

Description

Rolled Erosion Control Products (RECPs) include a variety of temporary or permanently installed manufactured products designed to control erosion and enhance vegetation establishment and survivability, particularly on slopes and in channels. For applications where natural vegetation alone will provide sufficient permanent erosion protection, temporary products such as netting, open weave textiles and a variety of erosion control blankets (ECBs) made of biodegradable natural materials (e.g., straw, coconut fiber) can be used. For applications where natural vegetation alone will not be sustainable under expected flow conditions, permanent rolled erosion control products such as turf reinforcement mats (TRMs) can be used. In particular, turf reinforcement mats are designed for discharges that exert velocities and shear stresses that exceed the typical limits of mature natural vegetation.



Photograph RECP-1. Erosion control blanket protecting the slope from erosion and providing favorable conditions for revegetation.

Appropriate Uses

RECPs can be used to control erosion in conjunction with revegetation efforts, providing seedbed protection from wind and water erosion. These products are often used on disturbed areas on slopes that are 3:1 or steeper, in areas with highly erosive soils, as part of drainageway stabilization, or any location where additional protection is needed. In order to select the appropriate RECP for site conditions, it is important to have a general understanding of the general types of these products, their expected longevity, and general characteristics. The Erosion Control Technology Council (ECTC 2014) characterizes RECPs into these categories:

Temporary RECPs:

- **Mulch control netting:** A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable rolled erosion control product to anchor loose fiber mulches.
- **Open weave textile:** A temporary degradable rolled erosion control product composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.
- **Erosion control blanket (ECB):** A temporary degradable rolled erosion control product composed of processed natural or polymer fibers which are mechanically, structurally or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment. ECBs can be further differentiated into rapidly degrading single-net and double-net types or slowly degrading types.

| Rolled Erosion Control Products | |
|---------------------------------|-----|
| Functions | |
| Erosion Control | Yes |
| Sediment Control | No |
| Site/Material Management | No |
| Vegetation Protection | Yes |

Permanent RECPs:

- **Turf Reinforcement Mat (TRM):** A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh, and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term functionality by permanently reinforcing vegetation during and after maturation. Note: TRMs are typically used in hydraulic applications, such as high flow ditches and channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation or in areas where limited vegetation establishment is anticipated.

Tables RECP-1 and RECP-2 provide guidelines for selecting RECPs appropriate to site conditions and desired longevity. Table RECP-1 is for conditions where natural vegetation alone will provide permanent erosion control, whereas Table RECP-2 is for conditions where vegetation alone will not be adequately stable to provide long-term erosion protection due to flow or other conditions.

Table RECP-1. ECTC Standard Specification for Temporary Rolled Erosion Control Products
(Adapted from Erosion Control Technology Council 2017)

| Product Description | Slope Applications | | Channel Applications | Minimum Tensile Strength | Expected Longevity |
|---|--------------------|-----------------------|--------------------------|--------------------------|--------------------|
| | Maximum Gradient | C Factor ¹ | | | |
| Mulch Control Nets & Open Weave Textiles ⁴ | 5:1 (H:V) | ≤0.10 @ 5:1 | 1.0 lbs/ft ² | 125 lbs/ft | Up to 12 months |
| Netless Rolled Erosion Control Blankets | 3:1 (H:V) | ≤0.10 @ 3:1 | 1.0 lbs/ft ² | 125 lbs/ft | |
| Single-net Erosion Control Blankets | 3:1 (H:V) | ≤0.10 @ 3:1 | 1.5 lbs/ft ² | 60 lbs/ft | |
| Double-net Erosion Control Blankets | 2:1 (H:V) | ≤0.10 @ 2:1 | 1.75 lbs/ft ² | 75 lbs/ft | |
| Erosion Control Blankets & Open Weave Textiles (slowly degrading) | 2:1 (H:V) | ≤0.05 @ 2:1 | 2.00 lbs/ft ² | 100 lbs/ft | 24 months |
| Erosion Control Blankets & Open Weave Textiles (long term) | 1.5:1 (H:V) | ≤0.05 @ 1:1 | 2.25 lbs/ft ² | 100 lbs/ft | 36 months |

¹ This value should be the maximum C Factor from standardized large-scale rainfall performance testing,

ASTM D6459 or equivalent deemed acceptable by the engineer.

