EAST BEND GENERATING STATION

WEST SPECIAL WASTE LANDFILL

CELL No. 2 CONSTRUCTION

BID SPECIFICATION

April 13, 2018

EAST BEND GENERATING STATION
WEST SPECIAL WASTE LANDFILL
CELL No. 2 SPECIFICATION

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EAST BEND GENERATING STATION

WEST SPECIAL WASTE LANDFILL

CELL NO. 2 SPECIFICATION

1.0 PROJECT TITLE

The specific project for which this document has been prepared will be known as: WEST LANDFILL CELL NO. 2.

2.0 PROJECT LOCATION

The East Bend Generating Station is located at 6293 Beaver Road, Rabbit Hash, KY 41091. The general area of the West Landfill is 4,000 feet northeast of the Power Plant. Three access points into the station are available for Contractor use:

- Main Station Entrance Road.
- Farm land north of the West Landfill (personnel only), and
- Barge off-loading at southeast corner of ash pond (bulk materials only).

The Bidder shall satisfy itself as to the conditions and nature of these roads as well as other roads, bridges, and barge off-loading facilities at the plant to be utilized for transport of material, equipment, and labor to the site including any restrictions. The Bidder shall be familiar with the approved plant haul roads to be used for construction and hauling of materials.

Contractor shall provide a construction trailer which shall be placed at Duke Energy approved location.

3.0 PROJECT SCOPE

3.1 Description of Work

The general scope of work covered by this document shall include the provision of all supervision, labor, equipment, and material necessary to construct Cell No. 2 and associated facilities. The general construction items include:

- Cell No. 2 Footprint;
  - Excavation and fill to reach base of prepared subgrade elevation;
  - Placement of prepared subgrade material;
  - Installation of Geocomposite Liner system;
  - Installation of Leachate Collection System and Drainage Layer;
  - Placement of Protective Cover; and,
  - Installation of perimeter contact water diversion ditches;
  - Construction of Temporary Exit Road from Cell No. 2 to Permanent Haul Road

All Work shall be performed to meet facility permit specifications and regulatory

requirements including maintenance and cleanliness of the roads and Contractor areas

3.2 General Requirements

This work shall conform to, but not be limited to, the following items:

- Detailed construction quality assurance procedures outlining inspection, monitoring, sampling, testing methods/frequencies, and documentation during site construction, operation, and closure are contained in the Construction Quality Control Plan West Special Waste Landfill, East Bend Station, Revised September 2015 hereafter referred to as the "CQC Plan" and any associated addendums referenced and included herein (see Appendix 3). Bidder shall be familiar with and conform to the CQC Plan and associated addenda as it relates to the work at the site.
- The construction and maintenance of all necessary berms, drainage ditches, temporary holding ponds and temporary haul roads.
- The control of fugitive dust at the work site, borrow areas, and haul roads. Such controls shall include the covering of dusting trucks with tarps and the wetting of haul roads as required and/or directed by Duke Energy. Fugitive dusting emissions shall conform to all applicable federal, state and/or local environmental rules and regulations. See attached air permit (PTI) in Appendix 6.
- Submission of Daily Reports summarizing the work performed.
- The Contractor shall provide full time supervision of all on-site craft and subcontractors.
- The Contractor shall send at least one representative to weekly progress meetings scheduled by the Owner. The Contractor is expected to be prepared to discuss coordination of on-site work with Duke Energy during the meeting as well as providing the following updates:
    - Project Schedule;
    - Summary of Outstanding RFI's and Submittals;
    - Summary of expected work to be performed in the 2 weeks following the meeting.

The aforementioned items listed are major items required for the construction of Cell No. 2. This list is not intended to address the entire Scope of Work for these areas. The Bidder must review the project drawings and the bid documents to ascertain the full scope of work requirements for these areas.

4.0 GENERAL REQUIREMENTS

4.1 Haul Roads

4.1.1 The Cell No. 2 Contractor is responsible for the construction of the road depicted in the drawings. These roads shall remain at the completion of work.

4.1.2 The Contractor is responsible for constructing temporary haul roads at their own expense. The temporary haul roads include, but are not limited to, access to the work areas, the excavated material stockpile areas, and any other haul roads

required to perform work. Temporary roads needed to complete the work shall be removed at the completion of work.

4.1.3 The Contractor shall maintain all temporary haul roads utilized within the site at their own expense including dust control, grading, repairing potholes or erosion areas, and snow and ice control.

4.1.4 The Contractor is responsible for cleaning any spillages of material or debris on permanent and temporary haul roads at its own expense

4.1.5 Contractor is responsible for keeping haul roads and public roads clear of construction material and debris spillages.

4.2 Borrow Material

Material to be used as soil fill shall be obtained from on-site excavations shown on the drawings. Excess cut material shall be stockpiled within designated areas. Soils information is included in Appendix 7.

4.3 Conditions Affecting Work

The Bidders should visit the work site and take such other steps as may be reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work. Site visits shall be coordinated with Duke Energy.

4.4 Construction Facilities

4.4.1 The work areas required by the Contractor shall be assigned by Duke Energy. The Contractor shall set up office trailer(s) in the approved location on Drawing EBS_WESTLF_6A. Duke Energy will cover the expense for installing power (240/120 volt) only to trailers set up in the Contractor Trailer area and up to a maximum of four trailers.

4.4.2 Laydown and equipment parking shall be limited to the areas specifically identified on Drawing EBS_WESTLF_6A.

4.4.3 If additional facilities are required by the Contractor they shall be at the Contractor's expense and subject to Duke Energy approvals.

4.4.4 The Contractor shall, at its own expense, make the necessary arrangements for the operation, safety, security, and upkeep, mowing, and grounds-keeping of office areas, laydown areas, and parking areas.

4.4.5 The Contractor shall be responsible for monitoring the facility and shall conform to all applicable federal, state, and/or local environmental rules and regulations.

4.4.6 The Contractor is required to submit a Staging and Access Plan which identifies all locations of working and storage trailers, equipment staging areas, and material stockpile areas. The plan must show the proposed haul route between the water truck fill port and the west landfill and the haul route from the barge off-loading area to the west landfill. All other temporary access roads proposed by the Contractor to access the site which are not shown on the Drawings shall also be included in the plan.

4.5 Communications

The Contractor shall arrange, provide and maintain, at its own expense, all communication equipment including radio, telephone, and internet service required in connection with the Work.

4.6 Lighting

When any work is performed when daylight is obscured, the Contractor shall, at its own expense, provide artificial light sufficient to safely perform work and permit inspection of the work area. If the lighting is deemed insufficient by Duke Energy to safely and effectively perform the work, the Owner can stop the work until requested modifications are made. Work hours shall abide by Section 4.20 unless written permission is received from Duke Energy.

4.7 Existing Utilities and Pipelines

4.7.1 Contractor shall be responsible for identification, location, and protection of existing utilities within and near work areas.

4.7.2 The accompanying drawings indicate the general location of known existing utilities and pipelines. Notwithstanding the information shown on the drawings, the Bidder shall satisfy itself as to the exact location of these items on and in the vicinity of the job site.

4.7.3 The Contractor shall take all necessary measures to prevent disturbance and damage to the above items. Temporary utility crossings for construction access shall be avoided but, where necessary, shall be subject to approval by the Duke Energy Engineer.

4.8 Water Supply (for Contractor's use)

4.8.1 Water for construction purposes including soil moisture control and dust control is available for Contractor’s use from a truck fill port located at the cooling towers. If Contractor desires an alternate source, the Contractor shall provide, at its own expense, an adequate supply of water and shall operate all pumping plants, pipelines, tanks and appurtenances necessary for the adequate operation of its water system. Water containers and the distribution of drinking water to the Contractor's employees will be the responsibility of the Contractor.

