# Check Dam Cd

## DEFINITION

A temporary grade control structure, or dam constructed across a swale, drainage ditch, or area of concentrated flow.

## PURPOSE

To minimize the erosion rate by reducing the velocity of the storm water in areas of concentrated flow.

## CONDITIONS

This practice is applicable for use in small open channels and is not to be used in a live stream. Specific applications include:

1. Temporary or permanent swales or ditches in need of protection during establishment of grass linings.

2. Temporary or permanent swales or ditches that, due to their short length of service or other reasons, cannot receive a permanent non-erodible lining for an extended period of time.

3. Other locations where small localized erosion and resulting sedimentation prob lems exist.

## DESIGN CRITERIA

Check dams should be designed using 2.0 cfs. For any flows exceeding 2.0 cfs, check dams may be used in conjunction with other BMPs in the channel. Dam height should be 24 inches maximum measured to the center of the check dam.

**Drainage Area**

For stone check dams, the drainage area shall not exceed two acres. For straw-bale check dams and compost filter socks, the drainage area shall not exceed one acre.

**Side Slopes**

Side slopes shall be 2:1 or flatter.

**Spacing**

Two or more check dams in a series shall be used for drainage areas greater than one (1) acre. Maximum spacing between dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam. (See Figure 6-12.1)

**Geotextiles**

A geotextile should be used as a separator between the graded stone and the soil base and abutments. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile shall be selected/specified in accordance with AASHTO M288-06 Section 7.3, *Separation Requirements*, Table 3. Geotextiles shall be "set" into the subgrade soils. The geotextile shall be placed immediately adjacent to the subgrade without any voids and extend five feet beyond the downstream toe of the dam to prevent scour.

## CONSTRUCTION SPECIFICATIONS

**Stone Check Dams** Cd-S

Stone check dams should be constructed of graded size 2-10 inch stone. Mechanical or hand placement shall be required to insure compete coverage of the entire width of the ditch or swale and that the center of the dam is lower than the edges. **The center of the check dam must be at least 9 inches lower than the outer edges.** (See Figure 6-12.2)

**Straw-bale Check Dams** Cd-Hb

Staked and embedded straw-bales may be used as temporary check dams in concentrated flow areas while vegetation is becoming established. They shall not be used where the drainage area exceeds one acre. Straw-bales should be installed per Figure 6-12.3.

**Installation**

Bales should be bound with wire or nylon string. Twine bound bales are less durable. The bales should be placed in rows with bale ends tightly abutting the adjacent bales.

**Downstream Row** (Refer to Figure 6-12.3)

Dig a trench across the small channel, wide enough and deep enough so that the top of the row of bales placed on their long, wide side is level with the ground. The tops of bales across the center of the channel should all be level and set at the same elevation. Place the bales in position and stake them according to the instructions below.

**Upstream Row**

Dig another trench across the small channel, upstream and immediately adjacent to the first row of bales. The trench should be wide enough to accommodate a row of bales set vertically on their long edge. The trench should be deep enough so that at least 6 inches of each bale is below ground starting with the bale in the channel bottom. The trench should be as level as possible so that the tops of the bales across the center of the channel are level and water can flow evenly across them. Continue this trench up the side slopes of the small channel to a point where the unburied bottom line of the highest bale (Point “C”, Figure 6-12.3) is higher than the top of the bales that are in the center of the channel (Point “D”, Figure 6-12.3).

**Anchorage**

Drive standard 2 x 2 stakes or #4 rebar through the bales and into the ground 1 1/2 to 2 feet for anchorage. The first stake in each bale should be driven toward a previously laid bale to force the bales together (See Figure 6-12.3).

Reference: Colorado NRCS Straw Bale Check Dam

## Compost Filter Sock Cd-Fs

The filter sock should be staked in the center. If the compost fi lter sock is to be left as a permanent filter or part of the natural landscape, it may be seeded at time of installation for establishment of permanent vegetation.