² Required minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion (>0.5 in soil loss) during a 30-minute flow event in large-scale performance testing, ASTM d6460 or equivalent deemed acceptable by the engineer.

³ The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.

⁴ C Factor and shear stress for mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material. (See Section 5.3 of Chapter 7 Construction BMPs for more information on the C Factor.)

Table RECP-2. ECTC Standard Specification for Permanent¹ Rolled Erosion Control Products
(Adapted from: Erosion Control Technology Council 2017)

| Product Type | Slope Applications | Channel Applications | |
|---|--------------------|-------------------------------------|---------------------------------------|
| Turf Reinforcement Mats with a minimum thickness of 0.25 inches per ASTM D 6525 and UV stability of 80% per ASTM D 4355 (500 hours exposure). | Maximum Gradient | Maximum Shear Stress ^{2,3} | Minimum Tensile Strength (ASTM D6818) |
| | 1:1 (H:V) | 6.0 lbs/ft ² | 150 lbs/ft |
| | 1:1 (H:V) | 8.0 lbs/ft ² | 175 lbs/ft |
| | 0.5:1 (H:V) | 10.0 lbs/ft ² | 200 lbs/ft |

¹ For TRMs containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.

² Maximum allowable shear stress TRM (fully vegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in.) soil loss) during a 30-minute flow event in large scale testing.

³ Acceptable large-scale testing protocols may include ASTM D 6460, or other independent testing deemed acceptable by the engineer. Large scale performance testing typically involves limited soil types and vegetative stands, therefore it is recommended that an appropriate factor of safety be used in design and product selection.

EC-6 Rolled Erosion Control Products (RECP)

Design and Installation

RECPs should be installed according to manufacturer's specifications and guidelines. Regardless of the type of product used, it is important to ensure no gaps or voids exist under the material and that all corners of the material are secured using stakes and trenching. Continuous contact between the product and the soil is necessary to avoid failure. Never use metal stakes to secure temporary erosion control products. Often wooden stakes are used to anchor RECPs; however, wood stakes may present installation and maintenance challenges and generally take a long time to biodegrade. Some local jurisdictions have had favorable experiences using biodegradable stakes. The designer should consider the differences in strength prior to selecting the appropriate stake material. Wood stakes are generally used in trench applications and areas with the need for additional hold down strength.

This BMP Fact Sheet provides design details for several commonly used ECB applications, including:

- ECB-1 Pipe Outlet to Drainageway
- ECB-2 Small Ditch or Swale
- ECB-3 Outside of Drainageway
- ECB-4 Drainageway

Staking patterns are also provided in the design details according to these factors:

- ECB type
- Slope or channel type

These design details are intended to serve as general guidelines for design and installation. Engineers should adhere to manufacturer's installation recommendations.

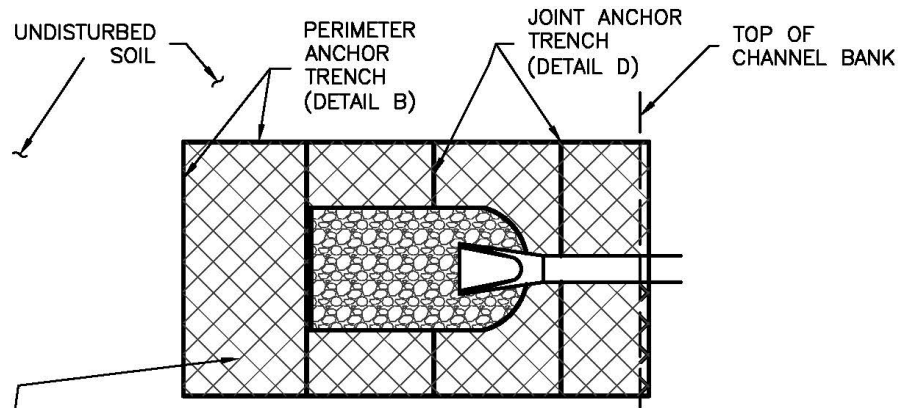
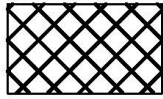
Maintenance and Removal

