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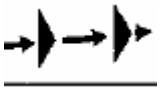


Check Dam

Description

This erosion control measure consists of a small riprap dam constructed across a swale, drainage ditch or other area of concentrated flow. Check dams are intended to prevent erosion by reducing the velocity of stormwater flow in a waterway. While small amounts of sediment will be collected by a check dam, it should not be considered a sediment-trapping device.

Selection Criteria

This BMP is applicable for use in small open channels (which drain typically ten acres or less). Specific applications include:

- Temporary or permanent swales or ditches in need of protection during establishment of grass linings.
- Temporary or permanent swales or ditches, which, due to a short length of service or for other reasons, cannot receive a permanent non-erodible lining for an extended period of time.
- Other locations where small localized erosion and resulting sedimentation problems exist.

Limitations

The main function of a rock check dam is to decrease velocity, not to collect sediment. Check dams are not to be used in a stream with perennial flows. Hay bales are not an acceptable material for these check dams.

Planning and Design

Although formal design is not required, the following standards should be used where rock check dams are proposed. The drainage area of the waterway should not be more than 10 acres. The height of the dam at the center should be at least 6 inches (1 foot for larger projects) lower than the height at the outer edges. This will form an overflow to minimize the potential for erosion due to flows around the ends of the dam where the rock check dam and natural ground meet. The flow depth on the overflow at the peak discharge generated by the design storm event should be checked to ensure that the structure would not be overtopped.

The height of the overflow at the center of the dam should be a minimum of 2 feet above the ditch bottom. The overflow may be as high as 3 feet above the channel bottom, provided that the overall structure would not be higher than the ditch banks. The upstream and downstream faces of the dam should be at a slope of 3H:1V or flatter.

Rock check dams should be constructed from machined riprap (Class A-1 or Class A-2). Mechanical or hand placement may be required to insure that the dam covers the entire width of the waterway and that the center of dam is lower than its edges.

The maximum spacing between dams should be such that the toe of the upstream dam is at the same elevation as the crest of the overflow on the downstream dam. Figure 2 provides a chart, which may be used to determine spacing based on this criterion.

If rock is the material used, a Geotextile Fabric (Type III) (Erosion Control) should be placed at the base of the Check Dam and should extend 3 feet beyond the downstream toe of the machined riprap slope. This fabric should meet the requirements of the standard specification for geotextiles (AASHTO designation M-288, Erosion Control).

The following material considerations should be used when designing rock check dams:

- Cross-section area of Check Dams (square feet, etc.)
- Amount of geotextile (Type III) (Erosion Control) needed (square yards, etc.)
- Sediment removal (cubic yards, etc.)

Note that the quantity computed for a check dam is not the horizontal plan area of the dam. Rather, it is the cross sectional area of the vertical projection of the dam above the bottom of the ditch. This area may be computed as the longitudinal distance across the top of the dam times the average height of the dam above the ditch.

Maintenance

Inspect for sediment buildup behind the check dam and signs of erosion around the check dam after each rain. Remove accumulated sediment whenever it reaches one-third of the upstream check dam height. Shovel by hand to prevent damage to the filter fabric and check dam. Dispose of accumulated sediment onsite in a manner that prevents additional movement of sediment. Permanent placement must also include guaranteed provisions for sediment removal.

Other Materials

Sandbag Check Dam

Sandbags filled with either aggregate or sand may also be used as a check dam. Sandbags should be staked and tied together, after being placed in a staggered fashion. Provide overflow weir in the center of channel similar to rock check dam. Figure 1 shows a typical check dam.

EXAMPLE APPLICATION (Larger scale project)

Given: A proposed V-ditch with 6H:1V side slopes has been designed along a roadway. The proposed ditch will be 200 feet long, and have a grade of 2% and a depth of 3.5 feet.

Find: Determine the required check dam size and spacing and calculate the required quantities.

Solution:

- Step1: Determine the height of the structure: Since the ditch is 3.5 feet deep, and the height at the center of the structure is to be 1 foot (for larger projects) less than at the sides of the ditch, the height of the structure at the center will be 2.5 feet.