Compost filter media used for compost filter sock filler material shall be weed free and derived from a well-decomposed source of organic matter.

The compost shall be produced using an aerobic composting process meeting CFR 503 regulations including time and temperature data.

The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted.

Test methods for the items below should follow US Composting Council Test Methods for the Examination of Composting and Compost guidelines for laboratory procedures:

A. pH – 5.0-8.0 in accordance with TMECC 04.11-A, “Electrometric pH Determinations for Compost”.

B. Particle size – 99% passing a 2-inch (50 mm) sieve and a maximum of 40% passing a 3/8-inch (~ 9.5 mm) sieve, in accordance with TMECC 02.02-B, “Sample Sieving for Aggregate Size Classification”. (Note - In the field, product commonly is between ½ and 2 inches (12.5 and 50 mm) particle size).

C. Moisture content of less than 60% in accordance with standardized test methods for moisture determination.

D. Material shall be relatively free (<1% by dry weight) of inert or foreign manmade materials.

E. Sock containment system for compost filter media shall be a photodegradable or biodegradable knitted mesh material and should have 1/8 to 3/8 inch (3.2 to 9.5 mm) openings.

**MAINTENANCE**

Periodic inspection and required maintenance must be provided. Sediment shall be removed when it reaches a depth of one-half the original dam height or before. If the area is to be mowed, check dams shall be removed once final stabilization has occurred. Otherwise check dams may remain in place permanently. After removal, the area beneath the dam shall be seeded and mulched immediately.

**TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN**

1.cfs in the channel/ditch that the check dam is being used in:_____

2. Above 2.0 cfs: Yes_____ No_____

3. If Yes, list BMP being used in conjunction with check dams:_____

# STONE CHECK DAM

## SPACING BETWEEN CHECK DAMS

A = THE TOE OF THE UPSTREAM CHECK DAM.
B = TOP OF THE DOWNSTREAM CHECK DAM.
L = THE DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION.

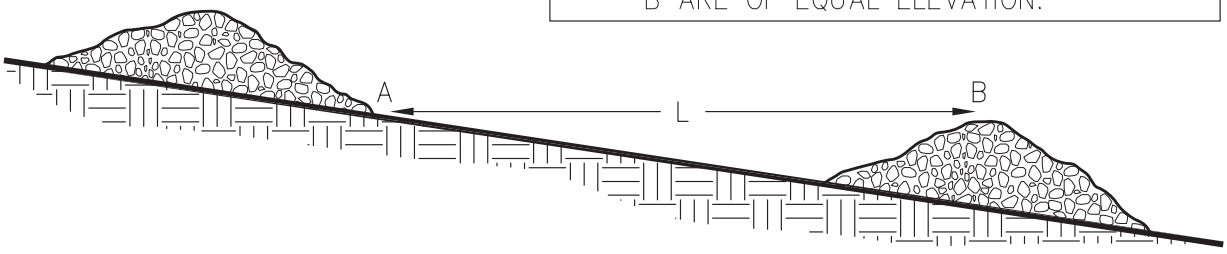
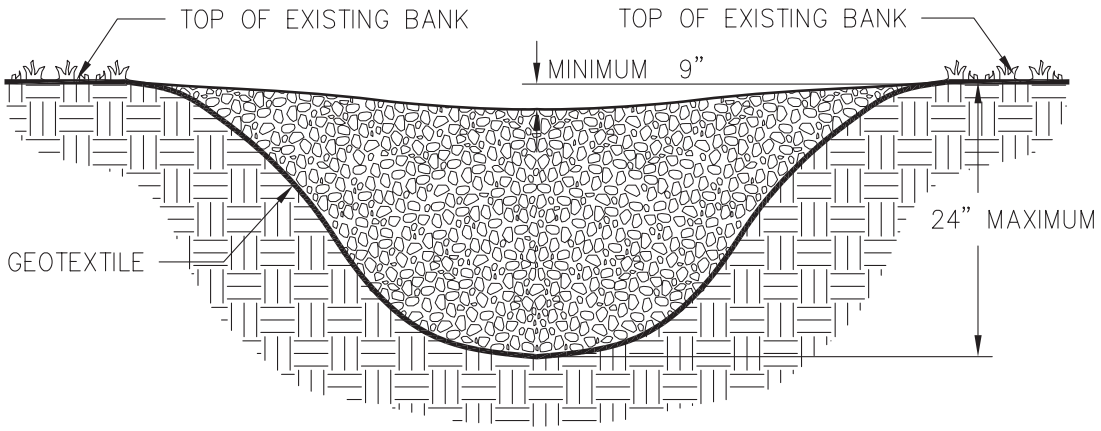


