

Thank you for purchasing the LANDLOK[®] Erosion Control Blanket (ECB) by Propex Operating Company, LLC (Propex). This document provides installation and maintenance guidelines for LANDLOK ECB used as slope armoring to increase earthen slope resiliency. LANDLOK ECB provides temporary erosion protection on either the flood side and/ or protected side of an earthen slope.

Temporary soil staples (staples) are used during installation to hold LANDLOK ECB in place. Staples also promote vegetation establishment keeping LANDLOK ECB in intimate contact with the soil.

LANDLOK ECB is an engineered solution with a unique design for each specific project. While Propex has made every effort to ensure general validity, this information should not be used for a specific application without independent professional examination and verification of its suitability, applicability, and accuracy. The information provided herein is for general information only, and is intended to present installation guidance. Project specific contract documents take precedence when staple placements are different than what is represented in this document. Depending upon the critical nature of the structure to be armored, work restrictions may be in place such as limiting work based on growing seasons, weather patterns, etc. Work should be performed under the provisions set forth for the specific project. Propex Engineering Services is available for support during installation to consult for solving constructability issues encountered in specific applications. Please feel free to call our technical support hotline at (423) 553-2450.

BEFORE INSTALLATION BEGINS

- *Coordinate with a Propex Representative:* A pre-construction meeting is suggested with the construction team and a representative from Propex. This meeting should be scheduled by the contractor with at least a two week notice.
- *Gather the Tools Needed:* Tools that you will need to install LANDLOK ECB include a pair of industrial shears to cut LANDLOK ECB, tape measure, and mallet or hammer.
- *Determine how to Establish Vegetation:* The method of vegetation establishment should be determined prior to the start of installation. Different vegetation establishment methods require different orders of installation. Refer to *Establish Vegetation* for further guidance.

INSTALLATION OF LANDLOK ECB ON SLOPES

PREPARE THE SITE

It is recommended during all stages of site preparation that disturbed soils remain unprotected for not more than a single day. Depending on project size this may require progressive site preparation during installation.

1. Grade and compact the area on the slope where LANDLOK ECB will be installed. The slope surface should be uniform and smooth, having all rocks, clods, vegetation or other objects removed so that during *LANDLOK ECB Laydown*, LANDLOK ECB comes in direct, intimate contact with the slope surface.
2. Prepare the area to be armored with LANDLOK ECB by loosening the topsoil to promote better vegetation establishment. This may be accomplished with a rotary tiller on slopes 3:1 or flatter. For slopes greater than 3:1, prepare topsoil in a safe manner.
3. If seeding, refer to *Vegetation Establishment* for additional considerations during site preparation.

LANDLOK ECB LAYDOWN

1. Begin the LANDLOK ECB Laydown process by starting with the downstream / downwind end of the site. To ensure proper stapling of the overlapped areas the proceeding roll width must be laid out before the current roll width can be stapled with exception to the final roll width. Panel edges should rest approximately perpendicular to the slope center line. For best results, panels of LANDLOK ECB should be continuous and free from seams or roll end overlaps that are parallel to the

centerline of the slope. Panel edge overlapping should follow a pattern of placing each proceeding panel's edge overtop the previous panel edge, shingling the panels in the direction of the water flow or prevailing wind.

- Starting at the COS, lay LANDLOK ECB roll so that the roll ends point towards the crest of the slope (Figure 1), with a 4 inch (100 mm) overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 4 inch overlap during *LANDLOK ECB Laydown*. (Figure 5)

