NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SEDIMENT BASIN

(No.)

CODE 350

DEFINITION

A basin constructed with an engineered outlet, formed by an embankment or excavation, or a combination of the two.

PURPOSE

To capture and detain sediment laden runoff or other debris for a sufficient length of time to allow it to settle out in the basin.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to urban land, construction sites, agricultural land, and other disturbed lands:

- Where physical conditions or land ownership preclude treatment of a sediment source by the installation of erosion-control measures.
- Where a sediment basin offers the most practical solution.
- Where failure of the basin will not result in loss of life, damage to homes, commercial or industrial buildings, main highways or railroads; or in the use of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway.
- The effective height of the dam is 35 feet or less. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam.
- The Hazard Class of the dam is Low.

CRITERIA

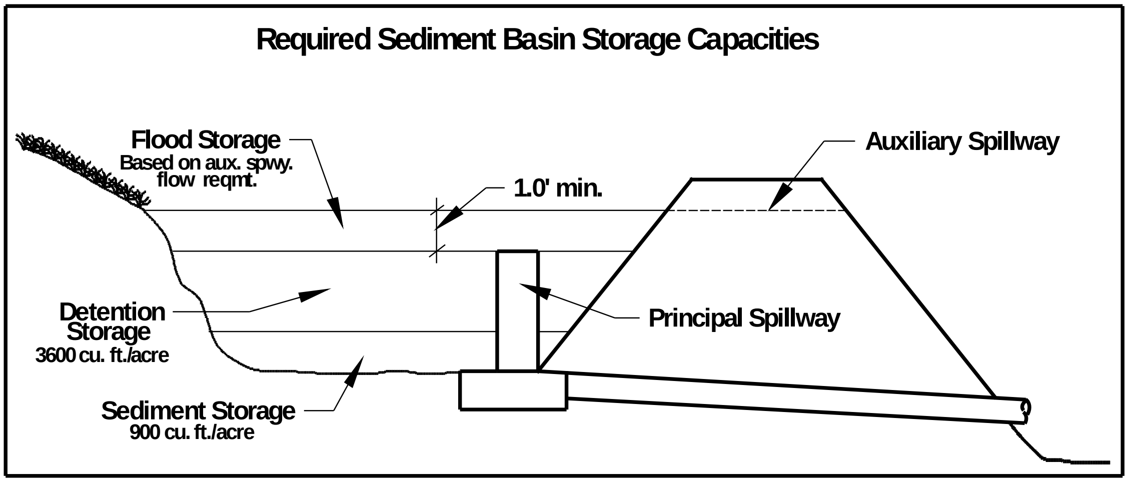
Sediment basin design and construction must comply with all applicable federal, state and local laws and regulations.

Location. Sediment basins are the last line of defense for capturing sediment when erosion has already occurred. When possible, construct basins prior to soil disturbance in the watershed. Choose the location of the sediment basin so that it intercepts as much of the runoff as possible from the disturbed area of the watershed. Choose a location that minimizes the number of entry points for runoff into the basin and interference with construction or farming activities. Do not locate sediment basins in perennial streams.

Basin Capacity. The sediment basin must have sediment storage, detention storage, and temporary flood storage capacities. For maximum sediment retention, design the basin so that the detention storage remains full of water between storm events. However, if site conditions, safety concerns, or local laws preclude a permanent pool of water, design all or a portion of the detention and sediment storages to be dewatered between storm events.

Design the sediment storage for a minimum of 900 ft^3/acre of disturbed area. The sediment storage volume is calculated from the bottom of the basin. Design the detention storage for a minimum of 3600 ft^3/acre of drainage area. The detention volume is calculated from the top of the sediment storage to the crest of the principal spillway.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.



Flood storage is based on the required design storm for the auxiliary spillways. Flood storage is calculated between the crest of the principal spillway and the crest of the auxiliary spillway. A minimum of 1 foot in elevation is required between the principal and auxiliary spillways.

Principal and Auxiliary Spillway Design. Design the principal spillway to carry long-duration, continuous, or frequent flows without discharge through the auxiliary spillway. The diameter of the principal spillway pipe must be 6 inches or greater.

The principal spillway can be designed to remove only water from the temporary flood storage or it can be designed to dewater all or part of the detention storage. Design the principal spillway to drawdown the temporary flood storage within 24 hours. Drawdown times for the detention storage can be longer to improve sediment trapping.

Design the auxiliary spillway to pass large storms without damage to the basin. Refer to NRCS Conservation Practice Standard 378, Ponds for the required design storm and design criteria for the auxiliary spillways.

The outlet of the principal spillway must be stable for anticipated design flow conditions.

Basin Shape. Design basins with a length to width ratio of 2 to 1 or greater. Baffles to divert the flow in the basin can be used to lengthen the flow path of incoming water to achieve the required length to width ratio.