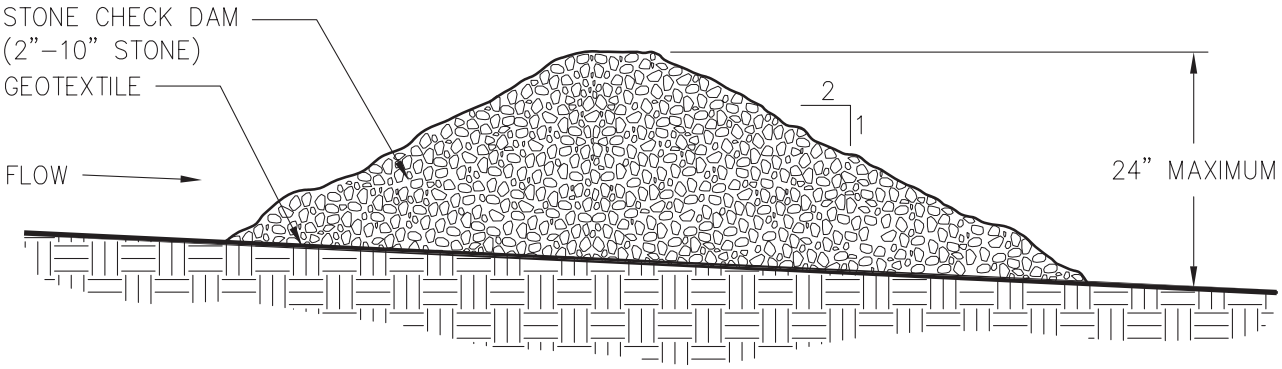

**Figure 6-12.1**

# STONE CHECK DAM

## CROSS SECTION




## PROFILE VIEW

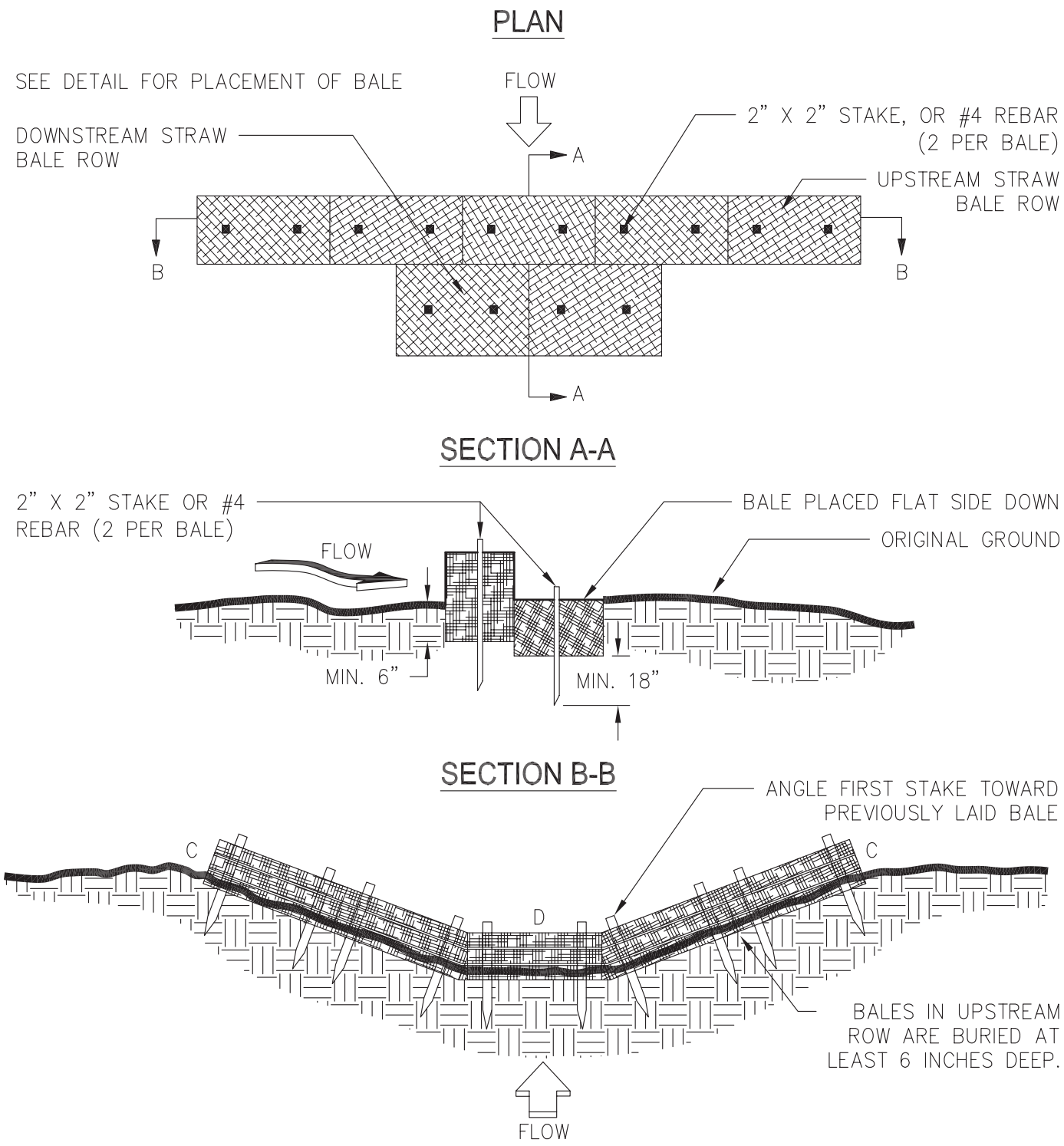



NOTES:

1. CHECK DAMS ARE TO BE USED ONLY IN SMALL OPEN CHANNELS (THEY ARE NOT TO BE USED IN LIVE STREAMS).
2. THE DRAINAGE AREA FOR STONE CHECK DAMS SHALL NOT EXCEED TWO ACRES.
3. THE CENTER OF THE CHECK DAM MUST BE AT LEAST 9 INCHES LOWER THAN THE OUTER EDGES.
4. THE DAM HEIGHT SHOULD BE A MAXIMUM OF 2 FEET FROM CENTER TO RIM EDGE.
5. THE SIDE SLOPES OF THE CHECK DAM SHALL NOT EXCEED A 2:1 SLOPE.
6. GEOTEXTILE SHALL BE USED TO PREVENT THE MITIGATION OF SUBGRADE SOIL PARTICLES INTO THE STONES (REFER TO AASHTO M288–96, SECTION 7.3, TABLE 3).

