

SECTION 02413

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 - GENERAL

1.01 SUMMARY

- A. GCL meeting the following specifications shall be installed as part of the clean soil cover system. Installer shall furnish all labor, materials, tools, supervision, transportation, and equipment for proper handling and installation over the area shown on the Drawings. Sufficient material for full coverage, overlaps, and waste shall be provided.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM), current edition.

1.03 SUBMITTALS

- A. Pre-installation: Submit prior to GCL delivery.
 - 1. Identification of bentonite used for production of GCL.
 - 2. Results of quality control tests conducted by GCL Manufacturer to verify that bentonite supplied met GCL Manufacturer's specifications.
 - 3. Written certification that minimum values given in Specifications are guaranteed by Manufacturer.
 - 4. Quality control certificates, signed by responsible party employed by Manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. These quality control tests shall be performed in accordance with test methods for at least every 100,000 lb for moisture content and swell index, and once per 40,000 ft² for mass per unit area. Index flux tests shall be performed in accordance with test methods for at least every 100,000 ft² of GCL produced. At minimum, results shall be submitted for:
 - a. Moisture content (ASTM D 4643 or D 2216)
 - b. Index flux (ASTM D 5887)
 - c. Swell index (ASTM D 5890)
 - d. Mass per unit area (ASTM D 5993)
 - 5. Verification that needle punched non-woven geotextiles have been inspected continuously for broken needles.
 - 6. Quality control certificates shall be delivered to ENGINEER prior to off- loading of the material on site.
- B. Installation: Submit as installation proceeds:
 - 1. Quality control documentation recorded during installation.

2. Subbase surface acceptance certificates signed by Earthwork CONTRACTOR and GCL Subcontractor for each area that will be covered directly by GCL. Submit prior to GCL deployment.
3. Deployment of GCL will be considered acceptance of subgrade if certificate is not submitted.
4. Material and Installation Warranty from manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. CONTRACTOR is responsible for providing protected GCL storage area.
- B. Protect GCL from ultraviolet light exposure, moisture, excessive humidity, puncture, cutting, or other damaging conditions.
- C. Rolls shall not be stacked so high as to cause thinning of the product at points of contact or as to cause crushing of the core.
- D. Identify rolls of GCL with following:
 1. Manufacturer's name.
 2. Product identification.
 3. Roll number.
 4. Roll dimensions.
- E. Rolls without proper identification will not be accepted or allowed on site.
- F. Handle rolls in accordance with ASTM D 4873.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Manufacturers:
 1. CETCO Bentomat DN
 2. Or alternate approved by ENGINEER.

B. GCL Properties:

| GEOSYNTHETIC CLAY LINER | | |
|--------------------------------------|---------------|---|
| Property | Method | Value |
| Index Flux | ASTM D 5887 | $1 \times 10^{-8} \text{ m}^3/\text{m}^2\text{-sec.}$ maximum |
| Mass Per Unit Area | | |
| 1. Bentonite Content | ASTM D 5993 | 0.75 lb/ft ² dry weight minimum |
| 2. Geotextile Upper Layer (nonwoven) | ASTM D 5261 | 6.0 oz/yd ² minimum |
| 3. Geotextile Lower Layer (nonwoven) | ASTM D 5261 | 6.0 oz/yd ² minimum |
| Swell Index | ASTM D 5890 | 24 ml/2 g minimum |
| Moisture Content | ASTM D 4643 | 12% maximum |

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Ensure supporting soil surface for GCL is below 100% saturation and free of debris or materials that could damage rolls.
- B. The subgrade shall be free of all angular stones protruding from the surface greater than 0.5 inch. Rounded stones or stones not protruding from the surface shall be less than 1.5 inches in greatest dimension.

3.02 QUALITY ASSURANCE SAMPLING

- A. CONTRACTOR shall make rolls available and assist ENGINEER in obtaining material inventory and material samples.
- B. OWNER reserves the right to sample and test delivered material for conformance to specifications.
- C. Material not meeting specification shall be rejected and removed from site at CONTRACTOR's expense. Retesting at CONTRACTOR's expense may be performed to limit rejection to specific rolls.