4.8.2 Use of water from existing treatment or sediment ponds is prohibited.

4.9 Signs

The Contractor shall, at its own expense, be responsible for all necessary signs within the landfill areas and along county owned roads around the outside of the landfill area. The size, color, lettering and location of all signs shall be subject to approval of Duke Energy. Signs shall be installed for the following purposes:

a. Standard road signs

b. Warning and danger signs

c. Control signs

d. Safety signs

e. Location indication

Additional signs shall not be erected without the approval of the Duke Energy Engineer.

4.10 Refuse Disposal

4.10.1 Except as otherwise provided for by the Technical Specifications in Appendix 2 of this specification, the Contractor shall be responsible for the collection and disposal of refuse from the premises and work areas at its own expense. Refuse waste shall be hauled to an appropriately licensed state or county landfill.

4.10.2 The Contractor shall periodically perform inspection tours along the haul roads and public roads used by his forces and properly dispose of any construction related refuse found.

4.10.3 The dumping of refuse, sewage, oil or toxic waste into any creek or other watercourse shall not be permitted.

4.11 Security

4.11.1 The Contractor shall, at its own expense and as may be necessary, assume full responsibility for the security of the work area. Security shall include, at the Contractor's discretion, all fences, lights, guards, flagmen, watchmen and other measures necessary. The above security should provide for the protection of the areas being worked, for the public, and for all persons employed in connection with the work throughout the duration of the Agreement.

4.11.2 Contractor personnel are not required to enter the work area through station security check-point. However, a list of all on-site contractor personnel, including sub-contractor personnel, must be provided to the Station Security personnel every day.

4.12 Electrical Power

Duke Energy will cover the monthly cost of the electricity at no cost to the Contractor. Contractor shall be responsible for all electrical power and other utility costs above those to be provided by Duke Energy.

4.13 Interference with Traffic and Adjoining Properties

4.13.1 The Contractor shall conduct its operations in such a manner that interference with traffic or adjoining properties is avoided and the Contractor shall not enter any property other than that of the Owners unless otherwise directed or designated by Duke Energy. The Contractor must coordinate their activities with the Cell 1 Operations Contractor, as waste placement into Cell 1 may be on-going throughout construction.

4.13.2 The Contractor shall immediately report to Duke Energy, complete details of any complaints received from any property owners.

4.14 Observation Wells and Piezometers

4.14.1 The Contractor shall be held responsible for any damage to the well(s), piezometer(s), and associated equipment in and around the work area and shall be required to repair and/or replace any such damaged equipment at its expense as directed by Duke Energy. This equipment should be identified in the field by the Contractor before excavation begins. Contractor is responsible for requesting information on existing equipment and shall not remove until receiving written

approval by Duke Energy.

4.14.2 This equipment includes but is not limited to:

1. Water supply wells
2. Ground water monitoring wells
3. Piezometers
4. Inclinometers
5. Survey Monuments

4.15 Surveys

A Kentucky Registered Land Surveyor will be contracted by the Contractor. Contractor is responsible for any and all surveying needed for the completion of his work.

4.16 Hazardous Substances

4.16.1 The Contractor shall submit a Spill Prevention, Control and Countermeasure (SPCC) Plan to the station environmental coordinator. The SPCC Plan shall be submitted for approval to Duke Energy prior to mobilization.

4.16.2 Should there be any release of oils, hazardous material, etc., the Contractor shall immediately implement the appropriate SPCC Plan and immediately contact the station environmental coordinator and the Duke Energy project manager.

4.17 Fuel

Contractor's bid price shall include the cost to provide all fuel necessary to operate his equipment throughout the contract period. If the contractor elects to store fuel on-site in temporary facilities, storage shall conform to all applicable federal, state, and local laws.

4.18 Permits

Contractor shall be responsible for obtaining all state or local permits needed for his work which are not specifically included as part of this Specification.

4.19 Testing

Owner will provide personnel to observe or complete the field testing services required by the CQC Plan and the Technical Specifications. Testing will be in accordance with the CQC Plan and the Technical Specifications. Contractor shall facilitate testing and inspection of his work.

Failure of the Owner or Owner's Representative to identify a construction deficiency does not relieve the contractor of their responsibility to properly construct Cell 2 in accordance with the contract documents.

4.20 Work Hours

Work hours, work days, and locations shall be approved by Duke Energy Engineer. Unless specifically approved by Duke Energy working hours shall be limited to between 7:00 AM and 7:00 PM local time Monday through Saturday.

5.0 TERMS AND MISCELLANEOUS

5.1 Contract Schedule

Pre-Bid Meeting – January 8, 2019

Last date Requests for Information and Requests for Substitutions will be accepted – January 18, 2019

Final responses to RFI's and Substitution Requests – January 25, 2019

Bids Due - February 4, 2019

Purchase Order Award Date – February 18, 2019

Contract Execution – March 4, 2019

Mobilization Begins – No later than April 1, 2019

Pre-Construction Meeting – April 2, 2019

Purchase Order Completion Date – November 30, 2019

5.2 Extra Work

The Contractor agrees that, in the performance of any extra Work requested by Duke Energy, Contractor's CPE-10 labor rate shall be the amount billed throughout the project. Time sheets for the Work performed, shall be signed on a daily basis. Signed time sheets must accompany related invoices as back up documentation.

6.0 REFERENCE DRAWINGS

6.1 Landfill Construction Drawings

Drawing Set Titled: Cell Two Construction and Operation, Revised 04/13/2018

6.2 West Landfill Permit Drawings

Drawing Set Titled: Special Waste Landfill Permit Application, Revised June 2016

6.3 KYTC Standard Drawings

7.0 PROPOSAL FORMS

7.1 Proposal Form No. 1 – Pricing Schedule

Appendix 1 contains the Price Schedule Forms on which the prospective Bidders shall submit their quotations. Bidders shall complete both Alternate A and Alternate B. Work Items and quantities for Alternatives A and B are identical with the exception of the protective layer of ash to be installed above the drainage layer. Alternative A includes installation of the protective layer under this contract whereas Alternative B excludes installation of the protective layer from the contract work.

The forms lists all the work items for which Duke Energy requests a price to be submitted. The Bidder shall input their unit price for each item. Item totals shall be Contractor's unit rate multiplied by Engineer's estimated quantity. Note that the Engineer's quantities are estimates only; contractor will be paid for actual quantities of each item completed and accepted.

Bidder shall also provide their own estimated quantity for each item. If Bidder believes a significant deviations exists between Engineer's estimated quantity and the actual quantity of work required, Bidder should bring the issue to the attention of Duke Energy to ensure Bidder's understanding of item is correct and/or estimated

quantities are reasonable.

The unit prices quoted herein will be the basis for payment for all work performed under the Agreement. All prices shall be firm for the duration of the Agreement.

All items listed in the pricing schedule are the Duke Energy's best estimate for the work required, but no guarantee is made that these are all the items needed to complete the project. If after studying the project specifications, CQC Plan, and drawings, the Bidder determines that there is a work item missing, the Bidder shall notify Duke Energy prior to submitting a bid.

7.1.1 Requests for Information and Substitutions

Duke Energy will attempt to respond to Bidder Requests for Information and Requests for Substitutions within 3 working days of contractor submittal. All Bidder Requests for information and Requests for Substitution must be submitted on or before noon of the date listed in Section 5.1 of this Specification.

Request for substitution must clearly identify to which Item the substitution applies and must include not only alternate product information, but also a demonstration of equivalency to the original item.