**Figure 6-12.2**

# TYPICAL STRAW BALE CHECK DAM



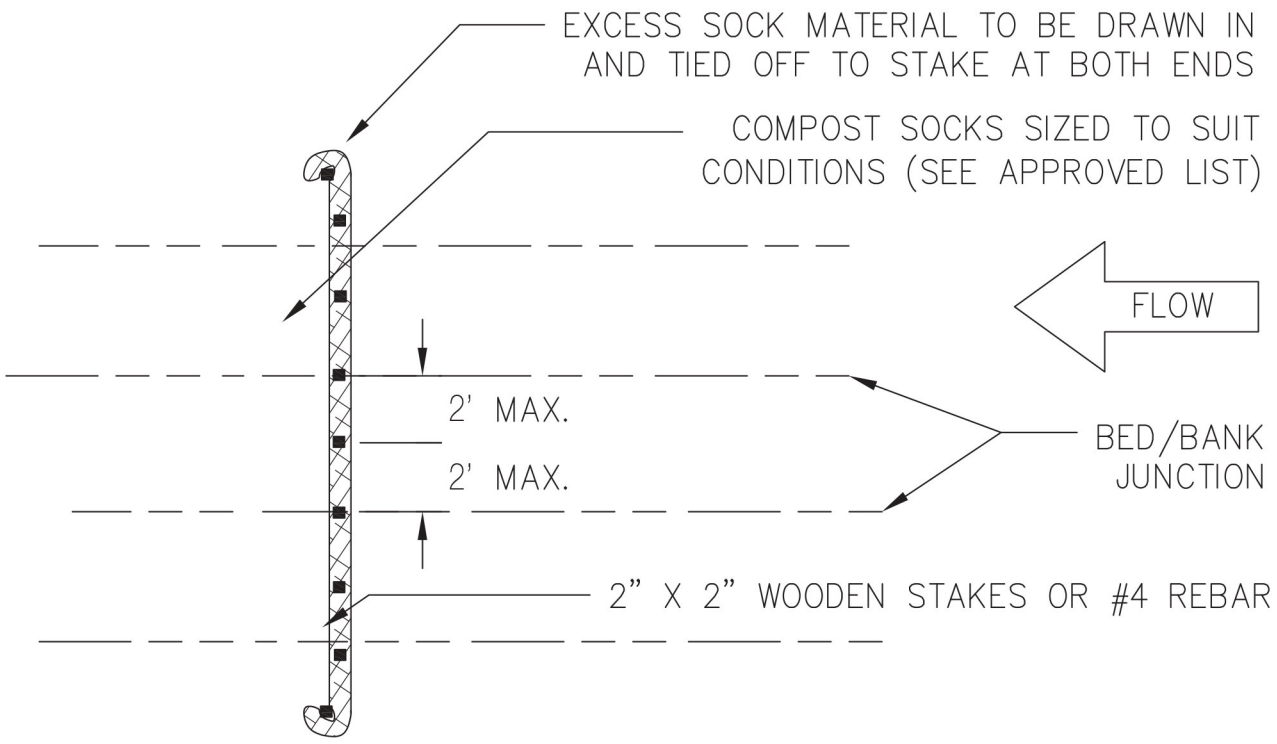

NOTES:

1. BALES SHOULD BE BOUND WITH WIRE OR NYLON STRING AND SHOULD BE PLACED IN ROWS WITH BALE ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. REMOVE #4 REBAR AFTER STRAW BALES ARE NO LONGER IN PLACE.
3. POINT C OF SECTION B–B SHOULD ALWAYS BE HIGHER THAN POINT D.
4. STRAW-BALE CHECK DAMS SHALL NOT BE USED WHERE THE DRAINAGE AREA EXCEEDS ONE ACRE.

**Figure 6-12.3**

# COMPOST SOCKS FOR CHECK DAMS

## TYPICAL PLAN




NOTES:

1. ALL MATERIAL TO MEET SPECIFICATIONS.
2. PLACE ONE STAKE AT THE CENTER OF THE DITCH/CHANNEL. ALSO PLACE STAKES AT THE BED/BANK JUNCTION AND AT END OF THE DEVICE NOT SPACED MORE THAN 2 FEET APART.
3. SEDIMENT SHOULD BE REMOVED FROM BEHIND THE CHECK DAM ONCE THE ACCUMULATED HEIGHT HAS REACHED $\frac{1}{2}$ THE HEIGHT OF THE CHECK DAM.
4. CHECK DAMS CAN BE DIRECT SEEDED AT THE TIME OF INSTALLATION.
5. MINIMUM STAKING DEPTH FOR SAND, SILT, AND CLAY SHALL BE 18".
6. COMPOST FILTER SOCK TO BE AT LEAST 18" DIA.