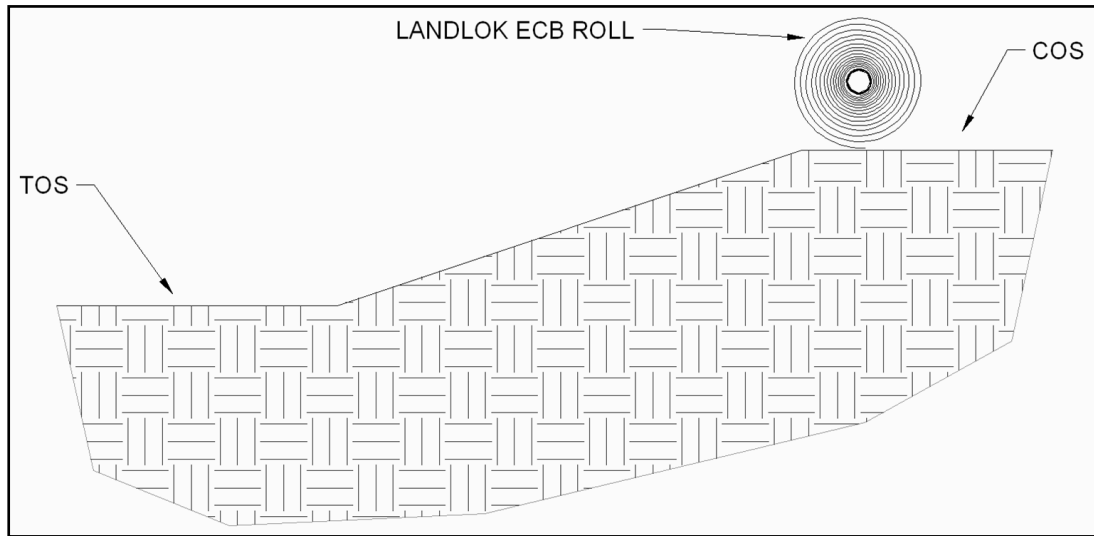


Figure 1: Crest of Slope (COS) Trench Alignment

- Secure LANDLOK ECB with staples on the COS edge. Staples should be made of 11 gauge steel, having a length between 6 and 24 in (150-600 mm) with sufficient ground penetration to resist pullout (Figure 2). Longer staples may be required for looser soils. Heavier metal pins may be required in rocky soils. Suggested placement of staples for the COS edge is along the edge with staples on 12 in (300 mm) centers (Figure 6). Staples should also be installed on panel edge overlaps on the COS edge.

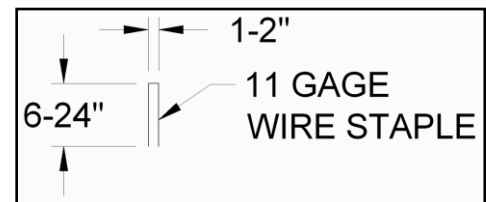


Figure 2: Securing Staple

- Unroll the LANDLOK ECB roll on the slope surface in the area to be armored (Figure 3). Ensure that LANDLOK ECB has intimate contact with the ground and all irregular surfaces beneath LANDLOK ECB are removed.

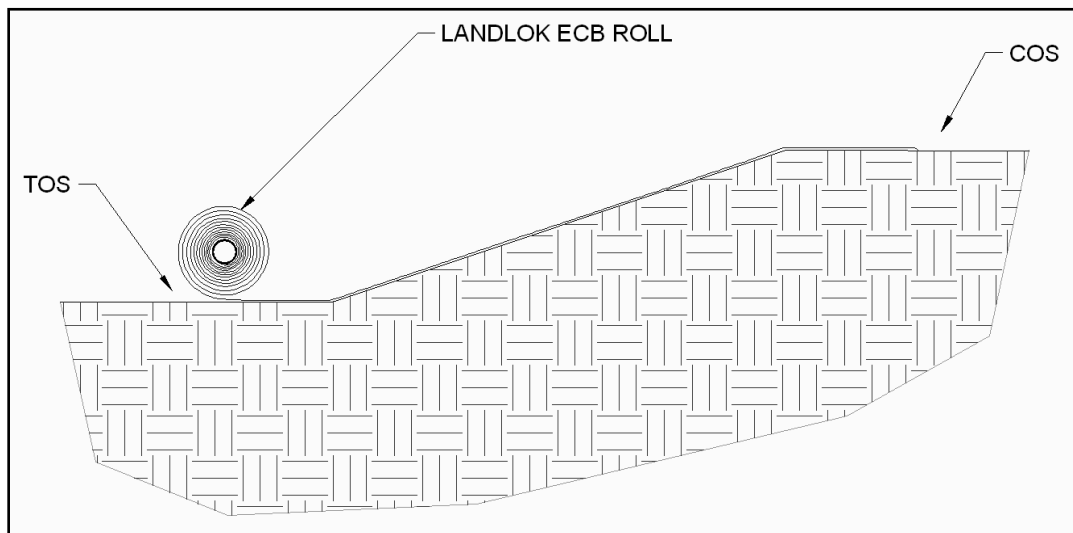


Figure 3: Placement of LANDLOK ECB across Slope

5. Secure LANDLOK ECB panels in place using staples across the slope surface according to the project’s engineered design. Staple placement should reflect a staggered checkerboard pattern across the slope surface for best results (Figure 4 and Figure 5).
 - The leading edge of the first LANDLOK ECB panel should be secured on the Slope Armoring Edge (SAE) with staples on 12 in (300 mm) centers (Figure 6).
 - Roll edges shall be overlapped a minimum of 4 in (100 mm) with staples placed on 12 in (300 mm) centers (Figure 5).
 - Roll ends shall be overlapped a minimum of 4 in (100 mm) with upstream / upwind panel on top. Secure roll end overlaps with two rows of staples staggered 4 in (100 mm) apart on 4 in (100 mm) centers (Figure 7)
 - At the break in slope interface towards the TOS, it is suggested that staples be installed on 1 ft (0.3 m) centers (Figure 8).

