

WATER AND SEDIMENT CONTROL BASIN 638-1

SOIL CONSERVATION SERVICE

WEST VIRGINIA

ENGINEERING STANDARD

Water and Sediment Control Basin (No.)

Definition

An earth embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and a water detention basin.

Scope

This standard applies to planning, designing, constructing, operating and maintaining water and sediment control basins. It does not apply to diversions (362), grade stabilization structures (410), or sediment basins (350).

Purpose

To improve farmability of sloping land, reduce watercourse and gully erosion, trap sediment, reduce and manage onsite and downstream runoff, and improve downstream water quality.

Conditions Where Practice Applies

This practice applies where:

1. The topography is generally irregular.
2. Watercourse and gully erosion are a problem.
3. Sheet and rill erosion are controlled to the extent possible by other conservation practices.
4. Runoff and sediment damage land and improvements or impair water quality.
5. Soil and site conditions are suitable.
6. Adequate outlets are available or can be provided.
7. Failure of the embankment will not result in loss of life or damage to roads, utilities, buildings or other improvements.
8. The total storage capacity, measured to the maximum settled fill elevation, for all basins in a series or for an individual basin, are within the following limits:

## 638-2 WATER AND SEDIMENT CONTROL BASIN

Maximum Embankment Height <sup>1</sup>	Maximum Accumulated Storage (all basins)	Maximum Storage (each basin)
Equal to or less than 6 feet	50 ac-ft.	3 ac-ft.
6 feet to 15 feet	15 ac-ft.	3 ac-ft.

<sup>1</sup> The greatest height for any individual basin in the series, measured from the low point in the natural ground along the downstream toe of the embankment to the settled embankment elevation.

### EFFECTS ON WATER QUANTITY AND QUALITY

This practice may reduce the volume and rate of discharge by using either underground outlets or soil infiltration outlets. When underground outlets are used, infiltration through the catchment area will be increased and runoff decreased. Peak flows will be reduced by temporary storage.

When soil infiltration outlets are used, infiltration may absorb most of the runoff. Deep percolation and ground-water recharge may occur when conditions permit. Where snow is available, it is often trapped in the channels and catchments of the practice and it infiltrates into the soil.

The practice traps and removes sediment and sediment-attached substances from runoff. Trap efficiencies for sediment and total phosphorous, that are transported by runoff, may exceed 90 percent in silt loam soils. Dissolved substances, such as nitrates, may also be removed from discharge to downstream areas because of the increased infiltration. Where geologic conditions permit, the practice will lead to increased loadings of dissolved substances toward ground water. Water temperatures of surface runoff, released through underground outlets, may increase slightly because of the longer exposure to warming during its impoundment.

### Design Criteria

#### General

Water and sediment control basins can be part of the treatment needed to protect the soil resource base, in addition to practices such as terraces, contour farming, conservation cropping systems, conservation tillage, and crop residue management.

Water and sediment control basins shall not be used in place of terraces. When a ridge and channel extend beyond the detention basin or level embankment, terraces shall be designed. The resource management system must reduce soil loss in the interval above and below the basin to prevent excessive maintenance and operation problems.

Spacing

Water and sediment control basins shall generally be spaced at terrace intervals. The grade of the watercourse between basins shall be considered, and the spacing shall be set to prevent watercourse or gully erosion. The drainage of each basin shall be limited so duration of flooding, infiltration, or seepage does not damage crops or create other problems.

The system of basins and row arrangements shall be parallel when possible and spaced to accomodate farm machinery widths. Consideration shall be given to embankment slope lengths, top width, and inlet location when determining spacing.

Alignment

The embankment orientation and row direction shall be approximately perpendicular to the land slope to permit contouring as near as possible. The arrangement should permit farmability without excessive short point rows or sharp curves. Field boundaries and row length should also be considered when determining basin location and row direction.

Cross section

Embankment slopes shall not be steeper than two horizontal to one vertical. The effective top width shall be at least as wide as shown in the following table:

<u>Fill Height (ft)</u>	<u>Effective top width (ft)</u>
0-5	3
5-10	6
10-15	8

The constructed height of the embankment shall be at least 5 percent greater than but not more than 10 percent greater than the designed height to allow for settlement. The maximum settled height shall be 15 ft. measured from the natural ground at the centerline of the embankment. Slopes may be vegetated or may be flattened to permit cropping.

Capacity

The basin shall be large enough to control the runoff from a 10-year, 24-hour-frequency storm without overtopping. The capacity of basins designed to provide flood protection or to function with other structures may be larger and shall be adequate to control the runoff from a storm of a frequency consistent with the other structures. Discharge through pipe outlets may be considered in determining the required storage volume.

The basin also shall have the capacity to store the anticipated 10-year sediment accumulation, unless provisions are made for periodic sediment removal from the basin to maintain the design capacity. When provisions are made for periodic sediment removal, the sediment storage volume will be equal to the volume of sediment expected between clean-outs.

## 638-4 WATER AND SEDIMENT CONTROL BASIN

Sediment yield will be determined using procedures contained in the WV Technical Guide, Manual for Erosion and Sediment Control for Developing Areas West Virginia, Agriculture Handbook No. 537, Predicting Rainfall Erosion Losses, or National Engineering Handbook, Section 3 as appropriate.

