



Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
WATER AND SEDIMENT CONTROL BASIN

CODE 638

(no)

DEFINITION

An earth embankment or a combination ridge and channel constructed across the slope of a minor drainageway.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Reduce gully erosion
- Trap sediment
- Reduce and manage runoff

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to sites where:

- The topography is generally irregular.
- Gully erosion is a problem.
- Other conservation practices control sheet and rill erosion.
- Runoff and sediment damages land and works of improvement.
- Stable outlets are available.

Do not use this standard in place of a terrace. Use WI Conservation Practice Standards (WI CPS) Terrace (Code 600) or Diversion (Code 362) where the ridge and/or channel extends beyond the detention basin or level embankment. Use WI CPSs Dam (Code 402), Pond (Code 378), Grade Stabilization Structure (Code 410) at edge of field locations.

CRITERIA

Federal, State, Tribal, and Local Laws

Water and sediment control basin structures shall comply with all Federal, State, Tribal, and local laws, rules or regulations. The owner and/or operator is responsible for securing required permits. Permitting authorities should be contacted during the planning phase of the project.

General Criteria Applicable to All Purposes

Install a water and sediment control basin as part of a conservation system that addresses resource concerns both above and below the basin. Where land ownership or physical conditions preclude treatment of the upper portion of a slope, a water and sediment control basin can separate this area and permit treatment of the lower slope.

The resource management system must reduce soil loss in the interval above and below the basin to less than, or equal to, the allowable soil loss (T).

Location

Locate the water and sediment control basin to reduce erosion in a drainageway. Install a basin singly or in series as part of a system to fit site conditions. Adjust the location to:

- Fit the topography.
- Maximize storage.
- Accommodate farm equipment and farming operations.
- Accommodate property lines.

When choosing the location of a water and sediment control basin, be sure to consider the extent of ponding that will occur from the basin.

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.

Table 1. Maximum spacing between basins

Slope (percent)	Maximum Spacing (ft.)
0-4	700
4-6	600
6-12	500
More than 12	400

The system of basins and row arrangements shall be parallel when possible and spaced to accommodate 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.

Earth embankment

Minimum top widths are in Table 2. Construct the embankment at least 5 percent greater than design height to allow for settlement. The maximum settled height of the embankment is 15 feet or less measured from natural ground at the centerline of the embankment.

Strip the foundation surface to remove any vegetation and/or unsuitable material, such as crop residue or large rocks, and scarify the surface prior to fill placement for the embankment, and if applicable, prior to installing a foundation cutoff and/or seepage control.

Table 2 Minimum top width of embankments

Fill Height (ft.)	Top Width (ft.)
0-5	3
5-10	6

Fill Height (ft.)	Top Width (ft.)
10-15	8

Design embankment slopes no steeper than 2 horizontal to 1 vertical. The sum of the horizontal components of the upstream and downstream slopes of the embankment must be 5 or greater. Design the farmed slopes to be no steeper than that which is safe to operate farm equipment.

The basin shall have the ends closed to the design elevation. A maximum of 1 foot of freeboard may be added to the design fill height to provide for an auxiliary spillway around one or both ends of the basin. The auxiliary spillway must not contribute runoff to a lower basin that does not have an auxiliary spillway.

Foundation cutoff and seepage control

Portions of a basin ridge designed to impound more than a 3-foot depth of water must include foundation cutoff, and if conditions warrant, seepage control. Refer to WI CPS Pond (Code 378) for criteria for foundation cutoff and seepage control.

Capacity

As a minimum, design the water and sediment control basin with sufficient capacity to control the runoff from a 10-year frequency, 24-hour-duration storm using a combination of flood storage and discharge through the outlet.

The water and sediment control basin must have a minimum capacity to store the anticipated 10-year sediment accumulation. The sediment storage volume may be reduced if periodic sediment removal is required in the operation and maintenance plan.

The following tables can be used to size basins, slotted risers, and underground outlets (UGOs).

Required water storage and Minimum Design Discharge with perforated/slotted risers, and UGO systems

Duration of Flooding (hours)	Water Storage (Inches per inch of runoff per unit area (In./In./Acre)	Design Outflow (CFS per acre-inch of runoff)
6	0.33	0.1
12	0.42	0.06
18	0.45	0.049
24	0.50	0.035
30	0.53	0.029
36	0.56	0.025
42	0.59	0.021
48	0.61	0.019

Required sediment storage (as expressed as water storage, inches)

Soil Loss (tons/acre/year)	Estimated 10 year sediment yield (inches/acre)
1	0.07
2	0.14
3	0.21
4	0.28
5	0.34

Soil Loss (tons/acre/year)	Estimated 10 year sediment yield (inches/acre)
7	0.48
10	0.83

Outlets

The water and sediment control basin must have an outlet that can convey runoff water to a point where it will not cause damage. The outlet can be an underground outlet, a pipe drop structure, a soil infiltration area, a stable channel, or a combination of outlet types.