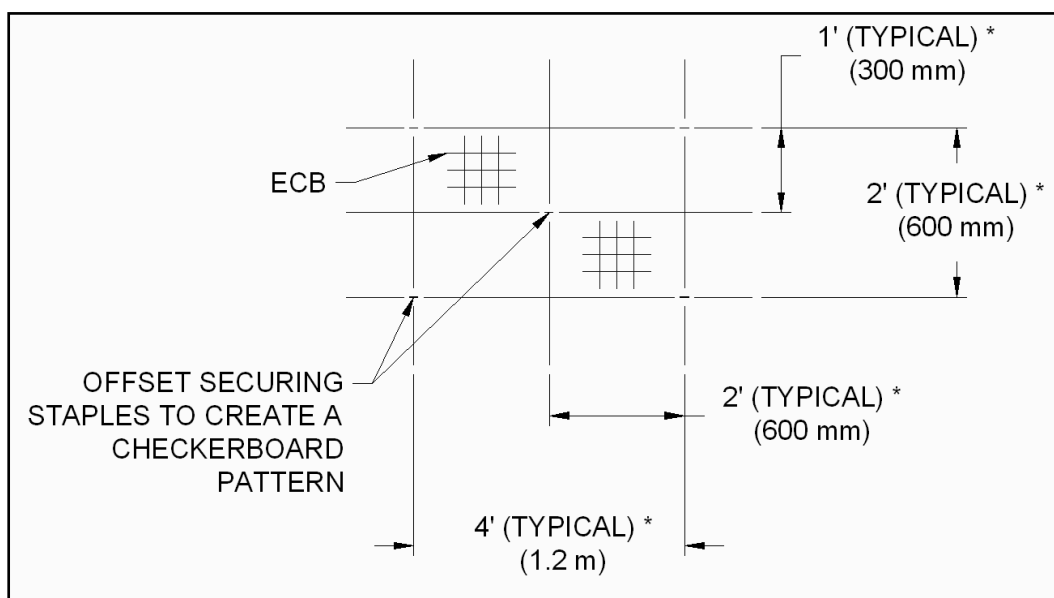


Figure 4: Example Staple Pattern

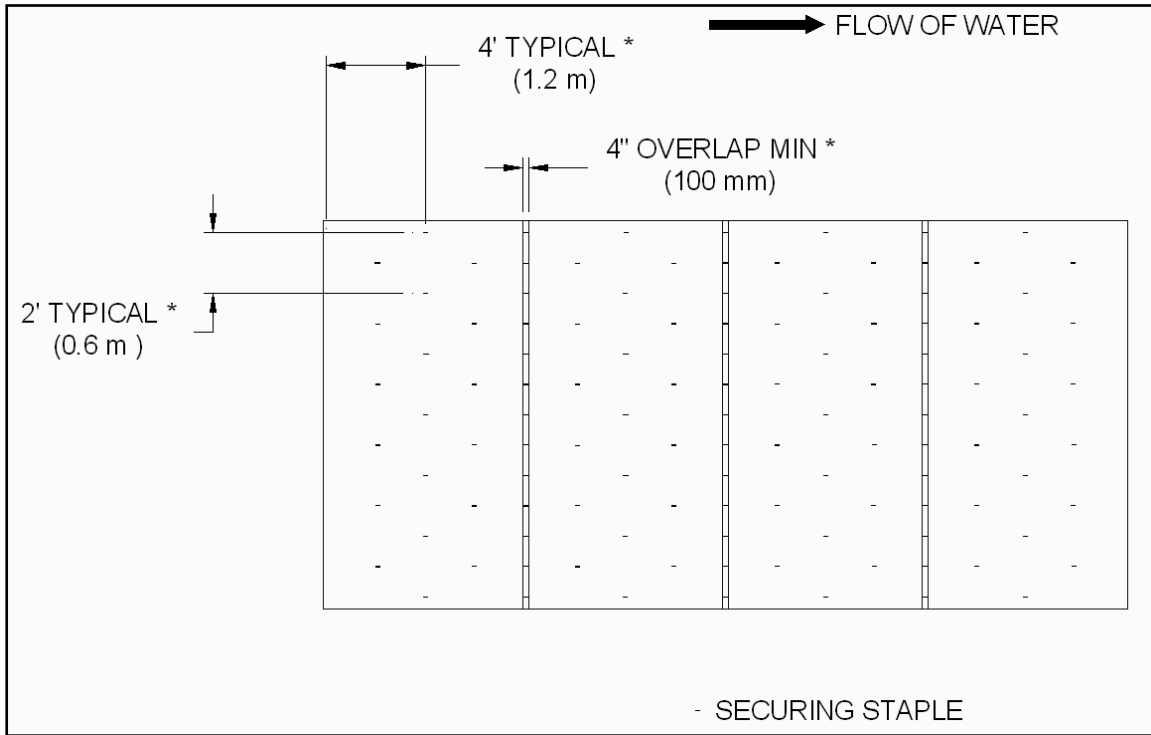


Figure 5: Example of Panel Overlap

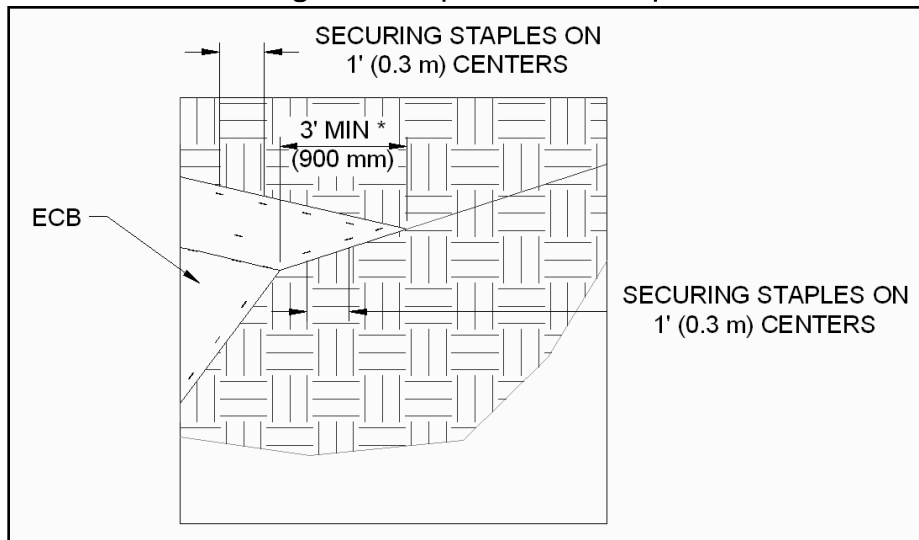


Figure 6: Crest of Slope (COS) and Slope Armoring Edge (SAE)

