impregnating the mat with asphalt prolongs its life. Perforated fiber-glass matting can be used in the same way as jute netting to protect newly seeded channels. It can be used as a transition apron, lining the head of a channel to protect it from runoff, especially that from road culverts, which tends to cut a gully down the channel. And used as erosion stops, perforated matting can check rilling.

Fiber-glass erosion stops have certain advantages over rigid stops of masonry or wood. Soil often settles around rigid structures causing a turbulent and erosive flow. The fiber-glass stops are flexible and conform to the channel. Also, they are porous—water can seep through them—so subsurface drainage is improved.

stabilizing cut-and-fill slopes

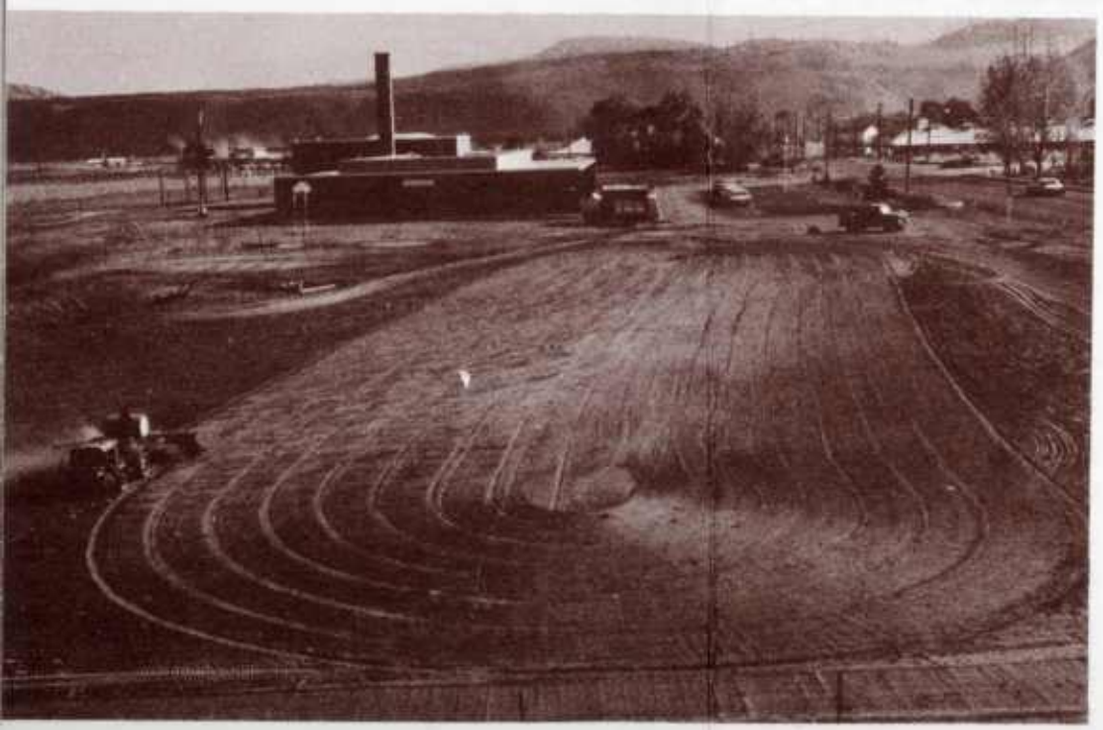
The first requirement in stabilizing cut-and-fill slopes is to prevent runoff from flowing over the face of the slopes. Temporary diversions, berms, shoulder dikes, or other measures should be used to intercept and divert the runoff. Permanent structures such as brow ditches and valley gutters are required where the areas contributing to runoff are large, for example, in areas of highway construction.

MD-30,544

A temporary cover of annual ryegrass protects this graded area against erosion until construction begins.

The cultipacker seeder works exceptionally well on a well-prepared seedbed.

WN-90,356



Small benches, intercepter ditches, or other measures can be used to protect long slopes from runoff originating on the slope itself.

Methods of establishing vegetation vary for different parts of the country, depending on the plants used and on soil and climate. In selecting plants and in getting them established, it is best to be guided by the methods commonly used and recommended in the area.

As a general rule, when seeding grasses and legumes it is advisable to prepare as good a seedbed as site conditions permit. Applications of lime and fertilizer should be based on local standards or on soil tests.