**Figure 6-12.4**

# Channel Stabilization

Ch

**DEFINITION**

Improving, constructing or stabilizing an open channel for water conveyance.

**PURPOSE**

Open channels are constructed or stabilized to be non-erosive, with no sediment deposition and to provide adequate capacity for flood water, drainage, other water management practices, or any combination thereof.

**CONDITIONS**

This standard applies to the improvement, construction or stabilization of open channels and existing ditches with drainage areas less than one square mile. This standard applies only to channels conveying intermittent flow, not to channels conveying a continuous, live stream.

An adequate outlet for the modified channel length must be available for discharge by gravity flow. Construction or other improvements of the channel should not adversely affect the environmental integrity of the area and must not cause significant erosion upstream or flooding and/or sediment deposition downstream.

**DESIGN CRITERIA**

**Planning**

The alignment and design of channels shall give careful consideration to the preservation of valuable fish and wildlife habitat and trees of significant value for wildlife food or shelter or for aesthetic purposes.

Where channel construction will adversely affect significant fish or wildlife habitat, mitigation measures should be included in the plan. Mitigation measures may include pools, riffles, flats, cascades or other similar provisions.

As many trees as possible are to be left inside channel rights-of-way considering the requirements of construction, operation, and maintenance.

Unusually large or attractive trees shall be preserved.

**Realignment**

The realignment of channels shall be kept to an absolute minimum and should be permitted only to correct an adverse environmental condition.

**Channel Capacity**

The capacity for open channels shall be determined by procedures applicable to the purposes to be served.

**Hydraulic Requirements**

Manning's formula shall be used to determine velocities in channels. The "n" values for use in this formula shall be estimated using currently accepted guides along with knowledge and experience regarding the conditions. Acceptable guides can be found in hydrology textbooks.

**Channel Cross-Section**

The required channel cross-section and grade are determined by the design capacity, the materials in which the channel is to be constructed, and the requirements for maintenance. A minimum depth may be required to provide adequate outlets for subsurface drains and tributary channels.

**Channel Stability**

All channel construction, improvement and modification shall be in accordance with a design expected to result in a stable channel that can be maintained.

**Characteristics of a Stable Channel**

1. Aggradation or degradation does not interfere with the function of the channel or affect adjacent areas.

2. The channel banks do not erode to the extent that the channel cross-section is changed appreciably.

3. Excessive sediment bars do not develop.

4. Excessive erosion does not occur around culverts, bridges or elsewhere.

5. Gullies do not form or enlarge due to the entry of uncontrolled surface flow to the channel.

6. The determination of channel stability considers "bankfull" flow. Bankfull flow is defined as flow in the channel that creates a water surface that is at or near normal ground elevation for a significant length of a channel reach. Excessive channel depth created by cutting through high ground should not be considered in determinations of bankfull flow.

## CHANNEL LININGS AND STRUCTURAL MEASURES

Where channel velocities exceed safe velocities for vegetated lining due to increased grade or a change in channel cross-section, or where durability of vegetative lining is adversely affected by seasonal changes, channel linings of rock, concrete or other durable material may be needed. Grade stabilization structures may also be needed.

The following categories for flow velocities shall apply when selecting the channel lining:

**Category 1 (less than 5 ft/sec*)** **Ch-1**

### Vegetated Lining

A vegetated lining may be used to stabilize channels with a velocity of less than five ft/s temporary erosion control blankets or sod shall be used on all channels and concentrated flow areas to aid in the establishment of the vegetated lining. Refer to specifications **Ds3 - Disturbed Area Stabilization (With Permanent Vegetation), Ds4 - Disturbed Area Stabilization (With Sodding), and Ss – Slope Stabilization,** Hydraulic Erosion Control Products (HECPs) are not intended to be applied in channels, swales or other areas where concentrated flows are anticipated, unless installed in conjunction with Rolled Erosion Control Products (RECPs).