Inspection of erosion control blankets and other RECPs includes:

- Check for general signs of erosion, including voids beneath the mat. If voids are apparent, fill the void with suitable soil and replace the erosion control blanket, following the appropriate staking pattern. Good soil to blanket contact throughout the disturbed area is critical for the product to function as intended.
- Check for damaged or loose stakes and secure loose portions of the blanket.
- Check the area to see if additional BMP are needed to prevent recurrence of any erosion issues.
- Check to make sure the installed product is adequate and evaluate the need for modification or replacement of the selected product.

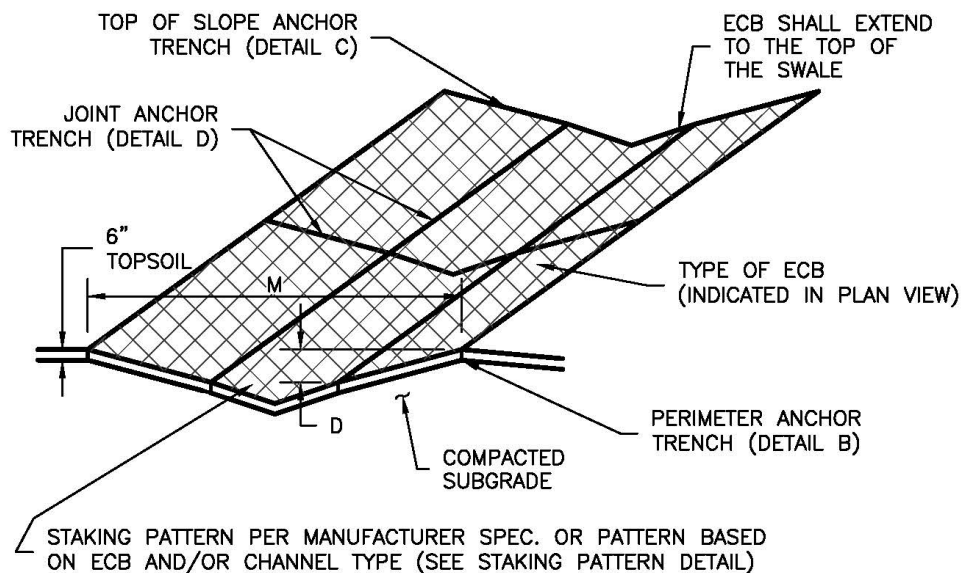
Erosion control blankets and other RECPs that are biodegradable typically do not need to be removed after construction. If they must be removed, then an alternate soil stabilization method should be installed promptly following removal.

Turf reinforcement mats, although generally resistant to biodegradation, are typically left in place as a dense vegetated cover grows in through the mat matrix. The turf reinforcement mat provides long-term stability and helps the established vegetation resist erosive forces.