Usually a good stand can be obtained by broadcasting, drilling, or hydroseeding if other conditions are met. Mulching after seeding and then anchoring the mulch are essential in most areas. Irrigation is needed in many places.

Sodding is more costly than seeding, but it provides immediate protection. It should be used where the concentration of runoff is such that other methods of stabilization will not be effective. Sod can be laid anytime the soil is not frozen. Sod responds to a good seedbed and to lime and fertilizer. The strips of sod should always be laid across the slope, anchored to the soil, and watered. Some grasses can be established by sprigging and chunk sodding.

If trees are used to stabilize steep slopes, they are usually planted in pure stands. Mulching is important. Vines are usually established by transplanting individual plants or crowns.

Right, top. Hydroseeding—spraying seed and fertilizer in a water solution is one way of establishing grass on a graded area.

Right, bottom. The notched-disk machine is anchoring the mulch to the soil.

Below. This machine spreads a uniform cover of straw mulch to control erosion on the face of the dam.

WVA-861

MASS-244

OKLA-11,824

apply measures during construction

Installation of erosion and sediment control measures should be planned and scheduled as a part of construction operations. Construction contracts should clearly outline the location, scope, and manner of performing or installing the measures.

If possible, construction should be scheduled for that time of year when erosion is less of a hazard. This is particularly advisable for those sites where limitations for construction are severe because of steep slopes and erodible soils. Avoiding erosion hazards is an inexpensive way of controlling erosion and sedimentation.

Structures for controlling erosion on newly graded areas should be written into the grading contract. All permanent structures should be installed as early in the construction schedule as possible. Sediment basins also, if they are needed, should be installed early. Newly constructed slopes and other areas susceptible to erosion should be mulched or seeded to a temporary cover crop as soon as possible after grading. Finished grading leaves the soil extremely vulnerable to erosion. For this reason, it is advisable to schedule finished grading for the time of year that is favorable to establishing vegetation; the site can be seeded and mulched or sodded immediately following grading.

During construction, equipment should be used in a manner that does not leave the site more susceptible to erosion. Leaving deep wheel tracks up and down the slope, for example, should be avoided. Cultivation and seeding should be across the slope where possible. Access and work roads should be located and built so as not to encourage erosion.

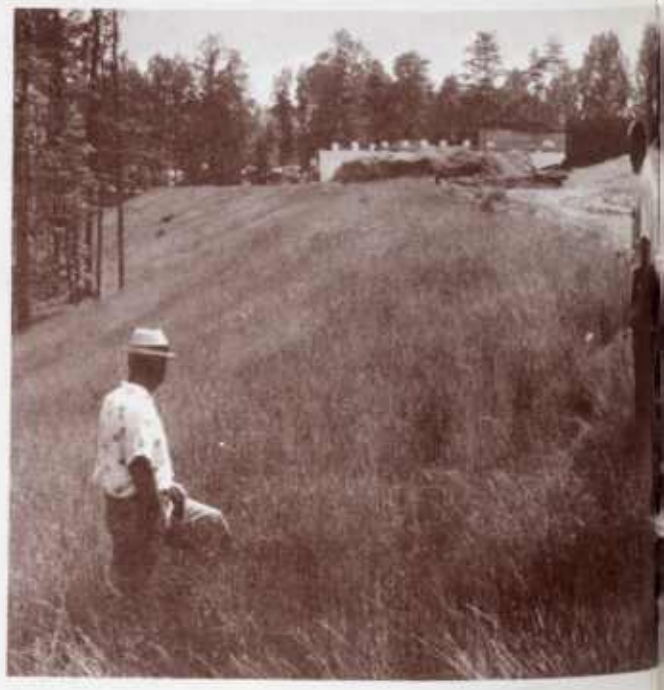
If the construction site borders streams, lakes, or reservoirs, special measures may

VA-W-173

This severely eroded fill was the source of tons of sediment that were deposited on parkland below.

The same area 2 years later is well stabilized. A shoulder dike prevents runoff from going over the face of the slope.

VA-W-224



be necessary to prevent damage to fish and wildlife, water supplies, and irrigation systems. Construction should conform to regulations of water resource and fish and wildlife agencies.