Embankment and Side Slopes. If the sediment basin includes an embankment, it must be constructed of well compacted soil with stable side slopes. Refer to NRCS Conservation Practice Standard 378, Pond for design requirements for the embankment.

Above the permanent water line, the side slopes of the pool area must be 3 horizontal to 1 vertical or flatter. Side slopes below the permanent water line can be as steep as 2 horizontal to 1 vertical.

Vegetation. Establish vegetation on the embankment and side slopes of the basin and pool area immediately after construction. Refer to NRCS Conservation Practice Standard 342, Critical Area Planting for criteria for the establishment of vegetation. If construction takes place during a time period that is not conducive to establishing vegetation, protect the embankment by mulching or other methods. Refer to NRCS Conservation Practice Standard 484, Mulching for mulching criteria.

If arid climatic conditions do not allow for the establishment of vegetation, other means of reducing erosion may be used.

Safety. Sediment basins are often installed in developing areas and can be an attractive nuisance and safety hazard to the public. Design with the safety of the public in mind. Where appropriate, include safety features such as fencing to limit access to the pool area and embankment, signs to warn of danger and a safety ledge below the water level 6 feet wide and 4 horizontal to 1 vertical (4:1) or flatter around the edge of the permanent pool.

<u>Criteria Applicable to Temporary Basins</u>

Scope. Any sediment basin designed to (1) function for 36 months or less, (2) have a maximum height of dam less than 15 feet, (3) have a drainage area of 200 acres or less, and *(4) will be removed within 36 months of construction* may be designed in accordance with the following minimum requirements.

Temporary basins shall be classified according to Table 1:

Table 1 Temporary Basin Classification

Type	Maximum Drainage Area (acres)	Maximum Height of Dam (feet)
1	5	5
2	50	10
3	200	15

Sediment Storage Capacity. The minimum volume of the sediment basin, measured from the bottom of the basin to the crest of the principal spillway, shall be not less than 0.5 acre-inches for each disturbed acre in the watershed. To maintain efficiency, sediment basins should be cleaned out when one-half of the volume for sediment has been filled up.

Principal or Mechanical Spillway Conduit. When a pipe conduit is used for the principal spillway, the minimum capacity shall be in accordance with Table 2. The principal spillway conduit shall be placed through the dam to extend beyond the downstream toe of the fill. The minimum size shall be 4-inch smooth pipe or 6 inch corrugated metal pipe. A perforated riser (vertical pipe) connected to the barrel at the upstream end shall be designed to provide for draining sediment pools if necessary for safety and vector control after each storm event. The minimum cross-sectional area of the riser shall be one and one-half times that of the conduit.

Table 2 Temporary Basin Design

Type	Minimum Principal Spillway Capacity	Minimum Emergency Spillway Capacity
1	0.15 cfs / ac	10-yr, 24-hr
2	0.15 cfs / ac	25-yr, 24-hr
3	0.21 cfs / ac	25-yr, 24-hr

The following types of pipe conduits are acceptable: cast iron, steel, corrugated metal, asbestos cement, plastic, reinforced concrete, and rubber gasket vitrified clay. All pipe joints within the embankment shall be made watertight by use of watertight couplings or gaskets or by welding or caulking.

The pipe shall be capable of withstanding the external loading without yielding, buckling, or cracking.

Perforated Riser. When it is necessary to drain the sediment pool, the riser shall be perforated with 1/4" to 1/2" diameter holes with a minimum spacing of 3" centers in each outside valley. The lower one-third of the perforated riser shall be covered with suitable filter material that will allow complete drainage of pool and adequate filtration during periods of drainage.

The crest elevation of the riser shall be a minimum of 1.0 foot below the crest elevation of the emergency spillway.

Trash Guard. A trash guard shall be installed on the top of the riser to prevent trash or debris from clogging the conduit and provide safety when pond is temporarily full.

Antiseep Collars. Antiseep collars are not required for Type 1 and 2 basins. For Type 3 basins, antiseep collars are to be installed around the pipe conduit within the normal saturation zone when either of the following conditions exists:

1. The conduit is of smooth pipe larger than 8 inches in diameter.
2. The conduit is of corrugated metal pipe larger than 12 inches in diameter.

The antiseep collars and their connections to the pipe shall be watertight. The collar material shall be compatible with pipe materials. The maximum spacing shall be in accordance with Table 3.

Table 3 No. of Antiseep Collars Required

Fill Height	Collar Projection 1.5 feet	Collar Projection 2.0 feet
0 to 11	1	1
12 to 15	2	1

Auxiliary Spillway. Provisions shall be made for emergency bypassing of the minimum design storm in accordance with Table 2 to avoid overtopping and possible washout of the embankment.