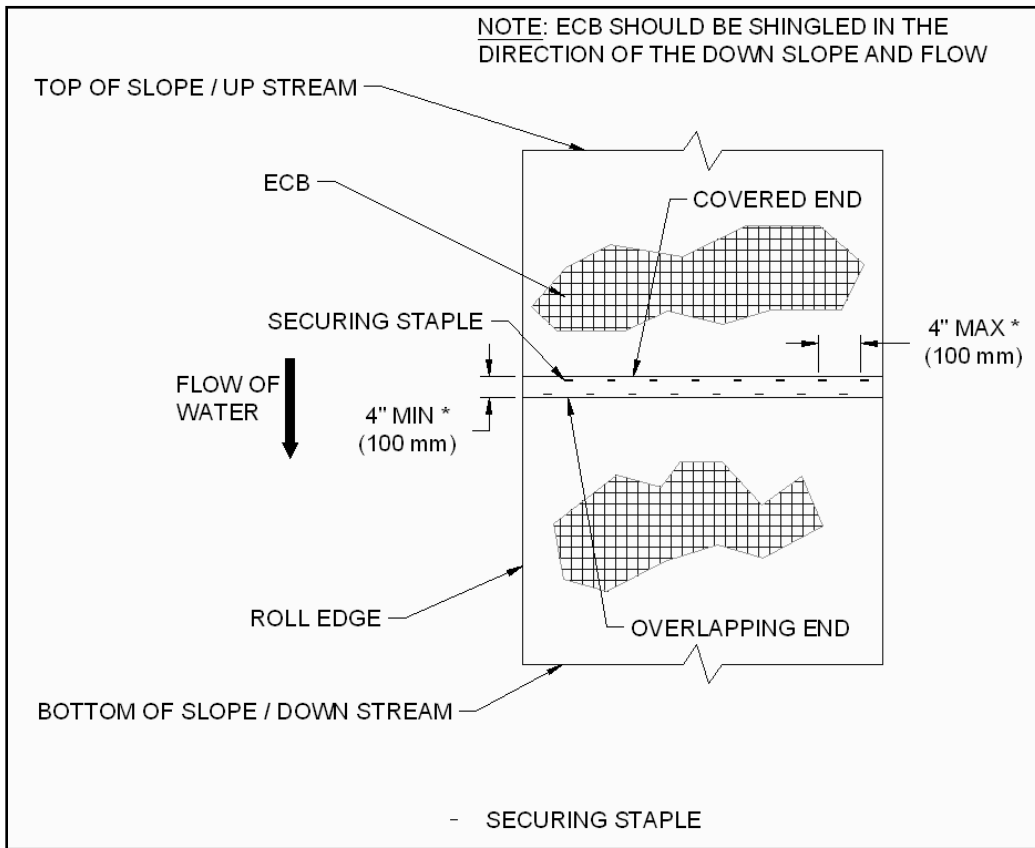


Figure 7: Roll End Overlap

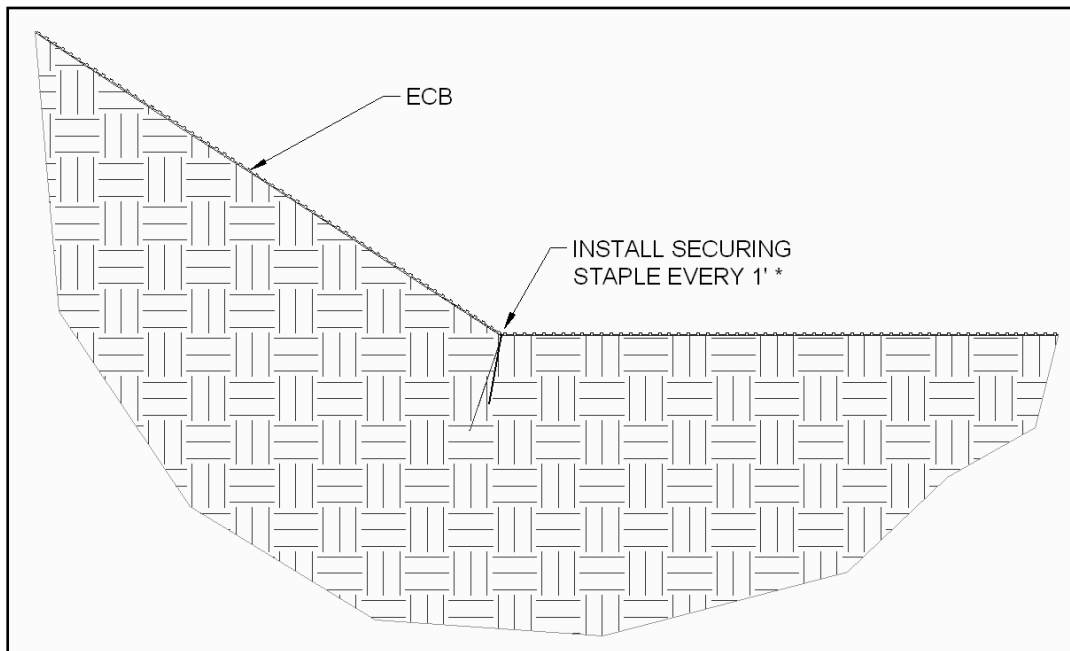


Figure 8: Break in Slope Interface

- Secure LANDLOK ECB with staples on the TOS edge. Suggested placement of staples for the TOS edge is along the edge with staples on 12 in (300 mm) centers (Figure 9).

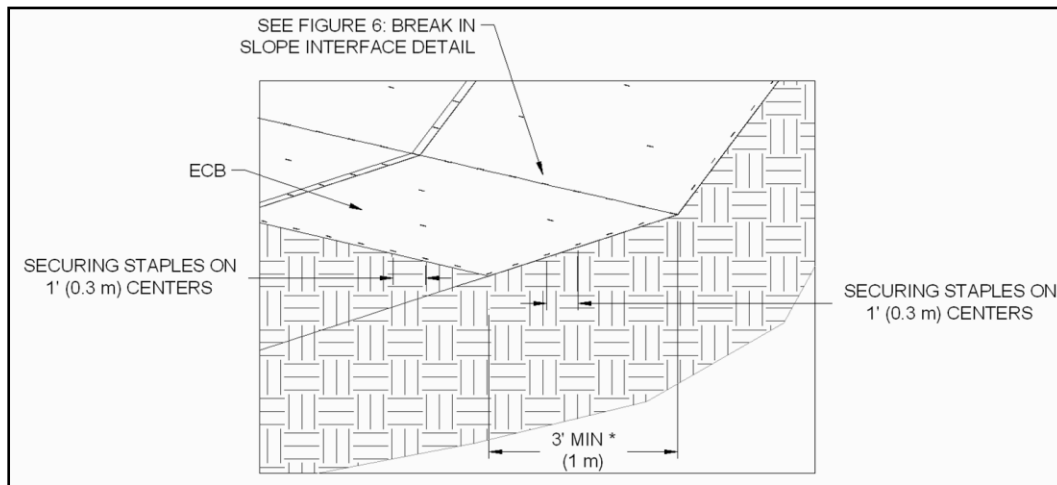


Figure 9: Toe of Slope (TOS) and Slope Armoring Edge (SAE)

- Continue to work down the length of the slope by repeating steps 1 through 6 overlapping each adjacent LANDLOK ECB panel by 4 inches (100 mm) (Figure 5). The last LANDLOK ECB panel should terminate on the Slope Armoring Edge (SAE) with staples on 12 in (300 mm) centers (Figure 9). At a minimum, LANDLOK ECB panels should be stapled entirely across the slope surface and staples should be installed on the edges at the end of each day to minimize rework in the case of a major rain event. Specific project conditions may warrant further evaluation of installation order for ease. An example isometric view (Figure 10) of a slope armored with LANDLOK ECB can be seen below for overall reference. Consult Propex Engineering Services at (423) 553-2450 with any questions that you may have.