Restoring borrow pits and spoil areas should help control runoff and sedimentation. Such areas should be drained, graded, and revegetated so as to blend into the surrounding landscape. Diversions, dikes, and sediment basins should be used where needed to keep sediment from entering streams or damaging land and structures.

Responsibility for maintenance of the permanent structures and plantings should be clearly understood when ownership or management of property transfers from the developer or builder to a private owner, a public land administering agency, or a community management association.

Permanent structures should be inspected soon after installation to locate and correct any deficiencies. They then should be inspected annually and after major storms.

Plantings should be fertilized and mowed according to a plan if they are intended to be permanent. In some places a change in cover may be planned or needed. Reseeding or other appropriate measures may be necessary in places to improve the cover before erosion becomes serious.

working together

Interest in community and area-wide planning is increasing in both urban and rural sectors. People want to get the most beneficial use out of the land, and they want pure water and clean air. They understand that these amenities come only as a result of good planning; well-administered ordinances, codes, and regulations; public understanding and support; teamwork; and dedicated leadership.

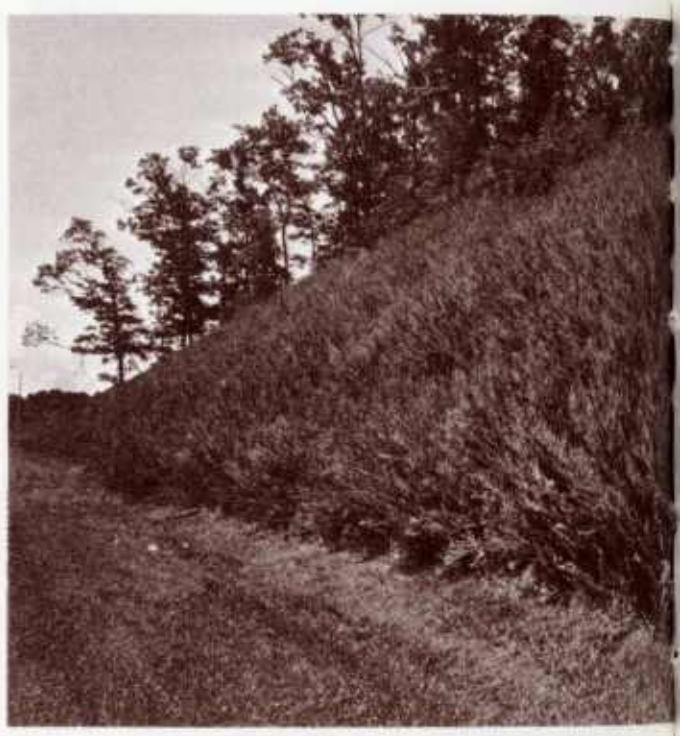
SCS through conservation districts can help engineers, planners, zoning boards, builders, and others by providing them with soil, water, and plant data, interpretations, inventories, and other technical assistance.

A few local governments have adopted erosion and sediment control programs along with appropriate ordinances, building codes, and regulations to help carry out their conservation policy. Ordinances, codes, and regulations can be helpful in two ways. They establish public policy and criteria and guides for erosion and sediment control, and they protect the people, public property, and natural resources.

Ordinances have sometimes failed to accomplish their intended purpose because they were too complicated and vague. Those that seem to work tie certain controls into the local code by adding to or amending existing subdivision regulations. Builders and developers already complying with the code merely assume additional responsibilities.

In areas where an erosion and sediment control ordinance has been adopted, the local conservation district has usually accepted the responsibility of providing technical assistance to the local government agency that administers the code. A site development plan then is approved only if the developer or builder provides for a level of protection against erosion that meets the standards set by the conservation district.

Some local governments have adopted ordinances to control flood-plain development or encroachment. Flood plains are the areas adjacent to streams that flood.



GA-D27-5

This steep cut slope was stabilized with sericea lespedeza, a low-maintenance cover.

Native trees, shrubs, and other plants have stabilized and beautified this roadside.

NJ-40,408

In recent years, some local governments have modified their zoning and flood-plain regulations to provide for planned unit development, whereby the upland and the flood plain are considered as a unit. This makes it possible to avoid problem areas and to preserve open space for scenic and recreation purposes.