Embankment Top Width. The minimum top width of the dam shall be:

Fill Height	Minimum Top Width
10 feet or less	8 feet
10 to 15 feet	10 feet

Freeboard. The settled top elevation of the dam for Type 1 sediment basins shall be a minimum of 1.0 foot above the natural ground elevation to allow emergency bypassing of flood flows around one or both ends of the dam.

The settled top elevation of the dam for Type 2 and 3 basins shall be a minimum of 1.0 foot above the maximum stage in the emergency spillway during the passage of the design storm.

Side Slopes. The combined upstream and downstream side slopes of the settled embankment shall not be less than 5 horizontal to 1 vertical with neither slope steeper than 2:1.

Settlement. The constructed height of the dam shall be increased by the amount needed to insure that the design top elevation will be maintained after all settlement has taken place but shall not be less than 5 percent.

CONSIDERATIONS

A large sediment basin may have an effect on the peak discharge rate from a watershed. Planners should consider this, and take steps to mitigate any potential negative effects this may have on riparian habitat downstream from the structure.

In many cases, the use of a sediment basin alone may not provide sufficient protection for offsite sedimentation problems. To work most effectively, the sediment basin should be the last practice in a series of erosion control and sediment capturing practices installed in the disturbed area. This incremental approach will reduce the load on the basin and improve effectiveness of the overall effort to prevent offsite sedimentation problems.

The efficiency of sediment removal in a basin is affected by the detention time of runoff, the type of dewatering device, the presence of a permanent pool in the basin, a decrease in turbulence in the basin and soil particle size. The uses of the following techniques are particularly effective if there is a need to remove clay and other fine grained particles.

- Detention time can be increased by increasing the storage volume in the basin. Increased storage along with a properly designed dewatering device can significantly improve the efficiency of sediment capture.
- Dewatering should be done in a manner, which removes the cleaner water above the sediment storage, without removing the sediment laden water found deeper in the basin. One dewatering device that has been very successful is a skimming device that floats on the surface of the water and rises and falls with the water level in the basin. Use of this type of dewatering device should improve the quality of the water leaving the basin. Details for this type of dewatering device can be found in the North Carolina Erosion and Sediment Control Planning and Design Manual.
- Maintaining a permanent pool also improves sediment trapping by reducing the re-suspension of sediment in the basin. This can be accomplished by only dewatering the temporary flood storage or

only a portion of the detention storage. Removal of sediment from the basin before it reaches the sediment storage elevation will maintain the pool volume and improve trapping efficiency.

- Turbulence in the basin can be reduced by constructing porous baffles that extend across the entire basin. The baffles slow down flows and force water to spread across the entire width of the basin. A thorough discussion and design criteria for porous baffles can be found in the North Carolina Erosion and Sediment Control Planning and Design Manual.
- For very fine grained sediments, flocculants can be added to the runoff before it enters the basin. One commonly used flocculant is anionic polyacrylamide (PAM). Do not use cationic polyacrylamide because it can be toxic to aquatic life.

Since the sediment basin must be designed to handle all of the contributing drainage whether it is from disturbed areas or not, diverting runoff from undisturbed areas away from the basin will improve the function of the basin. The design storm for diversion measures should be equal to the design storm for the auxiliary spillway of the basin.

The use of forebays that are separate from the main basin and easily accessible for cleanout will reduce turbulence and will allow larger particles to settle out of the runoff before it enters the main basin.

Because the sediment storage capacity of a basin is finite, choose a location that will allow access for sediment removal when the storage capacity is full.

Visual aesthetics may be a concern, especially in urban or suburban areas. To address these concerns, design the basin to blend with the surrounding topography, or use plantings to screen the view from surrounding homes or buildings.

In some situations, after they have served the sediment capture function, sediment basins may remain in place to function as stormwater detention or wildlife ponds. This will require appropriate planning during the design phase to ensure that the basin can function for a different use. In addition, significant modifications to outlet structures may need to be made as well as removal of accumulated sediment to convert it to a new use.

If the basin will be used by wildlife, the use of native species is recommended to provide food and habitat diversity. Also, consider wildlife use of the basin when scheduling maintenance activities that may disrupt wildlife life cycles or negatively impact pollinators.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for sediment basins that describe the requirements for applying the practice according to this standard. Include as a minimum, the following in the plans and specifications:

1. A plan view of the layout of the sediment basin.
2. Typical cross sections of the basin.
3. Details of the outlet system.
4. Seeding requirements if needed.
5. Construction specifications that describe site specific installation requirements of the sediment basin.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in the operation and maintenance plan are:

1. Periodic inspections and maintenance of the embankment, principal and auxiliary spillways and dewatering device, especially following significant runoff events.
2. Prompt repair or replacement of damaged components.
3. Prompt removal of sediment when it reaches pre-determined storage elevations.
4. Periodic mowing of vegetation to control of trees, brush and invasive species.
5. Periodic inspection of safety components and immediate repair if necessary.

REFERENCES

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