- Step2: Determine the number of rock check dams required: Based on Figure 2, the rock check dams should be spaced every 125 feet. Thus, the

number of check dams needed may be computed by dividing the length of the ditch by the required spacing: 200/125 = 1.60 ˜ 2 Check dams

- Step3: Determine quantities (of materials):

  Check Dams (in square feet)
  As described above, the quantity for this item is based on the vertical cross sectional area of the dam. To estimate this area for one dam, the cross section is simplified to an inverted triangle with its ends at the top of banks of the ditch and a rise of 3.5 feet. Because the ditch has a "V" cross section with 6H: 1V slopes and a depth of 3.5 feet, the longitudinal distance across the top of the dam may be computed as:

  $L = 3.5 \times 6 \times 2 = 42$ Feet

  Thus, the area of the inverted triangle may be computed as:

  Area= ½ x Length x Rise = ½ x 42 x 3.5 = 73.5 square feet

  The combined area of the two check dams is therefore 147.0 square feet

Geotextiles (Type III, Erosion Control, per Square Yard)

As discussed above, the geotextile for this BMP should extend 3 feet from the downstream toe of the dam. Thus, the quantity for this item will be computed based on the planimetric area of the footprint of the dam, combined with this 3-foot extension.
As depicted in the standard drawing, the footprint of a check dam in a "V" ditch forms a pattern composed of two triangles and a rectangle. Thus, the area of the footprint may be determined by computing the area of each shape. To simplify the computations, it will again be assumed that the top of the dam is horizontal, so that the rise of the dam at the center will be 3.5 feet. Since the upstream and downstream faces of the dam are at a 3H:1V slope (larger projects), the width of each triangle in the direction of flow may be computed as:

Width = 3×3.5 = 10.5 feet

The transverse distance across the top of the dam was computed above as 42 feet, thus, the area of the each triangle may be computed as:

Triangle Area = ½ x 10.5 × 42 = 220.5 ft2

Thus, the total area of the two triangles is 441.0 ft2. The area of the rectangle formed by the center of the dam may be computed as:

Rectangle Area = 1.5× 42 = 63.0 ft2

These results can be added together for a total footprint area of 504.0 ft2. The area of the 3 feet of geotextile extended downstream of the dam may be computed as:

Extended Area = 42×3 = 126.0 ft2

Thus, the area of geotextile for one dam is 630.0 ft2, and the total area for two dams is 1260.0 ft2. This area is converted to square yards to yield a final quantity of 140.0 Square Yards.

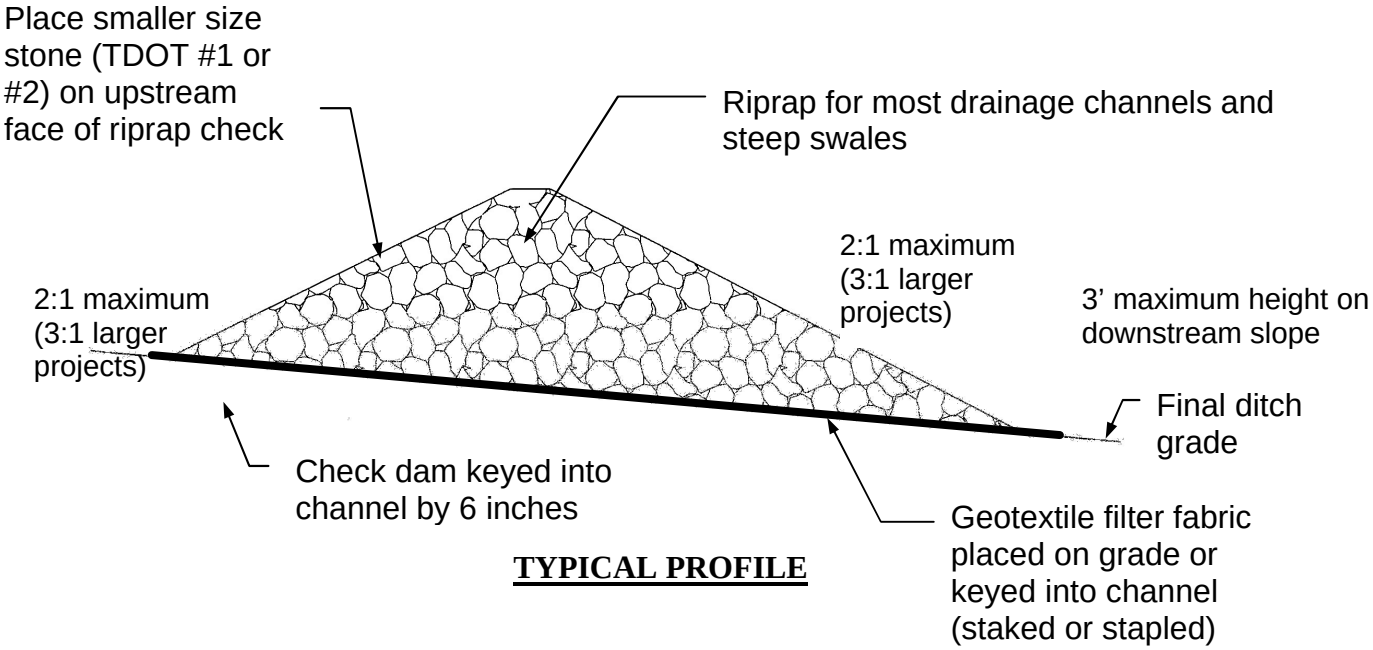
Photo 1 & 2 Installation of Rock Check Dam