Esthetic values are being lost in many urban areas as parts of streams, creeks, and runs are replaced by underground water disposal or drainage systems. But the loss goes beyond esthetics. Such systems are costly to install, and they increase the peak flows of runoff down-

stream. Innovations in storm drainage systems are needed to reduce peak flows, lower costs, and preserve and enhance esthetic values. An alternative to an underground water disposal system could be a stabilized natural stream with multipurpose structures for flood storage and water-based recreation. Alternatives, of course, need to be tested.

public understanding and support

There is no substitute for a well-informed public. People must know about the resource potentials and problems in their area, and they must know about the erosion and sediment control programs that can help them.

Civic groups are helping in many ways to inform the public. Some, for example, make available to other groups speakers and slide shows on urban erosion and sedimentation problems.

Builder associations publish technical material on erosion and sediment control practices and distribute it to their members. Some include conservation items in their newsletters; others join conservation districts or local government agencies in promoting erosion and sediment control.

Conservation councils, watershed associations, river-basin commissions, committees for preservation of green space, for protection of stream valleys, or for acquisition of park land, and many others influence public opinion and provide forums for citizen reaction.

Some builders and developers serve on their local conservation district governing board. Many builders and developers have been recognized by conservation districts for their outstanding conservation work.

policies need to be clearly stated

The conservation policy that a community or local government intends to follow must be clearly outlined and simply stated. Complexity or vagueness can lead to misunderstanding on the part of builders and developers, zoning boards, state or federal government agencies, or one of the many other groups that may have a function to perform or have simply an interest in conservation policy and procedures.

SCS conservationists working through conservation districts meet periodically with policy planning boards or other representatives of local government to review and evaluate conservation policy and operating procedures and to improve, if possible, coordination among individuals, groups, and organizations.

conservation districts provide leadership

Conservation districts are local public bodies responsible under state law to promote the conservation of soil and water and related resources. Districts meet their objectives through citizen, group, and community participation.

Crownvetch controls erosion and beautifies as well.

PA-40,962

VA-W-111

Conservation districts across the country have broadened their programs to give needed priority to urban conservation problems, particularly problems on land use. Several states have amended their district enabling legislation to include urban areas within their district boundaries. In some states, the original legislation limited district operations to rural areas.

Many districts have strengthened their leadership in the community through the election or appointment of urban leaders to their governing body. Districts are managed by local citizens who know local problems, and districts that take in substantial areas of urban land or rural land being converted to urban use need strong urban leaders on their governing boards.

Conservation tours, workshops, and seminars have been effectively used by districts to inform the public in urban areas about conservation problems. District newsletters, leaflets, and films have also been effective. A few districts have employed a public relations specialist to give leadership to such activities.

Districts are now looking beyond their own boundaries to form multidistrict resource councils to help solve resource conservation problems affecting large areas.

Left. The fibrous material will help protect this newly seeded streambank.

Right. Retaining walls of concrete rubble have stabilized and improved this storm channel. Careful planning and construction have saved the trees.

Below. The flat slopes along this concrete-lined storm channel can be easily mowed.

VA-W-115

VA-W-218

assistance is available

SCS, through local conservation districts, gives technical help to builders, developers, town and county officials, and others in working out land and water resource problems.

SCS can advise builders or developers concerning conservation problems, provide technical information, and suggest alternative solutions. The builders or developers decide what they want to do after considering the alternatives and use their own planners and engineers to carry out the decisions.

Builders and developers are encouraged to discuss erosion and other conservation problems with district conservationists before starting a site development plan.

Conservation in urban development means teamwork on the part of many agencies, organizations, groups, and individuals. The hub of the program is the county, town, or other local government and the local conservation district.

The local government establishes land-development policy and is responsible for community planning, zoning, approving site plans, issuing permits, and inspecting construction. Local government is the developer when public land is used for schools, recreation, parks, highways, and other public purposes.

Conservation districts and the Soil Conservation Service are the technical arms of the team. Districts represent the public and promote the public interest. SCS provides the technical information. It also makes soil surveys and administers the small watershed program.

Other agencies of the Department of Agriculture contribute to conservation with research on soil and water conservation and with educational programs. The Department of Housing and Urban Development insures loans for land development and through other programs helps communities and municipalities in many ways. Other departments and agencies provide assistance in the fields of hydrology and geology, health and sanitation, transportation, outdoor recreation, and preservation of scenic and historic areas.