**Category 2 (greater than or equal to 5 ft/sec* but less than 10 ft/sec*)** **Ch-2**

### Turf Reinforcement Matting

Turf Reinforcement Matting (TRM) shall be used, if a vegetated lining is used in channels with velocities greater than or equal to 5 feet/sec but less than 10 ft/sec. TRM is permanent geosynthetic erosion control matting that is used in channels to stabilize the soil while permanent vegetation is rooting, and to provide additional long-term protection.

Velocities in channels when flowing at the bankfull discharge or the 25-year frequency discharge, whichever is the greater, shall be used in determining the appropriate TRM for stabilization of the channels.

### Rock Riprap Lining

Rock riprap shall be designed to resist displacement when the channel is flowing at the bankfull discharge or 25-year frequency discharge, whichever is the greater. Rock riprap lining should be used when channel velocities are greater than or equal to 5 ft/sec but less than 10 ft/sec.

Dumped and machine placed riprap should not be installed on slopes steeper than 1-1/2 horizontal to 1 vertical. Rock shall be dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. Rock shall be installed according to standards specified in Riprap, Appendix C.

A filter blanket layer consisting of an appropriately designed graded filter sand and/or gravel or geotextile material shall be placed between the riprap and base material. The gradation of the filter blanket material shall be designed to create a graded filter between the base material and the riprap. A geotextile can be used as a substitution for a layer of sand in a graded filter or as the filter blanket. Criteria for selecting an appropriate geotextile and guidance for recommended drop heights and stone weights are found in AASH-TO M288-96 Section 7.5, Permanent Erosion Control Specifications.

**Category 3 (greater than or equal to 10 ft/sec*)** Ch-3

**Concrete Lining**

If a channel has velocities high enough to require a concrete lining (when channel velocities exceed 10 ft/sec), methods should be utilized to reduce the velocity of the runoff and reduce erosion at the outlet - a common problem created by the smooth, concrete lining. Refer to specification **St - Storm Drain Outlet Protection** for information regarding energy dissipators.

If a concrete lining is chosen, it shall be designed according to currently accepted guides for structural and hydraulic adequacy. It must be designed to carry the required discharge and to withstand the loading imposed by site conditions.
A separation geotextile should be placed under concrete linings to prevent undermining in the event of stress cracks due to settlement of the base material. The separation geotextile will keep the base material soils in place and minimize the likelihood of a system failure.

**Grade Stabilization Structures**

Grade stabilization structures are used to reduce or prevent excessive erosion by reduction of velocities in the watercourse or by providing structures that can withstand and reduce the higher velocities. They may be constructed of concrete, rock, masonry, steel, aluminum, or treated wood.

These structures are constructed where the capability of earth and vegetative measures is exceeded in the safe handling of water at permissible velocities, where excessive grades or overall conditions are encountered or where water is to be lowered structurally from one elevation to another. These structures should generally be planned and installed along with or as a part of other erosion control practices.

The structures shall be designed hydraulically to adequately carry the channel discharge and structurally to withstand loadings imposed by the site conditions. The structure shall meet requirements of **Gr - Grade Stabilization Structure**.

* The equivalent shear stress may also be used to determine the appropriate measure.

TO BE SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN

1. The velocity in the channel, in ft/sec, for when the channel is flowing at the bank-full discharge or 25-year frequency discharge, whichever is the greater.

2. The type of lining to be used to stabilize the channel, i.e. vegetation (Ch-1): indicate type of vegetation and matting or blanket to be used), riprap (Ch-2): indicate average stone size), or concrete (Ch-3).