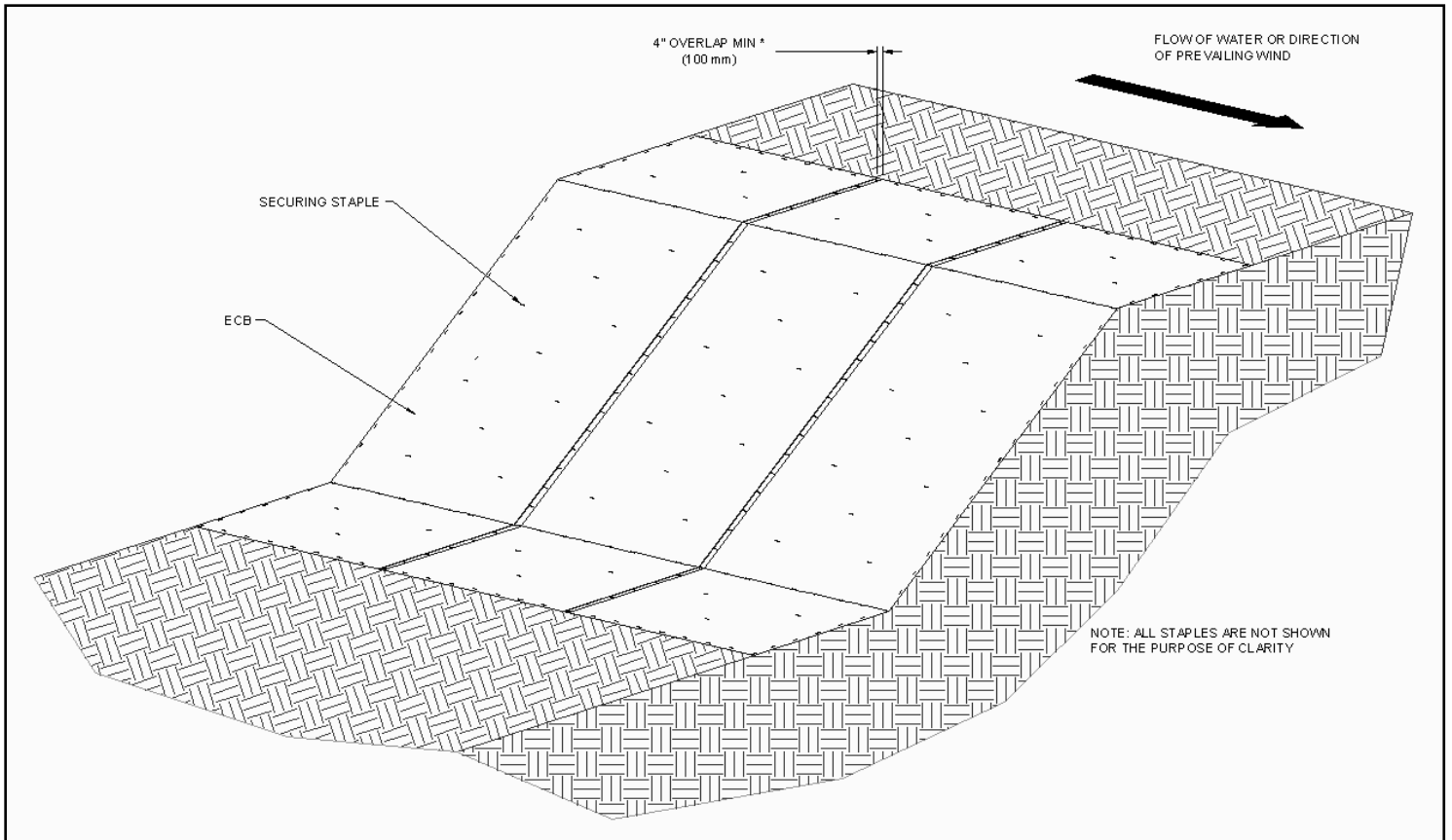


Figure 10: Completed Slope Isometric View

ESTABLISH VEGETATION

Vegetation can be established with LANDLOK ECB by broadcast seeding or hydraulic seed application (hydroseeding). Seed application rate, seed type, and irrigation rate should be selected based on local or site specific knowledge and time of year. For best results, consider having a site specific soil test performed to help determine what soil amendments, such as lime and fertilizer, need to be incorporated into the soil to promote healthy vegetation.

Irrigate as necessary to establish and maintain vegetation until 75% of vegetation has established and has reached a height of 2 inches. Frequent, light irrigation will need to be applied to seeded areas if natural rain events have not occurred within two weeks of seeding. When watering seeded areas, use a fine spray to prevent erosion of seeds or soil. Do not over irrigate. Proper irrigation guidance is provided under the Maintenance portion of this document.

CONSIDER PROJECT SPECIFIC NEEDS

1. For applications that require special transitions (i.e. connections to riprap, concrete, T-walls, etc.), refer to the project specific drawings or consult with Propex Engineering Services at (423) 553-2450.
2. Hard armoring may be required when slopes have severe scour potential at the toe location.
3. For installing LANDLOK ECB panels around curved sections of a slope, trim panels at an angle so that no more than two layers of LANDLOK ECB overlap at any point in time. Additional staples may be needed to secure panel edges towards the toe of the slope depending upon the radius of the curved slope. Install staples as necessary to securely fasten LANDLOK ECB to the ground.
4. Avoid any and all traffic on the LANDLOK ECB until full vegetation has been reached.
3. Disturbed areas should be reseeded. If ruts or depressions develop for any reason, rework soil until smooth and reseed such areas.