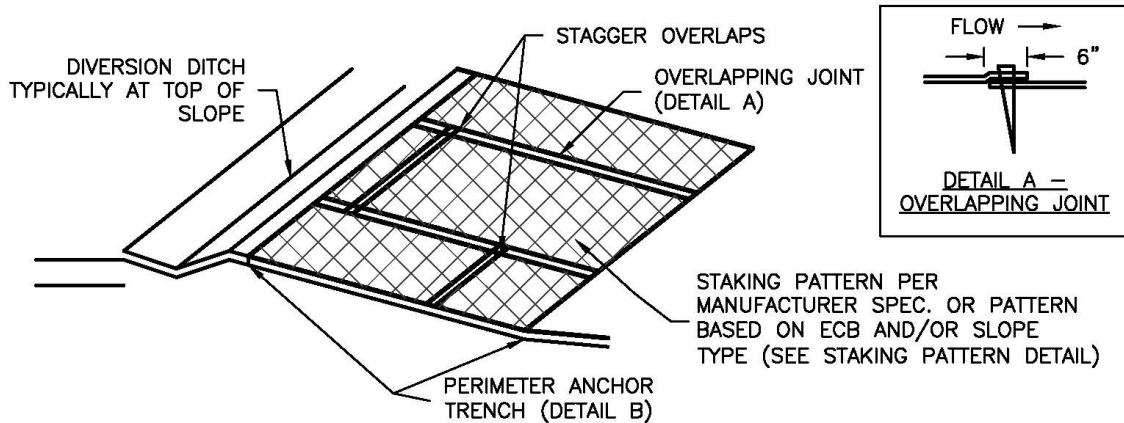


TYPE OF ECB AS INDICATED IN PLAN VIEW. INSTALL IN ALL DISTURBED AREAS OF STREAMS AND DRAINAGE CHANNELS TO DEPTH D ABOVE CHANNEL INVERT. ECB SHALL GENERALLY BE ORIENTED PARALLEL TO FLOW DIRECTION (I.E. LONG DIMENSIONS OF BLANKET PARALLEL TO FLOWLINES) STAKING PATTERN SHALL MATCH ECB AND/OR CHANNEL TYPE.

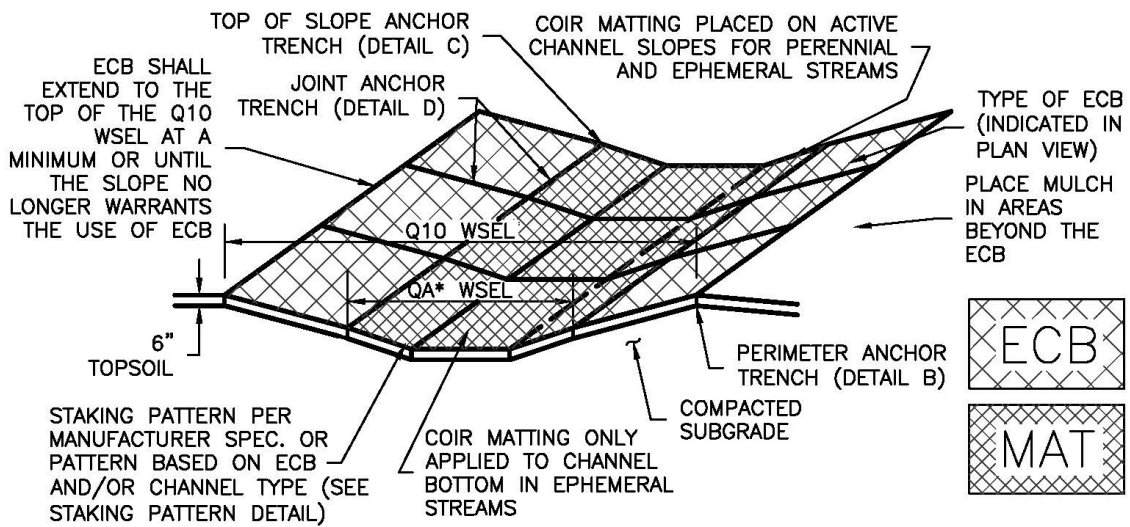
ECB-1. PIPE OUTLET TO DRAINAGEWAY



ECB-2. SMALL DITCH OR SWALE



ECB-3. OUTSIDE OF DRAINAGEWAY

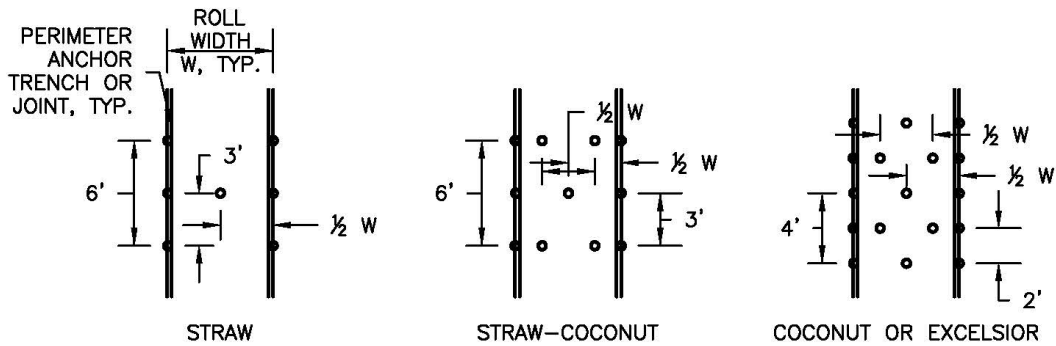


*CONSULT A GEOMORPHOLOGIST TO ASSIST IN DETERMINING ACTIVE CHANNEL FLOW (QA)