Stone, or rubble, side slopes provide added protection for this channel in open parkland.

ST-1157-9

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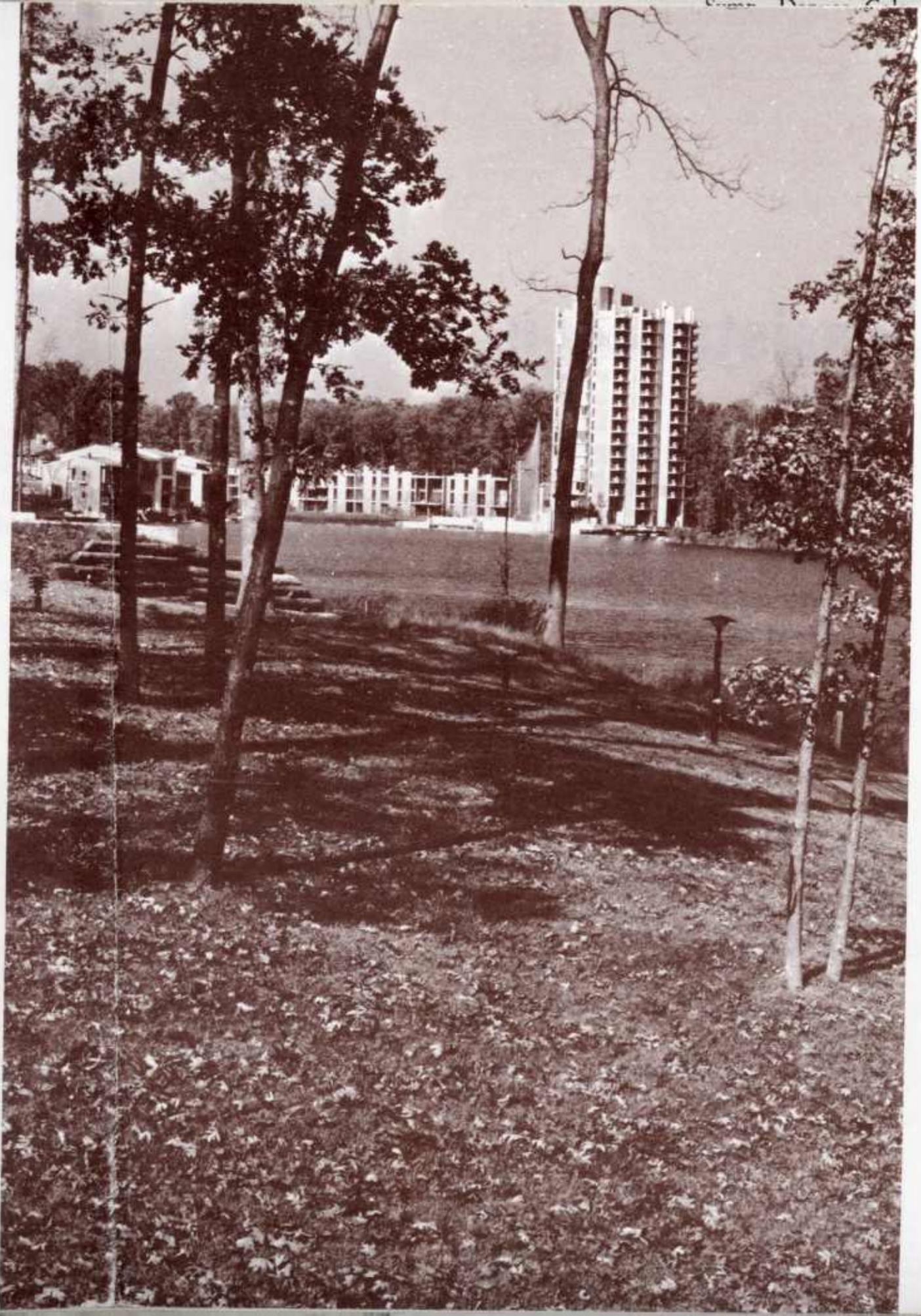

Open-space land for parks and recreation add beauty and enjoyment to everyday living.

December 1970

VA.-W-169