

**CHAPTER 3.6**  
**DRAINAGE LAYER**

<b><u>Paragraph</u></b>		<b><u>Page</u></b>
3.6-1	GENERAL	3.6-1
	a. Preconstruction Submittals	3.6-1
	b. Delivery, Storage, and Handling	3.6-1
3.6-2	PRODUCTS	3.6-2
	Geonet	3.6-2
3.6-3	EXECUTION	3.6-2
	a. Installation	3.6-2
	b. Repairs	3.6-3
	c. Covering	3.6-3
3.6-4	GRANULAR DRAINAGE LAYER	3.6-3
	a. Preconstruction Submittals	3.6-3
	b. Construction Submittals	3.6-4
	c. Granular Drainage Layer Material	3.6-4
	d. Installation	3.6-4
	e. Protection	3.6-4

### **CHAPTER 3.6 DRAINAGE LAYER**

3.6-1. **GENERAL.** Drainage layers are constructed with either geonets or coarse grained granular soils. A geonet consists of a set of parallel plastic ribs positioned in layers such that liquid or gas can be transmitted within the void spaces between the ribs. Geonets are often used instead of soils for drainage layers because they have a higher flow capacity, require less space, and are easier to construct. Most geonets are manufactured using polyethylene and are typically 5.0 to 8.0 mm (0.20 to 0.30 inches) in thickness. The large voids within the geonet must be protected from clogging. Therefore, geonets always function with either geomembranes and/or geotextiles on their two planar surfaces. Whenever the geonet comes supplied with a geotextile attached to one or both of its surfaces, it is called a geocomposite. The geotextiles are bonded to the geonet by heat fusing or by use of an adhesive.

a. Preconstruction Submittals. The contractor should provide preconstruction submittals as required by the specifications. The following is a list of typical submittal requirements.

- (1) Manufacturer's QC test results.
- (2) If a geotextile is attached to one or both sides of the geonet, bond adhesion test results should be submitted.
- (3) Interface friction test results.
- (4) Geonet sample with any attached geotextiles (if required).

b. Delivery, Storage, and Handling.

- (1) A QA Representative should be present during delivery and unloading of the geonet to inspect for damage.
- (2) Verify that rolls are labeled with the manufacturers name, product identification, lot number, roll number, roll dimensions, and date manufactured.
- (3) The QA Representative should record roll numbers, date delivered, name of manufacturer, and product type. This data is used to verify manufacturer's QC data sheets have been submitted for the rolls being delivered.
- (4) Geonet rolls should be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly should be used.
- (5) Do not allow rolls to be dragged, lifted by one end, or dropped to the ground.
- (6) Ensure the geonet is kept free of dirt, dust, mud, or any other foreign materials. Ideally, geonet should not be stored directly on the ground since they do not arrive at the job site with a protective plastic cover.
- (7) Temporary storage at the job site should be in a flat smooth area where standing water cannot accumulate. A geomembrane or ground cloth should be placed under the geonet if they are stored on soil for longer than a month. This will prevent weeds from growing

into the lower rolls of the geonet. If weeds do grow in the geonet during storage, ensure they are removed when the geonet is deployed.

(8) Geocomposite should be stored with an opaque cover over it to protect the geotextile.

(9) Ensure rolls are not stacked so high that the cores are crushed or the geonet is damaged.

### 3.6-2. PRODUCTS.

Geonet.

(1) Cross check the roll numbers of the geonet delivered to the site against the roll numbers on the manufacturer's QC test data submittals to ensure they match. Ensure the geonet meets the property requirements outlined in the specifications for material type and physical properties.

(2) Check the transmissivity test results to make sure the tests were run using the specified normal stress, gradient, and boundary conditions.

(3) Inspect geotextiles which have been heat bonded to geonets to make sure the geotextiles have not been damaged or thinned by the bonding process.

(4) If a geotextile is attached to one or both sides of the geonet by adhesives, check to make sure excessive adhesive has not filled the void spaces in the geonet.

### 3.6-3. EXECUTION.

a. Installation.

(1) A QA Representative should be present at all times during geonet installation.

(2) Prior to placement of the geonet, verify the subgrade is smooth and will not damage or clog the geonet.

(3) Do not allow geocomposite to be dragged across the surface of a textured geomembrane. This can result in damage to the geocomposite.

(4) The geonet should be unrolled down slope keeping the net in slight tension to minimize wrinkles and folds.

(5) Adequate ballast (e.g. sandbags) should be placed to prevent uplift by wind.

(6) Overlaps and Fasteners.