7.1.2 Bid Alternatives

Bidders may provide bid alternatives with bid submittal. However, Bidder must provide unit pricing for work as specified in addition to any alternatives proposed. Failure to include unit pricing as specified is grounds for classification of bid as non-responsive.

7.2 Bid Items

The following list summarizes each pay item listed on the Pricing Schedule forms and indicates which materials and work items are to be included in the price quoted for that item. The summary of each pay item given herein and on the proposal form is for identification of the pay items only, and is not intended to define the full scope of work covered by that pay item. The full scope of work is described in the Technical Specifications provided in Appendix 2.

7.2.1 Article 2 - Mobilization

7.2.1.1 Item 2.1

The Bidder shall quote a lump sum price for mobilizing and demobilizing 100% of all labor, equipment, materials, and any other items necessary to perform the work specified herein. This item shall also include compliance with contract general conditions. The measurement for payment will be based on percent complete based on the items described in Article 2.

7.2.2 Article 3 - Earthwork

7.2.2.1 Item 3.1 Stripping and Stockpiling

The Bidder shall quote a per cubic yard price for stripping and stockpiling topsoil. Work includes maintaining the stockpiles and establishment of a vegetative cover on stockpiled material. Topsoil shall be stockpiled in the Excavated Material Stockpile Area or in a temporary stockpile for Cell 2 footprint project. No additional

payment will be made for re-handling of temporarily stockpiled material. No temporary stockpiles shall remain at the completion of work. If temporary stockpiling is needed, work also includes maintaining temporary stockpiles including installation of appropriate erosion and sedimentation control measures. Topsoil shall be stockpiled separately from excavated sub-soils. Payment shall be based on the unit price bid and the actual volume of material stockpiled as measured in accordance with Article 3.

7.2.2.2 Item 3.2 Excavation, Material to Stockpile

The Bidder shall quote a per cubic yard price for excavation of non-topsoil material (soil) and stockpiling of the material in the Excavated Material Stockpile Area. Work includes maintaining stockpiles and establishment of a vegetative cover on stockpiled material. Excavated soils shall be stockpiled separately from topsoil. Contractor shall establish separate piles for excavated cohesive and non-cohesive soils. Payment shall be based on the unit price bid and the actual volume of material stockpiled as measured in accordance with Article 3. No payment will be made for excavation of material from the Stockpiles and transport back to work area. In the event that subsequent to measurement for payment material must be removed and transported back to work area, contractor shall estimate quantity removed and credit Owner at bid unit rate.

7.2.2.3 Item 3.3 Excavation, Material Re-Used

The Bidder shall quote a per cubic yard price for excavation of non-topsoil material (soil) which will be re-used as fill. Work includes excavation, transport, spreading, and temporary stockpiling as required. No additional payment will be made for re-handling of temporarily stockpiled material. If temporary stockpiling is needed, work also includes maintaining temporary stockpiles including installation of appropriate erosion and sedimentation control measures. No temporary stockpiles shall remain at completion of work. Temporary stockpile locations shall be within the construction footprint or in the contractor use areas identified on the drawings. Quantity of on-site cohesive material is limited and such material is needed by Owner for special applications; contractor shall make an effort to segregate encountered cohesive material and excavate such material under Item 3.2 *Excavation, Material to Stockpile.*

There shall be no measurement for this Item. Quantity of material to be included for payment shall be equal to the quantity of fill placed and accepted for Items 3.4, 3.5, 3.6, 3.7 and 3.8; quantity of material placed as Item 3.9 *Ditch Cover* shall be excluded for payment as part of this item.

7.2.2.4 Items 3.4, 3.5, 3.6, 3.7 and 3.8 Compacted Fill

The Bidder shall quote a per cubic yard price for placement and compaction of soil fill materials. Types of compacted fill materials for project include:

- Undercuts with structural fill re-placement;
- Structural Fill, below Prepared Subgrade;
- Structural Fill, Prepared Subgrade;
- Perimeter Berm Cohesive Fill; and,
- Perimeter Berm Structural Fill

Work includes proofrolling of surfaces to receive fill, survey of surfaces to receive fill, survey of final fill surface, moisture adjustment, compaction, and re-work of areas failing to meet project requirements. Payment shall be based on the unit price bid and the actual quantity of material placed and accepted as measured in accordance with Article 3.

7.2.2.5 Item 3.9 Ditch Cover Soil

The Bidder shall quote a per cubic yard price for placement of topsoil in constructed ditches and other areas requiring topsoil at final constructed grade. Work includes survey of surface to receive fill, survey of final surface, excavation of topsoil from Excavated Material Stockpile Area or temporary stockpiles, transport of material, spreading of material, and fine grading. Topsoil can only be obtained from the project limits and the Excavated Material Stockpile. Stripping of adjacent areas outside project limits is not allowed. Payment shall be based on the unit price bid and the actual quantity of material placed and accepted as measured in accordance with Article 3.

7.2.3 Article 4 Geosynthetic Materials

7.2.3.1 Items 4.1, 4.2, and 4.3 Geocomposite Liner System

The Bidder shall quote a per square foot price for furnishing and installing the Geocomposite Liner System. Components of the system from bottom to top include:

- Geosynthetic Clay Liner;
- Textured Geomembrane Liner; and,
- Nonwoven Geotextile.

Excavation and filling of anchor trenches shall be considered incidental to the work. Performance of an electrical leak location survey following installation of the overlying drainage layer shall also be considered incidental to the work. Separate prices shall be provided and payment made for each component; however, a single measurement shall apply to all materials. Payment shall be based on the unit price bid and the actual plan view area of material placed and accepted as measured in accordance with Article 4. No payment shall be made for seaming, overlaps, repairs, patches, embedment, cut-offs, rejected material, or material not installed.

7.2.3.2 Item 4.4 Permanent Turf Reinforcement Mat

The bidder shall quote a per square foot price for furnishing and placing permanent and temporary turf reinforcement mat (TRM) over the ditch cover soil and at locations shown on the Drawings. Payment shall be made based on the actual area of TRM installed as measured in accordance with Article 4. No payment shall be made for overlaps, repairs, patches, cut-offs, rejected material, or material not installed.

7.2.4 Article 5 Gravity Drained Collection and Discharge Pipes

7.2.4.1 Items 5.1, 5.2, 5.3 Leachate Pipes

The Bidder shall quote a per linear foot price for furnishing and installing the leachate pipe network. Components items of the system include:

- Perforated Lateral Pipes; and
- Perforated Collection Pipes; and
- Non-Perforated Outlet Pipes.

Payment for items 5.1, 5.2 and 5.3 shall be based on the unit price bid and the actual plan view length of pipes installed and accepted as measured in accordance with Article 5.

7.2.4.2 Items 5.4, 5.5 and 5.6 Leachate Pipes

The Bidder shall quote a per each price for furnishing and installing ancillary components of the leachate system. Ancillary components items of the system include:

- Leachate Pipe connection between Cell 1 to Cell 2. Item includes, but is not necessarily limited to, removal of perimeter berm at Cell 1 outlet pipe and backfilling with bedding material; and, fitting from N-12 to DR11 pipe;
- Chimney Drain; and
- Leachate Pipe Clean-outs.

The following items shall be considered incidental to the pipe:

- Fitting and connectors;
- Bedding stone; and,
- Filter Fabric.

Payment for items 5.4, 5.5, and 5.6 shall be per each for installation of connections and systems in accordance with the details on the drawings.

7.2.5 Article 6 Drainage Layer

7.2.5.1 Item 6.1 Drainage Layer

The Bidder shall quote a per cubic yard price to furnish and install drainage layer aggregate. Drainage layer aggregate must be delivered to the site via barge and hauled to the West Landfill using the Transport Road. Work includes survey of surface to receive aggregate, survey of final surface, placement of material, and spreading of material. Payment shall be based on the unit price bid and the actual quantity of material placed and accepted as measured in accordance with Article 6.