3.03 INSTALLATION

- A. Overlap GCL seams minimum of 6 inches on edge seams and minimum of 24 inches on end seams or as otherwise specified by the manufacturer.
- B. Overlap GCL panels to create a "shingle effect" such that water sheds over seams in the direction of flow.
- C. Do not deploy more GCL in one day than can be covered by end of that day.
- D. Repair perforations or cuts in GCL with additional GCL layer extending 1-foot from edge of perforation or cut in each direction or as otherwise specified by the manufacturer.
- E. Handle rolls to minimize loss of bentonite along edges during deployment.

- F. Remove GCL exposed to moisture and prematurely hydrated prior to placement of overlying material and replace with new GCL. Bentonite soft enough to displace when walked on shall be considered hydrated.
- G. The installer is responsible for repair of areas of premature hydration of GCL until final acceptance by the OWNER.
- H. GCL shall not be installed during precipitation, high wind, or other conditions that may hydrate or damage the GCL.
- I. Horizontal seams are not allowed on slopes steeper than 10% unless INSTALLER provides an installation plan for ENGINEER's approval that describes anchoring and transfer of shear.
- J. Supplemental bentonite, if required by the manufacturer, shall be applied at a rate of 0.25 pound per linear foot of seam.

3.04 GCL PROTECTION

- A. Materials placed on top of GCL shall comply with following:
 - 1. GCL and underlying materials are not damaged.
 - 2. Minimum slippage of GCL on underlying layers occurs.
 - 3. No excess tensile stress occurs in GCL.
- B. At no time shall vehicles or equipment be allowed to drive directly on top of the GCL unless approved by ENGINEER.
- C. Place soil over GCL using LGP equipment with less than 5 psi ground contact pressure. Maintain a minimum of 12" between surface of GCL and tracks of LGP equipment at all times.
- D. All other vehicles that are not LGP equipment shall maintain a minimum of 3 feet of soil between GCL and tracks or tires of vehicle or equipment.

END SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Placement and grading of the subgrade soils.
- B. Providing, placing, and compacting of soils, gravel, and rip rap over the GCL..

1.02 RELATED SECTIONS

- A. Geosynthetic Clay Liner (GCL), Section 02413.

1.03 SUBMITTALS

- A. Soil Materials: Submit 75-lb samples and results of recent (within previous month) testing laboratory grain size analyses for imported soils, material must conform to the specified gradations or characteristics as specified herein.
- B. Chemical analysis confirming the proposed fill is not contaminated prior to importing soil onto site. **Please note, this testing may takes a much as 6-8 weeks to complete, so please plan accordingly to avoid construction delays.**
- C. A report from a testing laboratory verifying that imported material is asbestos-free.

1.04 EXISTING CONDITIONS

- A. Site Information:
 - 1. Soil and grades at the site for this project area are the result of the installation of the slurrywall and the groundwater extraction system. The material movement from the associated construction zones may not be complete at the start of the subgrade finishing and GCL deployment..
 - 2. The Contractor may perform additional test borings and other explorations at no cost to Owner.
- B. Existing Utilities:
 - 1. Locate existing underground utilities in areas of work. Provide adequate means of support and protection during earthwork operations. This includes groundwater wells and benchmarks.
 - 2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - 3. Do not interrupt existing utilities serving facilities occupied and used by Owner or others during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
 - 4. Provide minimum of 48-hour notice to Owner, and receive written notice to proceed before interrupting any utility.

- C. Existing Extraction Wells: Identify, mark, and protect existing ground water extraction wells located within the work zone.

1.05 LAYOUT AND GRADES

- A. Lay out all needed lines and grades not presently established at the site in accordance with the Contract Documents. Establish permanent benchmarks by employment of a registered land surveyor or professional civil engineer. Maintain all established bounds and benchmarks and replace any that are destroyed or disturbed. Bring any deviations from the locations and elevations indicated on the Drawings to the attention of the Engineer immediately.
- B. Verify all existing ground surface elevations within the contract limits.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General Backfill to create subgrades: Backfill material is available onsite from the designated source areas. This material shall be used to create the proposed subgrades. Any additional offsite fill shall be approved by the Owner before hauling starts.
- B. Nevada Power Sand: Clean natural sand or a mixture of sands that meet the following gradation or as approved by the Engineer:

| Sieve Sizes | Percent Passing by Mass |
|-------------|-------------------------|
| 3/8 inch | 100 |
| No. 4 | 90-100 |
| No. 50 | 10-40 |
| No. 200 | 0-7 |

