Rock Check Dam

Plan Symbol

Description

A rock check dam is a small, temporary or permanent rock fill dam constructed across a drainage ditch, swale, or channel to lower the speed of concentrated flows. Design rock check dams to have an 80 percent design removal efficiency goal of the total suspended solids (TSS) in the inflow.

When and Where to Use It

Install rock check dams in steeply sloped swales, or in swales where adequate vegetation can not be established. Use rock check dams in small open channels. Do not place check dams in Waters of the State or USGS blue-line streams (unless approved by SCDHEC, State, or Federal authorities).

Rock Check Dam Design Criteria

Design Aids

The Design Aids located in this section (RC-C, RC-M, RC-F) may be used to properly size rock check dams. Sedimot III, SEDCAD4, and other computer models that utilize eroded particle size distributions and calculates a corresponding trapping efficiency may also be utilized.

General Design Requirements

a. 80 percent design removal efficiency goal for TSS
b. Maximum Drainage Area – 5 acres
c. Maximum Height – 2-feet
d. Spacing varies with the bed slope of the ditch. Space rock checks such that the toe of the upstream check is at the same elevation as the top of the downstream check.
e. If the rock check dam is not properly sized, the flow will overtop the structure and the Trapping Efficiency is assumed to be 0 percent when this failure takes place.

Installation

Install the center section of the rock check lower than the edges.

Inspection and Maintenance

- Inspect every 7 calendar days and within 24-hours after each rainfall event that produces ½-inches or more of precipitation.
- Inspect for sediment and debris accumulation.
- Inspect rock check dam edges for erosion and repair promptly as required.
- Remove sediment when it reaches 1/3 the original check height.
- In the case of grass-lined ditches and swales, remove rock check dams when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4 percent.
- After construction is complete, remove stone if vegetation is used for permanent stabilization.
- Seed and mulch the area beneath the rock ditch checks immediately after dam removal.

Rock Check Dam Design Aids

Design aids for rock check dams were developed similarly to those for ponds. Again, the D_{15} eroded particle size is used for the calculation of the characteristic settling velocity. The ratio for ditch checks is defined by:

The Rock Check Dam Design Aids have been designed for the following soil classifications:

- Coarse (sandy loam)
- Medium (silt loam)
- Fine (clay loam).

The design ratio should be less than or equal to the curve value at any given trapping efficiency.

$$\text{Rock Check Ratio} = \frac{Sq^{(1-b)}}{aV_{15}}$$

Where:

S = Channel slope (%),
q = Unit width flow through the check for the 10-year 24-hour storm event (cfs/ft),
V_{15} = Characteristic settling velocity (fps), of the characteristic D_{15} eroded particle (mm).
Coefficients *a* and Exponent *b* is interpolated from tables

Constraints for the use of Rock Check Dam Design Aids:

- Watershed area is less than or equal to 5 acres
- Overland flow length is less than or equal to 500-feet
- Overland slope is less than or equal to 15 percent
- Maximum depth of the ditch is less than or equal to 6-feet

Rock Check Ratios above the design curves are not recommended for any application of the design aids. If the Rock Check Ratio intersects the curve at a point having a trapping efficiency less than the desired value, the design is inadequate and must be revised.

A rock check dam located on coarse soils has a ditch check ratio equal to 1.10 E3 at 80 percent trapping efficiency as shown in Figure RC-C.

A rock check dam located on medium soils has a ditch check ratio equal to 5.80 E3 at 80 percent trapping efficiency as shown in Figure RC-M.

A rock check dam located on fine soils has a ditch check ratio equal to 1.20 E4 at 80 percent trapping efficiency as shown in Figure RC-F.

Rock Check Dam Design Examples

Given: Install a rock check dam with a channel slope of 1.0 percent in the Piedmont on an area having Cecil sandy loam soils with an eroded size distribution of medium texture.

The runoff coefficient "C" for the rational method is estimated as 0.4 with an intensity of 6.75 in/hr for the design storm.

Drainage area to the ditch check is 4.4 ac.

Average rock diameter of the ditch check is 0.10 m (4 in.).

Average width (perpendicular to flow) is 6.7 ft and ditch check length is 3.3 feet.

Find: The trapping efficiency for the rock ditch check.

Solution:

1. A Cecil D_{15} topsoil is 0.0066 mm, and the settling velocity is found to be V_{15} = 1.2 E-4 fps.

2. Peak flow is estimated from the given information by substituting into the rational formula so that:

$$q_p = C\ i\ A = 0.4\ (6.75)(4.4) = 11.9\ cfs$$

3. The flow rate should be converted to flow per unit width by dividing the peak flow by the check width to obtain the design q as

$$q = 11.9\ cfs/6.7\ ft = 1.78\ cfs/ft$$

4. Appropriate values of the coefficients a and b are interpolated from the table provided in the Design Aids Section of this Handbook.

- Rock diameter of 0.10 m
- Flow length of 1.0 m

a = 4.13
b = 0.6651

Substitute all values and calculate the ditch check ratio

$$Sq^{(1-b)}/a\ V_{15} = (1.0)(1.78^{(1-0.6651)})/(4.13)(1.2E\text{-}4) = 2448$$

5. Enter the Rock Check Dam Design Aids for medium texture soil (Figure RC-M) on the y-axis with Rock Check Ratio = 2.5E3, go to line and turn to the x-axis to read trapping efficiency.

6. Trapping efficiency equals 86 percent.

Note: The rock check dam must also be checked for overtopping since this is a common occurrence and results in total failure of the check. If the check overtops, the trapping efficiency is assumed to be zero.

Rock Check Dam

Rock Check Dam

Preventive Measures and Troubleshooting Guide

Field Condition	Common Solutions
Too much sediment has accumulated.	Remove accumulated sediment to recover holding capacity.
There is insufficient ponding area.	Space check dams farther apart. Increase height of dam.
The check dam is higher than the drainage channel.	Lower check dam so that it is 6 inches lower than the channel side.
Check dams wash away.	Use larger stone for the body of the check dam. Decrease check dam spacing by adding more dams.
Wrong type of materials is used to construct check dam.	Use larger stones. Do not use straw bales or silt fence for checks.