7.2.5.2 Item 6.2 Drainage Layer, Protective Cover

The Bidder shall quote a per cubic yard price to install a protective layer of ash above the drainage layer. Work includes survey of surface to receive protective cover, survey of final surface, excavation of material from Cell 1 of the West Landfill at East Bend Station, transport of the material, placement of the material, and spreading of the material. Payment shall be based on the unit price bid and the actual quantity of material placed and accepted as measured in accordance with Article 6.

7.2.6 Article 7 – Roadways

7.2.6.1 Item 7.1 Road, Type 4B

The Bidder shall quote a per linear foot prices for installation of each type of road identified on the Bid Form. Work includes proofrolling, surveying sub-grade, surveying finish grade, and furnishing, placement, compaction, and fine grading of aggregate materials. Geogrid and fabric materials shall be considered incidental to the work. Topsoil stripping, soil excavation, and structural fill associated with the road construction shall be included for payment under the appropriate separate pay items. Payment shall be based on the unit price bid and the actual plan view length of road installed and accepted as measured in accordance with Article 7.

7.2.7 Article 8 – Concrete Structures

7.2.7.1 Item 8.1 Concrete Run-Off Channel Outlet Apron and Splash Board

The Bidder shall quote a per each price for the installation of reinforced concrete aprons. Splashboard are considered incidental to the aprons. Work includes but is not limited to material, labor, and equipment associated with sub-grade shaping, formwork, reinforcement, concrete, finishing, joints, and water stops. Payment shall be made at the unit price bid for each installed and accepted apron as measured in accordance with Article 8.

7.2.7.2 Items 8.2 Temporary Pipe Culverts

The Bidder shall quote a per linear foot price to furnish and install pre-cast, reinforced concrete, temporary pipe culverts. Excavation, backfill, and bedding stone, fabric, and cover stone are considered incidental to the culverts. Culverts are considered temporary by Owner and are to be removed by others at a later date under a separate contract; materials shall not be returned to contractor. Only temporary culverts identified on the drawings shall be included for payment under this item. Payment shall be made at the unit price bid for per linear foot and actual length of pipe installed and approved as measured in accordance with Article 8.

Contractor may need to install temporary culverts beyond those depicted on the drawing to facilitate work. If needed, such culverts shall be installed in general accordance with details included in the drawings. Unless such additional temporary culverts are identified by Owner to remain the completion of work, all such additional temporary culverts shall be removed at the completion of project. Additional temporary culverts which are identified by Owner to remain at completion of work shall be included for payment under this item; no payment will be made for culverts which are to be removed at completion of work. Failure of contractor to remove temporary culverts not designated by Owner to remain will not be considered grounds for payment for such culverts.

7.2.8 Article 12 – Vegetative Cover

7.2.8.1 Item 12.1 Vegetative Cover

The Bidder shall quote a per acre price for all labor equipment and material necessary for establishment of a vegetative cover on designed cut and fill grades. Work includes, but is not limited to, fine grading, seed bed preparation, fertilizer, and mulch. Vegetative cover is not required on protective cover placement areas.

Establishment of vegetation is required for all contractor disturbed areas. Measurement and payment under this item excludes the following:

- Temporary Access Road restoration;
- Laydown Area restoration;
- Temporary Stockpile Areas;
- Temporary vegetative cover for Erosion and Sedimentation Control;
- Other areas of disturbance beyond design cuts and fills;

Reimbursement for vegetation for other areas excluded from this Article shall be included for payment under the following items:

- Soil stockpiles; establishment of vegetative cover on stockpiles is included as part of Item 3.3 and 3.4 Excavation; and,
- Temporary vegetative cover as required for Erosion and Sedimentation Control; included as part of Item 9.1 Erosion and Sedimentation Control.
- All other; included as part of item 2.1 Mobilization

No payment shall be made for re-seeding of failed growth areas within the contract warranty period. If erosion or other damage occurs prior to the establishment of satisfactory vegetative cover, such damage shall be repaired and areas revegetated at no additional cost to Owner. Payment shall be based on the unit price bid and the actual area of vegetative cover installed and accepted as measured in accordance with Article 12, subject to the limitations described herein.

7.2.9 Article 15 Erosion and Sedimentation Control

7.2.9.1 Item 15.1 SWPPP and Implementation

The Bidder shall quote a lump sum price for development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) plan addressing all areas of contractor disturbance for the duration of the Contract. Work shall conform to Article 15 of Technical Specifications. Payment shall be the percent complete multiplied by the bid lump sum amount less prior partial payments.

7.3 Proposal Form No. 2 - Construction Schedule

This form consists of two parts. The first part shall be a list of all major work milestones. Additional milestones are at the discretion of the bidder. The second part of the form shall be a bar graph of the construction schedule showing all work activities to be performed by the Contractor. No compensation shall be made to the Contractor for lost time due to weather.

7.4 Proposal Form No. 3A - Equipment Rental Schedule for Extra Work –

To Be Submitted Annually; and

7.5 Proposal Form No. 3B - Bare Equipment Rental Schedule for Extra Work -

On both of these forms the Bidder shall list all the equipment required to execute the work, and this shall represent 100% mobilization when available for work at the site. The Bidder will supply rental rates for this equipment. These rates will be used to cover extra work that might arise during the course of this work. When the form provided is not long enough, the Bidder may attach additional pages. The Bidder

shall also provide a list of equipment, with rental rates, for equipment not intended to be mobilized to execute the work, but for which a need might arise during the course of the work. If additional equipment is required for the project, and it is not listed on these forms, the Contractor is expected to provide the rates prior to mobilization of the equipment. The Bidder shall include equipment to perform the If Authorized Work Items, Bid Items No. 42 and 43.

The Bidder is advised to read carefully the notes provided on these forms outlining the basis for payment, and what shall be included in the rates. These forms shall be submitted yearly on the anniversary date of the contract.

7.6 Proposal Form No. 4 - Labor Relations Information

On this form the Bidder shall list all current collective labor agreements, including those of any subcontractors engaged. This information is to be submitted, with the bid and annually on January 1, if the Contract covers a period longer than a single calendar year.

7.7 Proposal Form No. 5 - Subcontractor Information

On this form the Bidder shall list all subcontractors, their addresses, and the portion of the Work for which they are proposed.

7.8 Proposal Form No. 6 - Supervisory Personnel

On this form the Bidder shall list all supervisory personnel to be assigned to the project, and shall provide a resume for each.

7.9 Proposal Form No. 7 – Safe Work Plan

On this page, and any additional attached pages, the Bidder shall describe how they will approach the work in a safe manner identifying the rules, systems, procedures, and practices that will be implemented to insure the work will be carried out in a safe manner.