Location: SR-37, Carter County, TN (2004)
Source: TDOT DESIGN DIVISION DRAINAGE MANUAL August 1, 2006

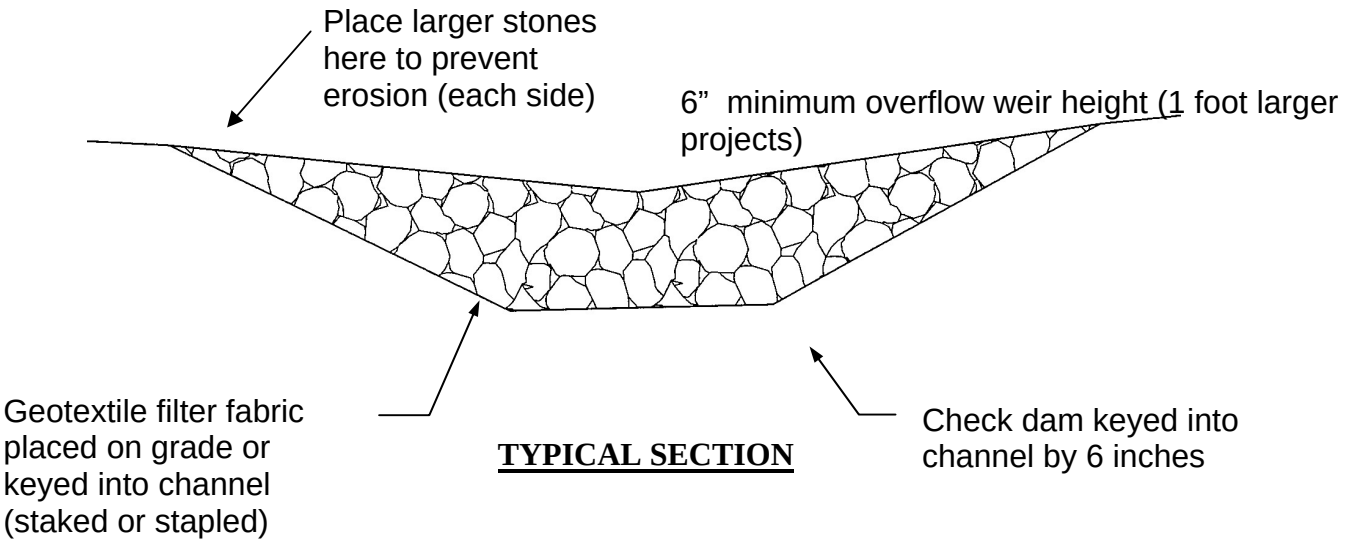
Photos 3 & 4 Rock Check Dams

Photo source http://www.duluthstreams.org/stormwater/toolkit/images/checkDams.jpg