- C. Required Analytical: provide at least one representative composite sample for every 25,000 cubic yards of imported clean material brought to the site: Required analytical parameters list is as follows:

| Parameters | Analytical Methods |
|--|-------------------------------------|
| Ions (bromide, bromine, chloride, chlorine (soluble), chlorite, fluoride, nitrate, nitrite, orthophosphate, and sulfate) | EPA 300.0/300.1 |
| Perchlorate | EPA 314.0 |
| RCRA 8 Metals | EPA 6020/6010B |
| Organochlorine Pesticides | EPA 8081A |
| Semi-volatile Organic Compounds | EPA 8270C |
| Asbestos Analyses by PLM | EPA Method 600/R-93/116 Section 2.3 |

- D. Type II Class B Aggregate: Clean natural gravel that meets the following gradation and quality of aggregate required by Nevada DOT.

| Sieve Sizes | Percent Passing by Mass |
|-------------|-------------------------|
| 1 inch | 100 |
| 3/4 inch | 90-100 |

| | |
|---------|-------|
| No. 4 | 35-65 |
| No. 200 | 2-10 |

- E. Rip Rap: Rip rap shall be class 150 nevada department of transportation class or equal approved by Engineer.

2.02 USE OF SOIL MATERIALS

- A. Use Nevada Power Sand directly above the GCL except on the pond slopes. Thickness shall not be less than 6-inches.
- B. Use Type II Class B aggregate on top of the GCL on pond slopes to provide base for rip rap and on top of the Nevada Power Sand in all other areas.

PART 3 - EXECUTION

3.01 GENERAL

- A. Prepare subgrade for the GCL placement in accordance with the lines and grades shown on the Drawings.
- B. Protect existing structures, utilities, sidewalks, pavements, and other facilities not designated for removal from damage by equipment, settlement, undermining, washout, and other hazards created by earthwork operations.
- C. Perform excavation work in compliance with OSHA guidelines and regulations.

3.02 DEWATERING

- A. Off-site dewatering is prohibited until clean cover is completed and approved

3.05 TESTING FOR COMPACTION

- A. Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D1557, Method C. Compact soil using the lift thicknesses indicated.
 - 1. Subgrade: compact to greater than 85 % modified Proctor, ASTM D-1557, maximum dry density and provide smooth uniform surface free of debris and ruts.
 - 2. Nevada Power Sand: compact to greater than 85% modified Proctor, ASTM D 1557.
 - 3. Type II Class B aggregate: compact to a smooth grade that does leave ruts greater than 2-inches.

3.06 PLACEMENT

- A. Place acceptable soil material in layers to required grade elevations for each area identified on the drawings.
- B. Place soils in methods that will not damage subgrade and GCL:
 - 1. Do not place fill on surfaces that are saturated, soft or muddy.
 - 2. Place fill in level, uniform layers.

3.07 GRADING

- A. Uniformly grade areas within limits of grading under this section including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

3.08 FIELD QUALITY CONTROL

- A. CONTRACTOR shall correct deficiencies to meet Contract Documents. If specification criteria cannot be met, or unusual weather conditions hinder work, CONTRACTOR shall develop and suggest solutions to ENGINEER for approval.
- B. CONTRACTOR shall schedule appropriate retests when defect has been corrected. Retests by ENGINEER shall verify that defect has been corrected before any additional WORK is performed by CONTRACTOR in area of deficiency.

3.09 FIELD QUALITY ASSURANCE

- A. Quality assurance testing during construction: Allow ENGINEER to test and observe subgrades and backfill layers before further construction work is performed.
- B. If, in opinion of ENGINEER based on testing and observation, fills have been placed below specified percent compaction, provide additional compaction at no additional expense.

3.10 QUALITY ASSURANCE TESTING

- A. Quality assurance testing of granular materials shall be performed to document material used on site. The following tests shall be conducted:
 - 1. Particle size analysis (ASTM D 1140, D 422) at a rate of one per 10,000 cubic yards of in-place material
 - 2. Moisture density relationship ASTM D 1557 Method C at a rate of 1 test per 10,000 cubic yards of in-place material.
 - 3. Density of testing of subgrade and fill material at a rate of 1 test per acre per lift of soil placed.
- B. Fill materials not in conformance shall be removed and replaced at no cost to the OWNER.

3.09 PROTECTION AND REPAIR

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required percent compaction prior to further construction.

END OF SECTION