### Overflow Protection

Additional protection of the embankment may be provided by installation of emergency spillways, by flattening the downstream slope of the embankment, or by raising the fill elevation within the maximum 15 ft. height limitation.

Emergency spillways may be either excavated or pipe spillways. The design capacity and resulting size of spillways will be based on the desired level of protection. However, installation of an emergency spillway and any desired freeboard shall not result in an embankment with a settled fill height greater than 15 ft. measured from the natural ground at the centerline of the embankment.

Excavated spillways may be parabolic, V-shaped, or trapezoidal in cross section. They will have a 2% or steeper inlet section followed by a 10 ft. long (minimum) level section. Side slopes will be no steeper than 2:1. Exit channel slopes will be no steeper than 5% where the ground is to be cultivated or 10% when maintained in vegetation.

Pipe emergency spillways may be constructed of any of the pipe materials listed in West Virginia Engineering Standard 378, Pond, with the limitations required by that standard. The pipe will have a stable outlet in a natural or constructed watercourse.

The emergency spillway must not contribute runoff to a lower basin in series that does not have an emergency spillway.

### Outlets

Water and sediment control basins shall have underground outlets or soil infiltration outlets that meet the requirements for terraces (600) and underground outlets (620).

Outlets will be designed to drain the design runoff storage volume within 48 hours, or more rapid if needed to prevent damage to crops.

Inlets will be standpipes which will allow for accumulation of sediment without affecting the function of the inlet. Provisions should be made for raising inlets should the need for increased storage develop at a later date.

### Vegetation and Protection

Slopes and disturbed areas that are not to be farmed shall be established to suitable erosion-resistant vegetation. Environmental quality and wildlife food and habitat shall be considered in selecting the species of vegetation. If soil or climatic conditions preclude the use of vegetative cover and protection is needed, an organic or gravel mulch may be used. Seedbed preparation, fertilizing, seeding, and mulching shall be in accordance with West Virginia Standards 512, Pasture and Hayland or 342, Critical Area Planting.

If needed, the embankment will be protected from livestock damage by installing fence in conformance with West Virginia Standards 472, Livestock Exclusion or 382, Fencing.

### Sediment Removal and Maintenance of Capacity

The sediment and design capacity shall be maintained by cleaning the basin or by raising the embankment height, within the 15 ft. maximum height limitation. Excavated material spread on the land shall be placed to maintain fertility and enhance topography. Fill material for increasing the embankment height shall be obtained in a manner that enhances topography and maintains productivity of the land.

### Operation and Maintenance

An Operation and Maintenance Plan shall be developed for water and sediment control basins. The plan shall outline the minimum maintenance necessary to insure the basins function as designed. The plan shall address:

1. Frequent inspections and inspections after each major storm event.
2. Maintenance requirements and repair of damage to embankments, spillways, outlets and vegetation or fencing (if used) before major damage occurs.
3. Frequency or elevation when sediment removal is required.
4. Disposal methods for sediment removal.
5. Maintenance of vegetation (if used) by liming, fertilizing and mowing to prevent the growth of trees or other woody cover.
6. When infiltration outlets are used, occasional disking or plowing of the pool area may be required to maintain infiltration.

### Plans and Specifications

Plans and specifications for installing water and sediment control basins shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

638-6 WATER AND SEDIMENT CONTROL BASIN

Drawings will be prepared to show the layout of the system in plan view and details of embankments, spillways, outlets, and fencing as appropriate. Drawings will indicate seeding materials rates and pipe material specifications when this information is not included in other specifications and when needed. Borrow areas and excess soil disposal areas will be indicated as needed.

Specifications may be prepared from NEH-20 specifications, West Virginia 700 Series Specifications or the attached specification may be used. Specifications for fencing, seeding, and underground outlets will be included as appropriate.

WATER AND SEDIMENT CONTROL BASIN 638-7

CONSTRUCTION SPECIFICATION

WEST VIRGINIA

Water and Sediment Control Basins

The foundation area and borrow areas shall be cleared of trees, logs, stumps, roots, brush, boulders, sod, and rubbish. Topsoil having a high organic matter content shall be removed.

Materials removed in the clearing operation will be burned, buried or otherwise disposed of as indicated on the drawings.

Topsoil will be stockpiled and spread on the completed embankment and borrow areas or spread to blend with the surrounding ground. Topsoil may also be used in the downstream face of the embankment and to flatten the downstream slope.

The foundation area will be thoroughly scarified before placement of fill material. The surface will have moisture added or be compacted if necessary so the first layer of fill material can be compacted and bonded to the foundation.

The embankment, spillways and outlets will be constructed to the line, grade, and dimensions shown on the drawings or staked in the field.

Fill will be placed in layers not exceeding 8 inches in thickness and compacted by traversing the surface area of each layer with at least 4 passes of the construction equipment. The moisture of the fill material shall be sufficient to permit molding a firm ball when firmly squeezed in one's fist. The soil will not be so wet that water runs out when squeezed nor so dry that the ball easily crumbles when slightly deformed. Water may need to be added if too dry.

Upon completion of excavation and fill operations, all disturbed areas will be graded smooth and blend with the surrounding ground.

When pipes, vegetation, and/or fencing are required, they shall meet the requirements specified in the drawings or in other specifications for the types of materials and installation methods indicated.

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized and held within legal limits.