(a) Ensure roll ends and edges are overlapped the specified distance. Typically, roll edges are overlapped a minimum of 75 mm (4 inches) and roll ends are overlapped a minimum of 160 mm (6 inches).

(b) Ensure plastic fasteners are used to join adjacent rolls. Metallic fasteners should not be allowed because they can puncture geomembranes.

(c) Ensure fasteners are placed at the specified spacings. Fasteners are typically spaced a maximum of 1.5 m (5 feet) apart along down slope roll overlaps and a maximum of 150 mm (0.5 feet) apart along cross slope roll overlaps.

(d) Fasteners should be of contrasting color from the geonet to facilitate visual inspection.

(e) Geonets should never be welded to geomembranes.

(f) If horizontal overlaps are required on side slopes, they should be staggered for adjacent rolls.

(g) When more than one layer of geonet is required, verify that end and edge overlaps are staggered so that joints do not lie above one another.

(h) Stacked geonet layers should always be laid in the same direction to maintain transmissivity requirements. However, they should be laid on top of each other such that interlocking does not occur.

(i) Do not allow geocomposites to be dragged across the surface of a textured geomembrane because the geotextile will be damaged.

(j) No personnel working on the geonet should smoke or wear shoes which could damage the geosynthetics.

(k) Verify that any area requiring repair is clearly marked.

b. Repairs.

(1) Holes or tears in the geonet are typically repaired by placing a patch of geonet extending a minimum of 610 mm (2 feet) beyond the edges of the hole or tear.

(2) Fasteners are typically spaced every 150 mm (6 inches) around patches.

(3) If a tear is present across more than 50 percent of the width of the geonet on side slopes, require the entire length of geonet to be removed and replaced.

c. Covering. Refer to Chapter 3.9 Cover Soil Layer for additional information on cover soil placement.

3.6-4. GRANULAR DRAINAGE LAYER. Granular drainage layers are generally composed of sand or gravel and usually have a minimum thickness of 300 mm (12 inches). If the drainage material will be placed adjacent to a geomembrane, the maximum particle size is typically required to be no greater than 12.5 mm (0.5 inches). The drainage layer should generally not be compacted since this may increase the percent fines, decrease the hydraulic conductivity, and damage underlying geosynthetics. A natural or geotextile filter is often provided on top of the granular drainage layer to prevent clogging.

a. Preconstruction Submittals. The contractor should provide preconstruction submittals as required by the specifications. The following is a list of typical submittal requirements.

(1) Materials Handling Plan which describes the processing and placement of the granular drainage layer.

(2) Borrow Source Assessment Report. At a minimum, one set of borrow assessment tests should be performed for each borrow source. A set of borrow source assessment tests generally consists of gradation, hydraulic conductivity, and possibly carbonate content.

(3) Samples of granular drainage material (if required).

b. Construction Submittals. The contractor should provide construction submittals as required by the specifications. The following is a list of typical submittal requirements.

(1) Borrow classification test results.

(2) Hydraulic conductivity test results.

c. Granular Drainage Layer Material.

(1) Check the properties of the drainage material (grain size distribution and hydraulic conductivity) being submitted against the requirements listed in the specifications. During construction, require additional testing if the properties of the drainage material appear to be changing.

(2) Hydraulic Conductivity Test Results. Consider requiring the contractor to perform additional testing prior to placement if pre-construction test results just barely meet the hydraulic conductivity requirements stated in the specifications. The reproducibility of hydraulic conductivity tests is not good, therefore, a material may just barely meet the hydraulic conductivity standard in one test but fail to meet minimum requirements in another test. Also, additional fines will be generated every time a drainage material is handled. The additional fines can significantly decrease hydraulic conductivity.

(3) Verify that oversize and angular material which could damage geosynthetic layers has been removed prior to placement.

d. Installation.

(1) Verify drainage material is being placed to the lines and grades shown on the drawings.

(2) Granular materials placed on top of geosynthetic components on side slopes should be placed from the bottom of the slope up.

(3) When granular drainage material is placed on top of geosynthetics and spread with a dozer, the sand or gravel should be lifted and tumbled forward to minimize shear forces on the underlying geosynthetics.

(4) Inspect the placement operation by observing the front of the working face as the materials are being spread to ensure that the underlying geosynthetics are not being damaged.

e. Protection.

(1) Verify that wind-borne and water-borne fines do not contaminate the drainage layer after placement.

(2) Watch for ponding on top of the drainage layer. This may indicate fines have contaminated the drainage layer.

(3) Areas of erosion should be repaired and grades reestablished.