APPENDIX 1

PROPOSAL FORMS

EAST BEND STATION

WEST LANDFILL

PROPOSAL FORMS

EAST BEND WEST LANDFILL

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Proposal Form #1A - Bid Schedule, Alternative A Rev 1

4/13/18

West Landfill Cell No. 2
East Bend Station

Bidder: _____

ITEM NO.	SPEC REF	DESCRIPTION	ENGINEER'S QUANTITY ESTIMATE	BIDDERS QUANTITY	UNITS	UNIT PRICE	BID PRICE
2.1	2	Mobilization	1		LS		$ -
3.1	3	Topsoil Stripping & Stockpiling	22,500		CY		$ -
3.2	3	Excavation, Material to Stockpile	367,000		CY		$ -
3.3	3	Excavation, Material Re-used	138,000		CY		$ -
3.4	3	Structural Fill, Undercut	40,500		CY		$ -
3.5	3	Structural Fill, Below Prepared Subgrade	5,400		CY		$ -
3.6	3	Structural Fill, Prepared Subgrade	128,000		CY		$ -
3.7	3	Perimeter Berm, Structural Fill	2,220		CY		$ -
3.8	3	Perimeter Berm, Cohesive Fill	2,110		CY		$ -
3.9	3	Ditch Cover Soil	2,300		CY		$ -
4.1	4	Geocomposite Liner, Geosynthetic Clay Liner	1,653,000		SF		$ -
4.2	4	Geocomposite Liner, Textured Geomembrane Liner	1,653,000		SF		$ -
4.3	4	Geocomposite Liner, Nonwoven Geotextile	1,653,000		SF		$ -
4.4	4	Turf Reinforcement Mat, Pemanent	53,380		SF		$ -
5.1	5	Pipe, Leachate Laterals, HDPE DR 11, 8" IPS, perforated	10,124		LF		$ -
5.2	5	Pipe, Leachate Collectors, HDPE DR 11, 12" IPS, perforated	2,318		LF		$ -
5.3	5	Pipe, Leachate Outlet, HDPE DR 11, 12" IPS, non-perforated	113		LF		$ -
5.4	5	Cell 1 to Cell 2 Pipe Connection	1		EA		$ -
5.5	5	Pipe, Chimney Drain, CD-2	1		EA		$ -
5.6	5	Leachate Pipe Clean-Out, Type 3	3		EA		$ -
6.1	6	Drainage Layer	121,000		CY		$ -
6.2	6	Drainage Layer, Protective Cover	128,000		CY		$ -
7.1	7	Road, Type 4B	90		LF		$ -
8.1	8	Concrete Run-Off Channel Outlet Apron and Splash Board	2		EA		$ -
8.2	8	Temporary Pipe Culverts, 24" Concrete Pipes	664		LF		$ -
12.1	12	Vegetative Cover	3.24		AC		$ -
15.1	15	Erosion and Sedimentation Control	1		LS		$ -

TOTAL BID PRICE $ -

Bid Price shall be Engineer's Estimated Quatity mulitplied by Unit Rate
Bidders Quantity for informational and evaluation purposes

Proposal Form #1B - Bid Schedule, Alternative B

Rev 0
4/13/18

West Landfill Cell No. 2
East Bend Station

Bidder: _____

ITEM NO.	SPEC REF	DESCRIPTION	ENGINEER'S QUANTITY ESTIMATE	BIDDERS QUANTITY	UNITS	UNIT PRICE	BID PRICE
2.1	2	Mobilization	1		LS		$ -
3.1	3	Topsoil Stripping & Stockpiling	22,500		CY		$ -
3.2	3	Excavation, Material to Stockpile	367,000		CY		$ -
3.3	3	Excavation, Material Re-used	138,000		CY		$ -
3.4	3	Structural Fill, Undercut	40,500		CY		$ -
3.5	3	Structural Fill, Below Prepared Subgrade	5,400		CY		$ -
3.6	3	Structural Fill, Prepared Subgrade	128,000		CY		$ -
3.7	3	Perimeter Berm, Structural Fill	2,220		CY		$ -
3.8	3	Perimeter Berm, Cohesive Fill	2,110		CY		$ -
3.9	3	Ditch Cover Soil	2,300		CY		$ -
4.1	4	Geocomposite Liner, Geosynthetic Clay Liner	1,653,000		SF		$ -
4.2	4	Geocomposite Liner, Textured Geomembrane Liner	1,653,000		SF		$ -
4.3	4	Geocomposite Liner, Nonwoven Geotextile	1,653,000		SF		$ -
4.4	4	Turf Reinforcement Mat, Pemanent	53,380		SF		$ -
5.1	5	Pipe, Leachate Laterals, HDPE DR 11, 8" IPS, perforated	10,124		LF		$ -
5.2	5	Pipe, Leachate Collectors, HDPE DR 11, 12" IPS, perforated	2,318		LF		$ -
5.3	5	Pipe, Leachate Outlet, HDPE DR 11, 12" IPS, non-perforated	113		LF		$ -
5.4	5	Cell 1 to Cell 2 Pipe Connection	1		EA		$ -
5.5	5	Pipe, Chimney Drain, CD-2	1		EA		$ -
5.6	5	Leachate Pipe Clean-Out, Type 3	3		EA		$ -
6.1	6	Drainage Layer	121,000		CY		$ -
7.1	7	Road, Type 4B	90		LF		$ -
8.1	8	Concrete Run-Off Channel Outlet Apron and Splash Board	2		EA		$ -
8.2	8	Temporary Pipe Culverts, 24" Concrete Pipes	664		LF		$ -
12.1	12	Vegetative Cover	3.24		AC		$ -
15.1	15	Erosion and Sedimentation Control	1		LS		$ -

TOTAL BID PRICE $ -

Bid Price shall be Engineer's Estimated Quatity mulitplied by Unit Rate
Bidders Quantity for informational and evaluation purposes

Proposal Form #2 Page 1 of ___

CONSTRUCTION SCHEDULE

PROJECT: _____

BIDDER: _____

BIDDER SHALL SUBMIT A BAR GRAPH SCHEDULE FOR THE PROJECT WHICH INCLUDES ALL MAJOR WORK ACTIVITIES AND SHOWS START AND END DATES FOR EACH ACTIVITY AS WELL AS PRODUCTION RATES FOR EACH ACTIVITY.

MILESTONE DATES FOR EACH MAJOR ACTIVITY SHALL BE LISTED. SCHEDULE SUBMITTED SHALL BE BASED ON THE PURCHASE ORDER AND COMPLETION DATES INDICATED BELOW AS WELL AS ANY OTHER MILESTONE DATES REQUIRED BY OWNER AND INDICATED BELOW.

NOTE: Bidder shall number the page(s) of his bar graph schedule starting with page 2, and attach it hereto.

At a minimum, the following milestones shall be included:

- Erosion and Sedimentation control installation complete
- Stripping and initial excavation/grading to base of prepared subgrade complete
- Prepared subgrade installation complete
- Liner installation complete
- Leachate piping complete
- Drainage layer complete
- Protective layer complete

Proposal Form #3A EQUIPMENT RENTAL SCHEDULE Page 1 of ___

FOR EXTRA WORK

(100% Mobilization)

PROJECT: _____

BIDDER: _____

The equipment listed below shall represent 100% mobilization when it is all available for work at the site. The Bidder shall list all equipment required to execute the Work. All substitutions shall require the written approval of the Duke Energy Engineer.

The rental rates quoted shall include all costs for rental, overhead, profit, fuel, oil, grease, repair parts and service maintenance labor. The rental rates shall not include operator labor costs.

Hourly rental rates. Determined by dividing the quoted monthly rate by 176, shall apply up to a maximum of 176 hours in any calendar month after which the monthly rate shall apply. No premium shall be Paid on these rates for overtime or shift Work.

The Bidder shall supply on Form 3A Part 2, rental rates for all of its equipment which is not included in the proposed 100% mobilization fleet for the Project.

The Bidder shall state the manufacturer, year of manufacture, model number, capacity, and quantity of each unit to be mobilized.

QUANTITY	DESCRIPTION	MONTHLY RENTAL PER UNIT
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Use following form for continuation if necessary)

Proposal Form #3A EQUIPMENT RENTAL SCHEDULE Page 2 of ___

FOR EXTRA WORK

(100% Mobilization)

PROJECT: _____

BIDDER: _____

OUANTITY	DESCRIPTION	MONTHLY RENTAL PER UNIT

(Copy and insert additional pages as necessary)

Proposal Form #3B BARE EQUIPMENT RENTAL SCHEDULE Page 1 of ___

FOR EXTRA WORK

(100% Mobilization)

PROJECT: _____

BIDDER: _____

The equipment listed below shall represent 100% mobilization when it is all available for work at the site. The Bidder shall list all equipment required to execute the Work. All substitutions shall require the written approval of the Duke Energy Engineer.