Figure 1
Rock Check Dams

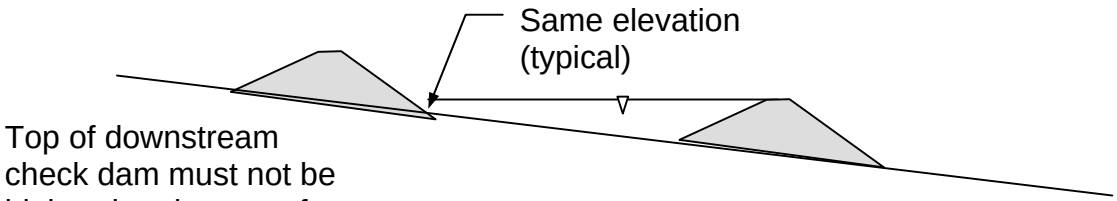


TYPICAL PROFILE



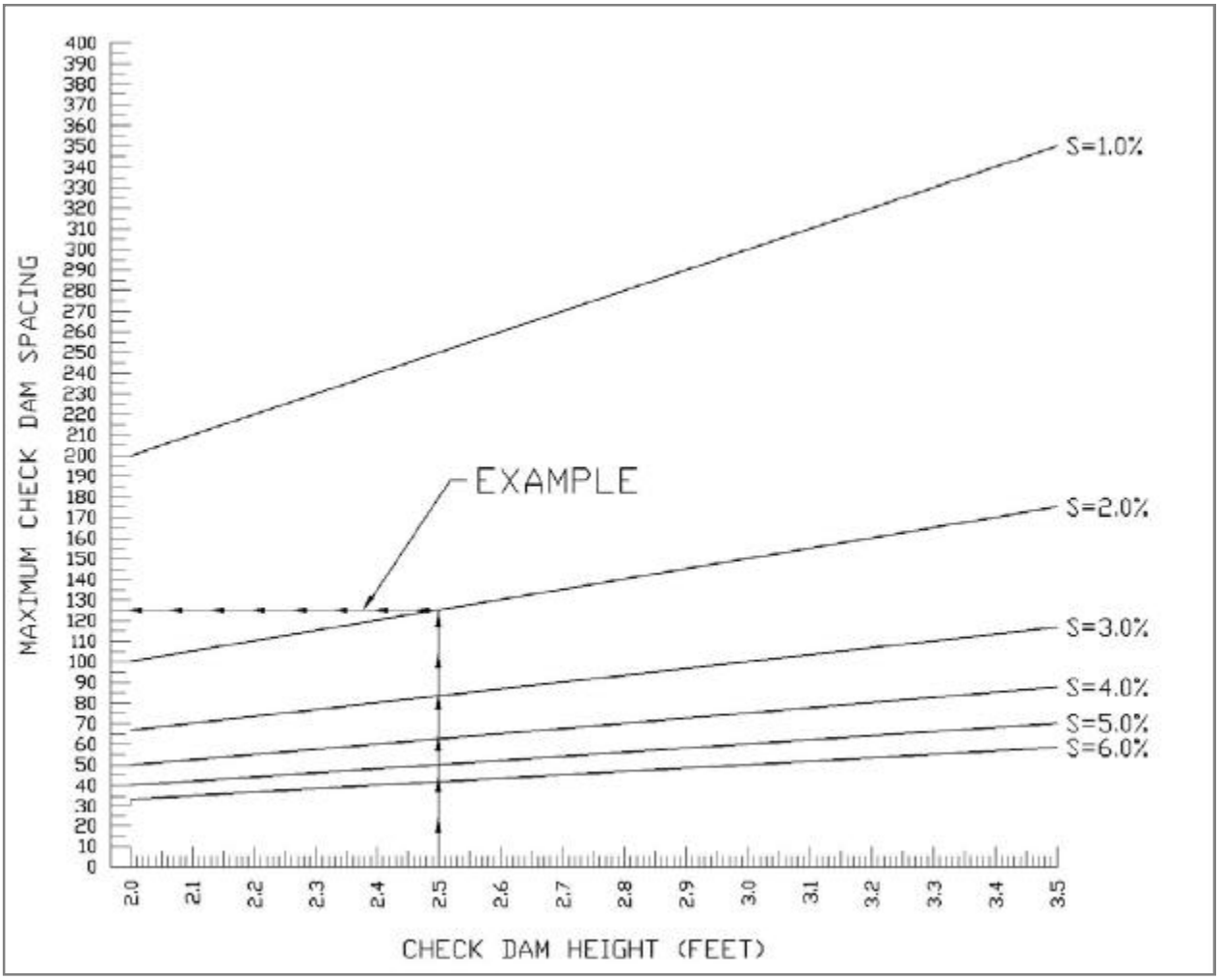
TYPICAL SECTION

NOT TO SCALE



SPACING

Figure 2
Rock Dam Spacing



For a full drawing with more Check Dam heights, go to:
http://www.tdot.state.tn.us/Chief_Engineer/engr_library/design/StdDrwgEng_PDFs/ECSTR6_041506.pdf

References

Tennessee Department of Environment and Conservation (TDEC). July 1992. *Tennessee Erosion and Sediment Control Handbook*.

United States Environmental Protection Agency (USEPA). April 1990. *Sedimentation and Erosion Control: An Inventory of Current Practices* (Draft).