MAINTENANCE OF LANDLOK ECB

The purpose of this section is to provide some general guidelines for performing maintenance of LANDLOK ECB with respect to maintaining vegetation and patching of LANDLOK ECB (in the event it needs to be removed or replaced). These procedures are to be considered minimum guidelines for proper maintenance, and further maintenance techniques may be appropriate considering local practices and procedures.

LANDLOK ECB PROTECTED SLOPES

For LANDLOK ECB to be most effective, it is important to ensure that it is properly maintained both during construction and after construction. Identifying trouble areas is easy with LANDLOK ECB, and it can make identifying potential threats much simpler and manageable. Look for areas with sparse, dying, or no vegetation as these are obvious signs that LANDLOK ECB is losing intimate contact with the slope surface. If loss of ground surface occurs, LANDLOK ECB will need to be removed and reinstalled as described in *Patching and Repairs* Section after the eroded area is backfilled with compacted soil that is similar to material of the slope. After LANDLOK ECB is reinstalled, re-establish vegetation on the newly installed LANDLOK ECB and disturbed areas. Monitor the sites to determine if frequent watering may be required to establish vegetation.

To minimize exposure to unwanted maintenance and repair, LANDLOK ECB armored slopes should be free of vehicular traffic. Routine maintenance and slope inspections should be performed by foot traffic only. Tracked equipment such as skid steers, excavators, or dozers should only be allowed to traffic over LANDLOK ECB in times of emergency after vegetation establishment is complete. Failure to control unauthorized traffic can result in LANDLOK ECB being damaged resulting in erosion below LANDLOK ECB during storm events. In addition, routine mowing maintenance should be avoided until full vegetation is reached.

MAINTAINING VEGETATION

Vegetative cover care starts before a project is complete and is ongoing until all LANDLOK ECB is installed. Vegetative cover should be given every opportunity to grow and establish well. This will require that a contractor periodically fertilize and water the grasses as needed until a project is complete in the short-term, with the owner of the slope fulfilling the maintenance of the slope in a similar fashion for the long-term. For the entire lifecycle of LANDLOK ECB, every effort must be made to prevent unauthorized encroachments, grazing, vehicle traffic, the misuse of chemicals, or burning.

1. After the installation of LANDLOK ECB is complete, immediately water and soak the entire area using a fine spray to prevent erosion and loss of seeds. A suggested amount of water is identified below; however warmer weather will necessitate more frequent applications.
 - A. For each reach/segment of installed vegetation, watering shall be conducted immediately after each installation or the day's work.
 - B. For initial vegetation establishment, water vegetation in a manner consistent with best practices for vegetation type and location.
 - C. Establish a watering schedule and follow until vegetation is well established and will thrive in the absence of manual watering.
 - D. Avoid excessive application of water, so that surface runoff does not occur. Runoff should be prohibited. However, additional watering may be required for repaired or damaged areas.
4. Fertilizer should be applied as needed to address any nutrient deficiencies revealed in soil testing.
5. Implement best practices for mowing after establishment of vegetation is complete.
 - A. Immediately after installation, signage and post shall be installed stating that "Vehicles and Pedestrians are Prohibited from Access" on the slopes and the newly installed vegetation. Signage shall be posted every 1,500 lineal feet.
 - B. Mowing should be avoided until full vegetation is reached.
 - C. To prevent damage to the newly established vegetation, the mowing tractor should be fitted with 3-rib agriculture tires. Note that tractors with 8-foot flail mowers provide best results. Tractors with 15-foot brush hogs should avoid sharp turns up the slope to prevent damage to vegetation.
 - D. Mowing should not take place for a minimum of 48 hours after a rainfall event of 2 inches or more to minimize the potential for rutting and/or damage to the slope surface. If turn-around pads are present, operate mowing equipment utilizing the turn-around pads to the fullest extent.

PATCHING AND REPAIRS

LANDLOK ECB may require localized repair at times. For emergency repairs, an adequate supply of LANDLOK ECB should be maintained in inventory with the necessary tools to install. This will allow for a timely, initial repair of the system.

1. In order to identify areas in need of repair, the site should be patrolled immediately after rain events of 2 inches or more. When patrolling look for areas of sparse vegetation and areas where direct contact between LANDLOK ECB and the slope surface is compromised. LANDLOK ECB should be rated as *Acceptable*, *Minimally Acceptable*, or *Unacceptable* during inspection.
 - A. *Acceptable* (A) - The rated area is in satisfactory, acceptable condition, and will function as designed and intended during the rain event. LANDLOK ECB is installed tightly by maintaining direct contact to the slope surface with no rilling beneath. There is no noticeable damage present.
 - B. *Minimally Acceptable* (M) - The rated area has a minor deficiency that needs to be corrected. The minor deficiency will not seriously impair the functioning of the area during the next rain event; however, the overall reliability of the project will be lowered because of the minor deficiency. Minimal erosion has occurred underneath LANDLOK ECB.