The bare equipment rental rates are for rental rates only and are not to include overhead and profit, fuel, oil, grease, repair, parts, service maintenance and operating labor.

Hourly rental rates, determined by dividing the quoted monthly rate by 176, shall apply up to a maximum of 176 hours in any calendar month after which the monthly rate shall apply. No premium shall be paid on these rates for overtime or shift Work.

The Bidder shall supply on Form 3B Part 2, rental rates for all of its equipment which is not included in the proposed 100% mobilization fleet for the Project.

The Bidder shall state the manufacturer, year of manufacture, model number, capacity, and quantity of each unit to be mobilized.

QUANTITY	DESCRIPTION	MONTHLY RENTAL PER UNIT
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Use following form for continuation if necessary)

Proposal Form #3B BARE EQUIPMENT RENTAL SCHEDULE Page 2 of ___

FOR EXTRA WORK

(100% Mobilization)

PROJECT: _____

BIDDER: _____

OUANTITY	DESCRIPTION	MONTHLY RENTAL PER UNIT

(Copy and insert additional pages as necessary)

Proposal Form #4 LABOR RELATIONS INFORMATION Page 1 of ___

PROJECT: _____

BIDDER: _____

Current collective labor agreements which Bidder or each company as a partner in a joint venture, has in force covering the site, are to be listed below. Similar information is to be given for each Sub-Bidder.

Bidder Agreements

	Union	Local	Termination Date
A.			
B.			
C.			
D.			
E.			

Sub Bidder Agreements

	Union	Local	Termination Date
A.			
B.			
C.			
D.			
E.			

Proposal Form #5 SUBCONTRACTOR INFORMATION Page 1 of ___

PROJECT: _____

BIDDER: _____

Bidder shall list all Sub-Contactors, their addresses, and portion of the work that they will perform.

	Sub-Contractor and Address	Portion of Work to be Performed
1.	_____	_____
	_____	_____
	_____	_____
	_____	_____
2.	_____	_____
	_____	_____
	_____	_____
	_____	_____
3.	_____	_____
	_____	_____
	_____	_____
	_____	_____

4. _____ _____

_____ _____

_____ _____

_____ _____

Proposal Form #6 SUPERVISORY PERSONNEL Page 1 of ___

PROJECT: _____

BIDDER: _____

Bidder shall supply a resume for each employee assigned to the work in a supervisory position.

Name	Position

SAFE WORK PLAN

PROPOSAL FORM # 7 Page 1 of _____

Bidder to provide a Safe Work Plan describing how they will approach the work in a safe manner identifying the rules, systems, procedures, and practices that will be implemented to insure the work will be carried out in a safe manner.

APPENDIX 2

TECHNICAL SPECIFICATIONS

EAST BEND STATION

WEST LANDFILL

TECHNICAL SPECIFICATIONS

WEST SPECIAL WASTE LANDFILL
EAST BEND STATION

SECTION V: Technical Specifications

Division 2: Civil / Structural / Architectural

Article

*Denoted Articles do not apply to Cell 2 Footprint Construction and have been omitted.

ARTICLE 1 – GENERAL

A. GENERAL INFORMATION

Existing topographic information shown on the plans is based on an aerial survey performed by Kucera International Inc. on August 25, 2017. Map accuracy is 2 foot contour interval at a scale of 1 inch = 100 feet. The coordinate system used for both existing features and proposed work is State Plane, Kentucky 1601 North, North American Datum (NAD) 1983 (1993 Adjustment), North American Vertical Datum (NAVD) 1988. All other surveying required to assure compliance with the plans are the responsibility of the Contractor. The Contractor is to verify that survey benchmarks and intended elevations for the work are as indicated on the plans. Any property corner pins or permanent survey markers disturbed during construction shall be reset by a Registered Surveyor at the Contractor's expense.

It is the responsibility of the Contractor to visit the site and verify the extent of the work to be performed prior to submitting a Bid.

Where "Owner" is referred to in the plans it shall mean Duke Energy. Where the "Engineer" is referred to it shall mean the Project Engineer from S&ME, Inc. or his representative. KYDEP or KDEP refers to the Kentucky Department of Environmental Protection. KYTC refers to the Kentucky Transportation Cabinet.

The Standard Specifications for Road and Bridge Construction, published by the KYTC (2012 Edition) together with the Construction Quality Control (CQC) Plan, CQC Plan Addendum 1, Technical Specifications, and Drawings shall govern materials and workmanship involved in the construction of the Landfill. Where discrepancies are identified between the Technical Specifications and the CQC Plan, the CQC Plan will control.

Field and laboratory testing and sampling shall be performed by the Owners representative. The Contractor shall cooperate with the necessary personnel to allow for proper testing and inspection of the work. The Owner’s Representative is authorized to observe all work performed and materials furnished. Such observation may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials furnished. The Owner’s Representative is not authorized to issue instructions contrary to the Contract, or to act as foreman for the Contractor. However, the Owner’s Representative has the authority to reject work or materials until any questions at issue are referred to and as the Engineer or Owner decides.

The Contractor shall keep the site free of trash, litter and waste material and shall maintain the site in a neat and orderly condition throughout the entire project. The Contractor shall remove all mud, soil and debris that may be tracked onto local roads or Plant access roads by his equipment or that of Subcontractors or Suppliers daily.

The Contractor shall be responsible for recording all the approved changes to these plans on a set of Record Drawings during construction. These plans are to be submitted to the Engineer at completion of the project. Any modification to the work as shown on these drawings must have prior written approval from the Owner.

Contractor is responsible for any and all surveying required for his work including surveying for measurement and payment. Additionally, a topographic survey utilizing a 50-foot grid pattern is required for:

1. Bottom of structural fill;
2. top of structural fill/bottom of prepared subgrade;
3. top of prepared subgrade;
4. top of drainage layer; and,
5. top of protective cover.

Survey of the top of the geosynthetic liner surface is not required. At the contractor's discretion, the elevation of the top of the geosynthetic liner can be either surveyed or calculated by adding a thickness of 0.05 feet to the elevation of the top of prepared subgrade. Other surveying is required for certification of work as noted within the CQC Plan or these Articles. Digital files shall be submitted to the Engineer for review in the latest version of Microstation or AutoCAD.

All work is to be completed in accordance with the plans as deemed acceptable to the Owner and Engineer. No work is to commence prior to authorization by the Owner and Engineer.

The Contractor shall secure and pay for all permits and government fees, licenses, and inspections necessary for the proper execution and completion of the improvements shown on the plans.

The Contractor and all the Subcontractors shall be solely responsible for complying with all Federal, State and Local safety requirements together with exercising caution at all times for the protection of persons (including Employees) and property. It is also the sole responsibility of the Contractor and Subcontractors to initiate, maintain and supervise all safety requirements, precautions and programs in connection with the work.

The cost of any dewatering operation required for the construction shall be included in the price bid for the various items.

The Contractor shall repair any and all existing work damaged during, or due to the execution of, this Contract at their own expense. All said work to be repaired or replaced to the satisfaction of the Owner's Engineer or Duke Energy.

Construction activities outside the hours of 7:00 AM and 7:00 PM. or outside the hours allowed for construction by local ordinances or regulations are not permitted without prior approval from Duke Energy.