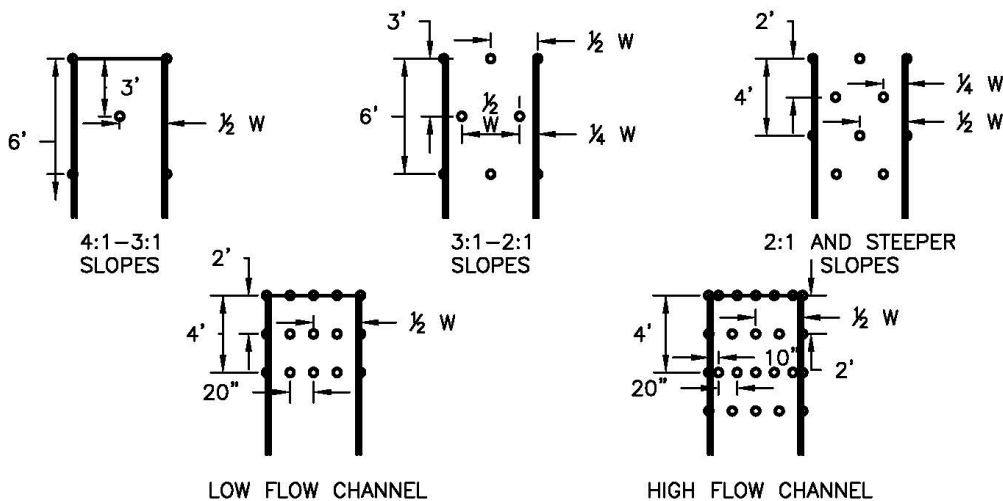
ECB-4. DRAINAGEWAY

| TABLE ECB-1. ECB MATERIAL SPECIFICATIONS | | | | |
|--|-----------------|---------------|-------------------|-----------------------|
| TYPE | COCONUT CONTENT | STRAW CONTENT | EXCELSIOR CONTENT | RECOMMENDED NETTING** |
| STRAW* | - | 100% | - | DOUBLE/NATURAL |
| STRAW-COCONUT | 30% MIN | 70% MAX | - | DOUBLE/NATURAL |
| COIR MAT | 100% | - | - | DOUBLE/NATURAL |
| EXCELSIOR | - | - | 100% | DOUBLE/NATURAL |

*STRAW ECBs MAY ONLY BE USED OUTSIDE OF STREAMS AND DRAINAGE CHANNEL.
 **ALTERNATE NETTING INCLUDING SINGLE NETTING AND SYNTHETIC PHOTODEGRADABLE FIBER MAY BE ACCEPTABLE IN SOME JURISDICTIONS