For a farmed basin, design the outlet so that the flow release time does not exceed the inundation tolerance of the planned crops. If sediment retention is a primary design goal, adjust the release rate according to sediment particle size to retain sediment in the basin. Refer to NEH, Section 3, Chapter 2, "Sediment Properties" for information on the settling rates of sediment particles and to WI CPS Underground Outlet (Code 620) for design criteria for underground outlets.

Use anti-seep collars when the basin ridge impounds more than 5 feet of water depth. Use a collar material that is compatible with the pipe material and ensures a watertight connection to the pipe. When using anti-seep collars, design the collars to increase the seepage path along the pipe by at least 15 percent of the base width of the embankment

Vegetation

After construction of the water and sediment control basin, vegetate all non-farmed disturbed areas with permanent native or noninvasive vegetation as soon as possible. If construction is complete when establishing permanent vegetation is not feasible, use temporary cover until establishment of permanent vegetation can occur. In non-farmland settings, use other erosion protection, such as gravel or organic mulches, as necessary.

Refer to WI CPS Critical Area Planting (Code 342) for criteria on seed selection, seedbed preparation, fertilizing, and seeding and WI CPS Mulching (Code 484) for criteria on mulch selection including erosion control blankets.

CONSIDERATIONS

Water and sediment control basins can be spaced at intervals down a slope, similar to terraces, in order to control erosion. Refer to WI CPS Terrace (Code 600) for methods to determine spacing. Install additional conservation measures in the watercourse between basins to prevent erosion as necessary.

The soil survey can be a valuable resource when planning and designing water and sediment control basins. The soil survey can identify potential problems such as the presence of limiting layers to plant growth in the soil profile. Field investigations can then identify problem areas to avoid such as shallow bedrock or dense, acid, or saline layers that will adversely affect plant growth if construction brings them into the root zone.

Where necessary to restore or maintain productivity, salvage topsoil and spread over the disturbed area after construction is complete. Temporarily stockpile the topsoil away from the site and provide erosion protection, as needed.

Biodegradable erosion control blankets can help protect bare soil surfaces during the establishment of vegetation.

Enhance sediment retention within the basin with inlet and outlet selection and by increasing the length-to-width ratio of the basin. Determine sedimentation rates using the Revised Universal Soil Loss Equation 2 (RUSLE2), or other approved methodology.

For cropped fields, orient the embankment and crop rows in a direction that is approximately perpendicular to the land slope to support contour farming. The design should support farmability by

limiting short point rows or sharp curves. Consider field boundaries and row lengths when planning basin locations and row direction.

The basin outlet system can include an auxiliary spillway above the primary storage to handle larger storm flows. If an auxiliary spillway is used, add freeboard to the design height of the embankment to provide for the safe operation of the spillway. The freeboard should be at least 0.5 ft above the design flow depth through the auxiliary spillway. If the auxiliary spillway of another basin contributes runoff to the basin, design the basin to handle the additional runoff. Refer to WI CPS Pond (Code 378) for criteria to design an auxiliary spillway.

An underground outlet from a water and sediment control basin can provide a direct conduit to receiving waters for contaminated runoff from cropland. To reduce the impact of this runoff, install the water and sediment control basin as part of a conservation system that includes such practices as grassed waterways, contouring, a conservation cropping system, conservation tillage, nutrient and pest management, crop residue management, and filter areas to reduce or mitigate contaminated runoff.

The construction of water and sediment control basins can introduce steep and potentially dangerous slopes into crop fields. During design, create slopes that will be safe for farm equipment operation.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for water and sediment control basins that describe the requirements for applying the practice to achieve the intended purpose. As a minimum, include:

- A plan view of the layout of the water and sediment control basin system.
- Typical cross sections of the basin.
- Profile of the basin.
- Details of the outlet system.
- For underground outlets, details of the inlet and profile(s) of the underground outlet.
- Seeding and mulching requirements if needed.
- Construction specifications that describe in writing site-specific installation requirements of the water and sediment control basin system.

OPERATION AND MAINTENANCE

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

- Periodic inspections, especially immediately following significant runoff events.
- Prompt repair or replacement of damaged components.
- Maintenance of basin ridge height and outlet elevations.
- Removal of sediment that has accumulated in the basin to maintain capacity and grade.
- Regular cleaning of inlets for underground outlets. Repair or replacement of inlets damaged by farm equipment. Removal of sediment around inlets to ensure that the inlet remains the lowest spot in the basin.
- Where vegetation is specified, regular mowing and control of trees and brush. Schedule vegetative disturbances to avoid the peak-nesting season.
- Notification of hazards about steep slopes on the basin.

REFERENCES

USDA, NRCS. National Agronomy Manual, Part 501, "Water Erosion."

USDA, NRCS. National Engineering Handbook (NEH), Part 650, Chapters 6 “Structures,” 8 “Terraces,” and 14 “Water Management (Drainage).”

USDA, NRCS. NEH, Section 3, Chapter 2, “Sediment Properties.”