B. NOTIFICATION REQUIREMENTS

The Owner and the Engineer must be notified 4 days in advance of the following construction activities:

1) Proofrolling
2) Placement of Structural Fill.
3) Placement of Concrete.
4) Placement of the geosynthetic materials.

If proper notification is not received, the Owner reserves the right to delay the activity.

C. UTILITY PROTECTION

The contractor shall be responsible for the investigation, location, support, protection and restoration of all existing utilities and appurtenances whether shown on the plans or not. The Contractor shall call Kentucky Underground Protection, Inc. (800-752-6007) at least 72 hours prior to construction and shall notify all utility companies at least 48 hours prior to work in the vicinity of their utilities. The Contractor shall coordinate all work with East Bend Station Personnel where near existing Plant utilities.

D. SEQUENCE OF CONSTRUCTION

Landfill Cells shall be constructed sequentially beginning with Cell 1 and ending with Cell 8. At the owner's discretion, each landfill cell may be subdivided and constructed in Phases.

A one-season construction schedule for Cell 2 is requested for evaluation by Duke Energy. .

E. SUBMITTALS FOR REVIEW

The following submittal schedule is provided for contractor convenience. Additional submittals may be required, identified, or requested by the Owner or Engineer during construction. The submittals are grouped according to the required submittal information.

Material Submittals (including manufacturer qualifications where required):

- Geocomposite Liner System Materials:
  - Geosynthetic Clay Liner
  - Geomembrane
  - Geotextile
- Aggregate Sources
- Geogrid
- Concrete Pipe
- Leachate Drainage Layer Sand
- Leachate Drainage Layer Aggregate
- Leachate Pipe Filter Fabric
- Leachate Pipe Manufacturers Data
- Permanent Turf Reinforcement Matting

Material Manufacture Quality Control Testing Data

- Geocomposite Liner System Materials:
  - Geosynthetic Clay Liner
  - Geomembrane
  - Geotextile
- Leachate Pipe including Manufacturer's Certifications

Planned Installation Procedures

- Leachate Pipe Fusion Methods

- Certification Survey Point Grid and material Elevations

- Electrical Leak Location Procedures
- Hot & Cold Weather Concreting Techniques
- Liner Panel Layout Plan

Environmental Plans

- Staging and Access Plan
- Spill Prevention, Control and Countermeasure (SPCC)
- Storm Water Pollution Prevention Plan (SWPPP)

Shop Drawings and Mix Designs

- Concrete Aprons
- Structural Reinforcement Fabrication Drawings
- Concrete Mix Designs

Post-Installation Documentation

- Leachate Pipe Fusion Records
- Electrical Leak Location Survey
- Certification spot elevations
- As-built liner limits/elevation
- As-built waste limits/elevation

ARTICLE 2 - MOBILIZATION

A. This item of work includes the furnishing of labor and equipment necessary for performing the work required under the contract not specifically included in any other items. Work includes but is not limited to Project Management, mobilization of construction trailers, and the development of equipment and material staging areas. The work also includes providing access to the work area as required to complete the construction.

B. The Contractor shall keep the site of the work free from trash, litter, and waste material and shall maintain the site in a neat and orderly condition throughout the period of the work. All damages to structures and property caused by the Contractor's operations shall be repaired and the surrounding grounds shall be cleared of all rubbish caused by construction.

C. At completion, this item shall include: demobilization of all personnel, equipment, and materials, removal of all temporary buildings, roads and other structures, and returning the entire premises to a clean and acceptable condition. Additionally, this item shall include restoration and re-vegetation of any and all areas disturbed by contractor operations, not otherwise included for payment under the Contract. Specific areas of restoration and re-vegetation included as part of mobilization are as follows:

1. Temporary access roads;
2. Laydown areas;
3. Borrow Pits;
4. SPCC structures;
5. Temporary stockpile areas; and,
6. Other areas of disturbance beyond design cuts and fills.

Owner reserves the right to request the Contractor to re-seed and re-mulch as necessary to restore the site to original condition.

D. No additional compensation will be made to the Contractor for remobilization after his equipment has been removed from the site.

ARTICLE 3 – EARTHWORK

3.1 EXCAVATION AND STOCKPILING

A. This item of work includes furnishing all labor, equipment, and material necessary to remove and stockpile soils from the site prior to placement of fill or other construction activities. The work includes but is not necessarily limited to:

1. clearing and grubbing;
2. stripping and stockpiling of topsoil;
3. excavation and stockpiling of sub-soils; and,
4. general site excavation and grading.

B. Clearing and Grubbing - The Contractor shall clear and grub all areas required for access to the site and execution of the work, including prior cleared areas. Contractor shall cut, clear, and completely remove all growth and vegetation, including stumps, logs, brush, downed timber or any other undergrowth without excessive disturbance of soil. Roots and other debris larger than 1-inch in diameter shall be removed by grubbing operations prior to stripping of topsoil.

C. Stripping and Stockpiling of Topsoil - Topsoil is defined as soils that contain greater than 3% organic content as determined by loss-on-ignition (LOI) testing. Topsoil shall be stripped from all areas of proposed cut and all areas where fill is to be placed. The topsoil shall be stockpiled at locations approved by the Owner for future use. Topsoil shall be stockpiled separately from other excavated soils. Work includes maintaining stockpiles and establishment of a vegetative cover on stockpiled material.

D. Excavation and Fill Archeological Clearance – No area shall be cut or fill placed without observations in accordance with the Unanticipated Discovery Plan.

E. Excavation and Stockpiling of Sub-Soils - Soils present above the proposed construction grades shall be excavated and stockpiled for future use at locations approved by the Owner. Soils excavated which will be replaced as fill material can be placed in temporary stockpiles. The temporary stockpile shall be within the proposed construction footprint, in the Excavated Material Stockpile area, or in the laydown areas allowed by the Owner for construction. No temporary stockpiles shall remain at the completion of the work. Sub-soils shall be stockpiled separately from topsoil. Contractor shall establish separate piles for excavated cohesive and non-cohesive soils. Non-cohesive materials are those with greater than 50% of the material coarser than a 200 sieve; determination of cohesive versus non-cohesive can be made visually with concurrence with the Owner or Owner's Representative. Work includes maintaining stockpiles and establishment of a vegetative cover on stockpiled material.

F. General Site Excavation and Grading - General site excavation and grading includes any and all excavation, handling, stockpiling, placement of fill, and grading necessary for the construction of the landfill which are not specifically identified in these specifications and/or included for payment as part of other items of work.

3.2 STRUCTURAL FILL

A. This item of work includes furnishing all labor, equipment, and materials necessary to place structural fill as depicted on the Drawings, as described in these specifications, and in accordance with the Construction Quality Control Plan.

B. Structural fill generally includes materials described on the Drawings as compacted soil, backfill, structural fill or prepared subgrade. This item of work specifically includes:

1. fill necessary for the construction of the berms associated with the anchor trenches;
2. embankments necessary for the construction of ditches;
3. filling of depressions to reach the base of the compacted soil subgrade layer;
4. prepared subgrade; and,
4. backfilling the anchor trench.

C. Materials - The material to be used for structural fill shall consist of inorganic soils. Topsoil shall not be used as structural fill. The soil shall have a maximum clod size of four (4) inches or half the lift thickness, whichever is less. The soil shall be free of stones larger than 3-inches in diameter, debris, roots, and other deleterious material.

D. Placement

1. Topsoil shall be removed prior to placement of fill. The fill shall not be placed on a frozen subgrade, nor shall snow, ice or frozen materials be incorporated into the fill. Fill shall not be placed in standing water.