- C. *Unacceptable (U)* - The rated area is unsatisfactory. The deficiency is so serious that the area will not adequately function in the next rain event. LANDLOK ECB has been physically torn, ripped, or lifted from the slope surface. There is evidence that erosion is occurring beneath LANDLOK ECB.
2. Repair any raised edges of LANDLOK ECB by driving existing and additional staples along the edges as necessary to securely fasten to the ground. Inspect areas where the vegetation is not growing. Many times this is an indicator that LANDLOK ECB has lost contact with the ground beneath. Check for voids beneath LANDLOK ECB and fill any holes, gullies, etc. with compacted fill material if possible. Replace LANDLOK ECB as described below.
 3. To repair LANDLOK ECB, cut out and remove damaged areas in a square configuration a minimum size of 2 ft by 2 ft. Remove all vegetation and debris. Loosen the top 1 to 2 in of soil in the patch area then seed. The subgrade of area to be patched shall be prepared to be smooth and uniform and transition smoothly into the in-situ area. Cut a square LANDLOK ECB patch a minimum of 12 in greater than the damaged area for all four sides of the patch. Overlap the patch area in all directions a minimum of 12 in. The patch overlaps shall be tucked under the existing damaged LANDLOK ECB material (Figure 11 and Figure 12)

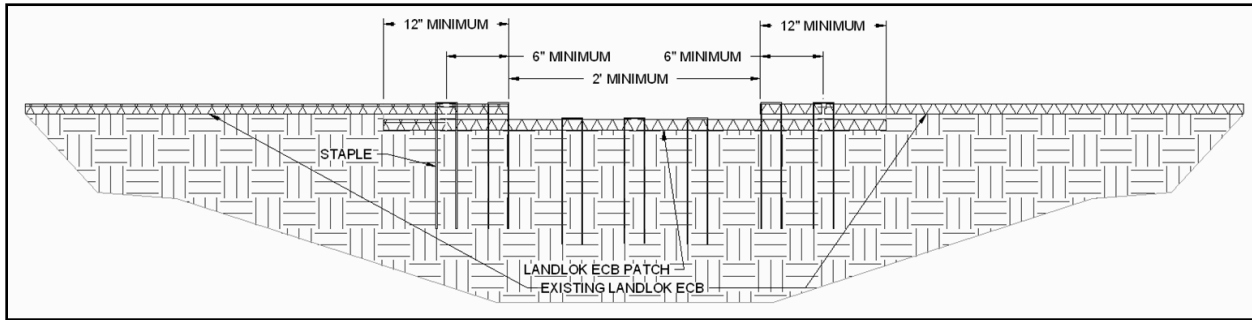


Figure 11: LANDLOK ECB Patch Cross Section

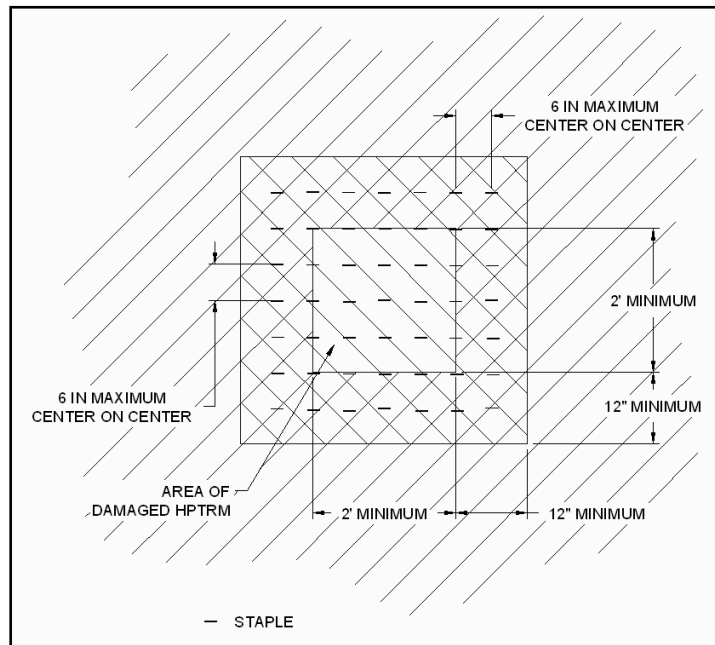


Figure 12: LANDLOK ECB Patch Plan View

4. Install staples on 6 in (150 mm) (max) centers. For larger areas of damage, staples should be installed to match existing staple pattern.

SUMMARY

Maintenance should consist of watering and weeding, repair of all erosion, and any re-seeding as necessary to establish a uniform stand of vegetation during construction and beyond. A minimum of 70% of the armored area should be covered with no bare or dead spots greater than 10 ft² (1 m²). Establishing vegetation should not be mowed prior to 70% vegetative density and a minimum grass growth of 4 in (100 mm). Throughout the duration of the project, the contractor should be responsible for mowing to facilitate growth and should not let the vegetation in the armored areas exceed 18 in (450 mm). In addition, the Contractor should water all grassed areas as often as necessary to establish satisfactory growth and to maintain its growth throughout the duration of the project.