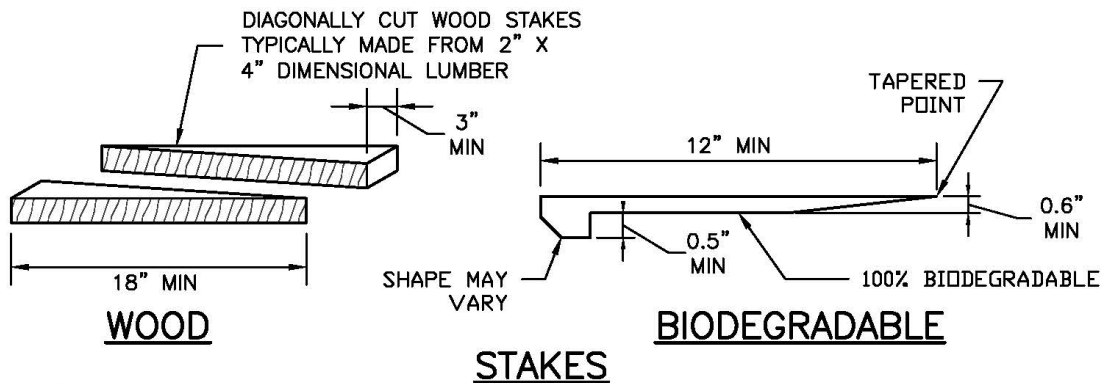


STAKING PATTERNS BY ECB TYPE



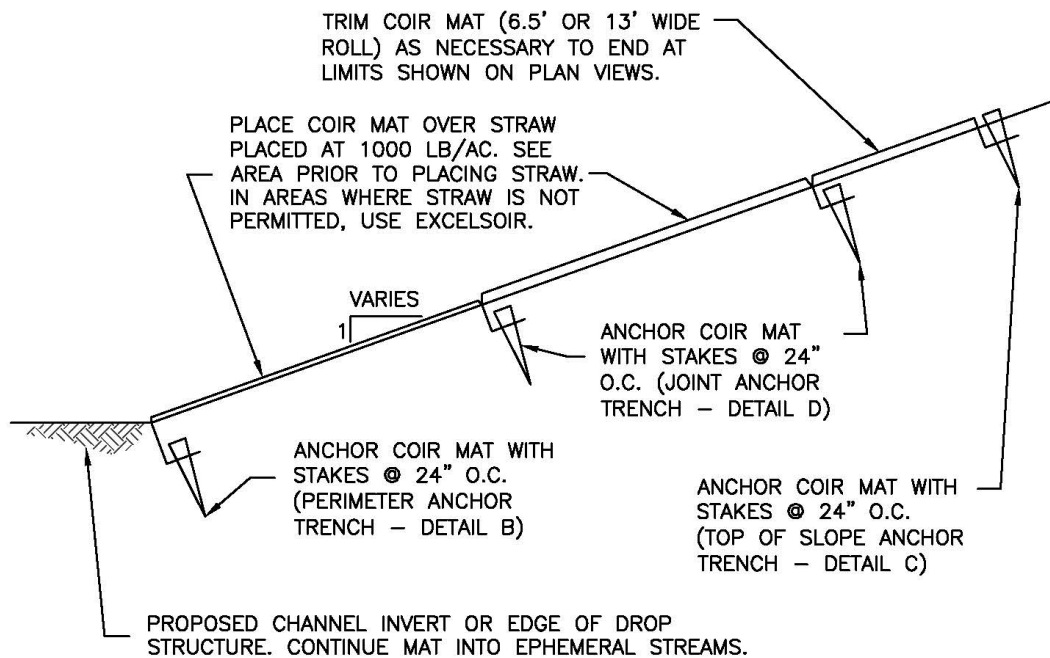
NOTE: IN ADDITION TO FLOW CONDITIONS, THE DESIGNER SHOULD CONSIDER THE PROPERTIES OF THE UNDERLYING SOIL. LESS COHESIVE SOILS MAY WARRANT A TIGHTER STAKING PATTERN.

STAKING PATTERNS BY SLOPE OR CHANNEL TYPE



NOTES

1. PLACE STAKES 18" O.C. TO 3' ABOVE WATER, THEN 24" O.C. TO UPPER LIMIT OF FABRIC OR AS RECOMMEND BY THE MANUFACTURER.
2. WHEN BLANKETING IS PLACED OVER RIPRAP, USE WOOD STAKES.



NOTE: USE WOODEN STAKES IN AREAS WHERE MAT IS PLACED OVER RIPRAP.

COIR MAT PLACEMENT DETAIL

EROSION CONTROL BLANKET MAINTENANCE NOTES

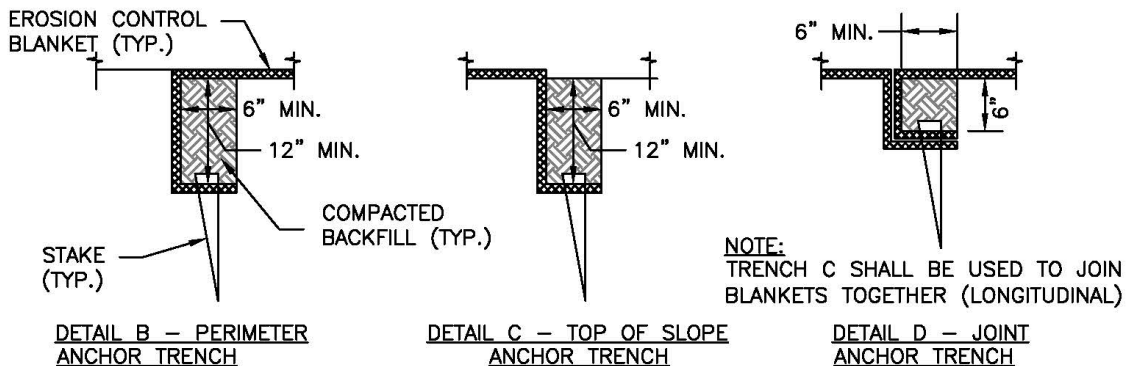
1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE. REPEATED FAILURE WARRANTS THE NEED FOR REDESIGN OF THE EROSION CONTROL PROTECTION.
4. ECBs SHALL BE LEFT IN PLACE TO BIODEGRADE UNLESS REQUESTED TO BE REMOVED BY THE LOCAL JURISDICTION.
5. ANY ECB PULLED OUT, TORN, OR OTHERWISE DAMAGED SHALL BE REPAIRED OR REINSTALLED. ANY SUBGRADE AREAS BELOW THE GEOTEXTILE THAT HAVE ERODED TO CREATED A VOID UNDER THE BLANKET, OR THAT REMAIN DEVOID OF GRASS SHALL BE REPAIRED, RESEEDED AND MULCHED AND THE ECB REINSTALLED.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO AND TOWN OF PARKER COLORADO, NOT AVAILABLE IN AUTOCAD)

EROSION CONTROL BLANKET INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION OF ECB.
 - TYPE OF ECB (STRAW, STRAW-COCONUT, COCONUT/ COIR, OR EXCELSIOR).
 - AREA, A, IN SQUARE YARDS OF EACH TYPE OF ECB.
2. ALL RECPs MUST BE 100% NATURAL AND BIODEGRADABLE MATERIALS.
3. IN AREAS WHERE ECBs ARE SHOWN ON THE PLANS, THE PERMITTEE SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO ECB INSTALLATION AND THE ECB SHALL BE IN FULL CONTACT WITH SUBGRADE. NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.
4. FOR MATS THAT HAVE OPENINGS LARGER THAN THE SOIL, ADD STRAW UNDER (RATE OF 1000# PER ACRE) TO HOLD SOIL AND SEED FROM MIGRATING THROUGH OPENINGS.
5. INSTALL MATS AND BLANKETS PARALLEL TO THE DIRECTION OF STREAM FLOW.
6. PERIMETER ANCHOR TRENCH SHALL BE USED ALONG THE OUTSIDE PERIMETER OF ALL BLANKET AREAS.
7. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL ECBs EXCEPT STRAW WHICH MAY USE AN OVERLAPPING JOINT.
8. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE-HALF ROLL LENGTH FOR COCONUT AND EXCELSIOR ECBs.
9. OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER FOR ECBs ON SLOPES AND WITHIN DRAINAGEWAYS. OVERLAP SEAMS SO THAT UPSTREAM RECPs IS ON TOP OF DOWNSTREAM RECPs SO THAT EXPOSED EDGE IS NOT LIFTED BY STREAM FLOWS.
10. MATERIAL SPECIFICATIONS OF ECBs SHALL CONFORM TO TABLE ECB-1.
11. ALL EXPOSED ROOTS SHALL BE TRIMMED TO BELOW THE SOIL SURFACE. ECB/TRM SHALL NOT BE INSTALLED OVER ROCKS OR SOIL CLOUDS GREATER THAN 4 INCHES.
11. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING ECBs SHALL BE RESEEDED AND MULCHED.
12. DETAILS ON DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION WILL GOVERN IF DIFFERENT FROM THOSE SHOWN HERE.
13. ADDITIONAL BANK PROTECTION AND/OR TOE REINFORCEMENT MAY BE NEEDED BASED ON CHANNEL GEOMETRY AND HYDRAULICS.



ANCHOR TRENCH DETAILS FOR EROSION CONTROL BLANKETS