2. Horizontal benches shall be excavated on to slopes to receive fill so that fill can be placed in horizontal lifts.

3. Maximum uncompacted lift thickness shall not exceed 8 inches.

4. If the top surface of the preceding layer of fill becomes too dry to permit a suitable bond, the surface shall either be removed; or, scarified and moistened by sprinkling water and discing to achieve acceptable moisture content prior to placement of the next layer of fill.

5. Placement of soil in the anchor trench shall be completed in two lifts. The first lift shall be compacted with a walk-behind vibratory compactor. The second lift shall be compacted at the surface with the walk-behind vibratory compactor or standard compaction equipment. Soil placement and compaction shall be performed in such a manner that the liner is not damaged.

E. Compaction - Structural Fill except in the anchor trench shall be compacted to a minimum of 98 percent of maximum dry density as determined by the "Standard" compaction test (ASTM D698) with a moisture content between minus two (-2) and plus two (+2) percent of optimum moisture content.

F. Observation and Testing

1. Prior to structural fill placement, the areas to receive fill shall be proofrolled to identify soft or weak areas. Proofrolling shall also be required on the surface of any structural fill placed in order to achieve a grade 24-inches below the liner grade. The proofroll shall be performed with equipment as specified in Section 2.2 of the CQC Plan.

   If Contractor desires to use an alternative piece of equipment for proofrolling than specified by the CQC Plan, then Contractor is responsible for preparing an equivalency demonstration and submitting the demonstration to the Owner at the preconstruction meeting. The demonstration requires approval by both the Engineer and KDEP and may not be accepted.

   Proofrolling shall be observed by the Owners field representative and any areas determined to be unsuitable for fill placement shall be overexcavated and replaced with structural fill.

2. Except where structural fill is being placed to construct the prepared subgrade or for the anchor trench, density/moisture content testing shall be performed by the Owners field representative at a frequency of one (1) test per 2,000 cubic yards. Where structural fill is being placed for the construction of the prepared subgrade, density/moisture content testing shall be performed by the Owners field representative at a frequency of nine (9) tests per lift per acre. Where structural fill is being placed for backfill of the anchor trench, no density testing is required.

3. Fill material for structural fill or prepared subgrade which is obtained from the permanent stockpile area, or whenever there is a concern regardless of source, shall be tested for Loss on Ignition (ASTM D2974) at a frequency not less than one test per lift per acre. Material having an organic content consistent with topsoil as defined in Paragraph 3.1 (C) of this Article shall not be used as structural fill or prepared subgrade. LOI testing shall not be required if the stockpiled material was obtained from within the cell footprint and the temporary stockpile is also located within the same cell footprint.

4. Costs for field and laboratory testing and sampling shall be paid by the Owner. The Contractor shall notify the Owner or the Owner's Representative at least 48-hours prior to fill placement.

3.3 PERIMETER BERM SOIL

A. This item of work includes furnishing all labor, equipment, and materials necessary to place perimeter berm soil fill as depicted on the Drawings and as described in these specifications. As depicted on the Drawings, an internal perimeter berm of compacted cohesive soil shall be constructed around the perimeter of Landfill Cells 1 through 5 and Landfill Cell 8. This item of work covers the placement of the following types of soil cover:

1. Structural Fill; and,

2. Cohesive Fill.

B. Materials –The compacted soil fill shall be in-organic soils. Topsoil shall not be used as compacted cohesive soil. The soil shall have a maximum clod size of four (4) inches or half the lift thickness, whichever is less. The soil shall be free of stones larger than 3-inches in diameter, debris, roots, and other deleterious material. For the cohesive soil, at least 50% of the material by weight shall pass the No. 200 sieve.

C. Placement - Placement of perimeter berm soil shall conform to the requirements for "Structural Fill," except the following maximum ground contact pressures must be followed for placement above the geosynthetic liner:

Max Equipment Ground Pressure (psi)	Thickness of Soil Cover (inches)
Equipment not permitted	< 12
<5	12 - 18
5 – 10	18 - 24
>10	> 24

D. Compaction - Compaction of perimeter berm soil shall conform to the requirements for "Structural Fill".

E. Observation and Testing - Observation and testing of the compacted cohesive soil shall conform to the requirements for "Structural Fill".

3.4 SOIL COVER

A. This item of work includes providing all labor, equipment, and materials necessary to furnish and install soil cover materials in accordance with the Drawings, these Specifications, and the Construction Quality Control Plan. This item of work covers the placement of the following types of soil cover:

1. Permanent;
2. Temporary; and,
3. Ditch.

B. Materials – The soil shall have a maximum clod size of four (4) inches or half the lift thickness, whichever is less. The soil shall be free of stones larger than 3-inches in diameter, debris, roots, and other deleterious material. Topsoil or topsoil mixed with inorganic soils is required. Inorganic soil shall meet the gradation requirements of the Unified Soil Classification System for any one of the following types: SM, SL, CL, or CH.

C. Placement - Material shall be placed and spread so as to minimize compaction. Where geosynthetic materials are to be covered, the soil cover shall be pushed onto and spread across the geosynthetic materials using equipment having the following maximum ground pressures:

Max Equipment	Thickness of

Ground Pressure (psi)	Soil Cover (inches)
Equipment not permitted	< 12
<5	12 - 18
5 – 10	18 - 24
>10	> 24

D. Observation and Testing

1. For areas of temporary and final waste cover, hand-dug test holes shall be completed by the Owners Representative at a density not less than 5 holes per acre to verify that the required minimum depth of placement has been achieved.

2. For areas of ditch cover, hand-dug test holes shall be completed by the Owners Representative at intervals not less than 200 linear feet to verify that the required minimum depth of placement has been achieved.

3.5 COMPACTED SOIL

A. This item of work includes furnishing all labor, equipment, and materials necessary to place compacted soil for the construction of surface water diversion berms on the temporary and permanent landfill cover as depicted on the Drawings and described in these specifications.

B. Materials - The soil shall have a maximum clod size of four (4) inches or half the lift thickness, whichever is less. The soil shall be free of stones larger than 3-inches in diameter, debris, roots, and other deleterious material. Topsoil mixed with in-organic soils is acceptable for use. Inorganic soil shall meet the gradation requirements of the Unified Soil Classification System for any one of the following types: SM, SL, CL, or CH.

C. Placement

1. The fill shall not be placed on a frozen subgrade, nor shall snow, ice or frozen materials be incorporated into the fill. Fill shall not be placed in standing water.

2. Maximum uncompacted lift thickness shall not exceed 8 inches.

3. If the top surface of the preceding layer of fill becomes too dry to permit a suitable bond, the surface shall either be removed; or, scarified and moistened by sprinkling water and discing to achieve acceptable moisture content prior to placement of the next layer of fill.

D. Compaction - Fill for surface water diversion berms shall be compacted to a minimum of 95 percent of maximum dry density as determined by the "Standard" compaction test (ASTM D698) with a moisture content between minus two (-2) and plus two (+2) percent of optimum moisture content.

E. Observation and Testing - Density/moisture content testing shall be performed by the Owners field representative at a frequency of one (1) test per 2000 cubic yards of material placed.

3.6 MEASUREMENT

A. Measurement

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement, including calculations where appropriate, shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Items to be paid on an area basis (clearing and grubbing), shall be measured for purpose of payment by a field survey of the perimeter of the actual areas of work completed and accepted. Survey points around the perimeter shall be obtained on intervals no greater than 50 feet.

3. Excavated and stockpiled sub-soils for Owners future use shall be measured for purposes of payment by surveying the stockpiled material. Calculation of volume shall be made using average end area method. Cross sections of planned stockpile areas shall be made after stripping of topsoil prior to stockpiling of material. Cross Sections of the completed stockpiles shall be made at the same locations. The cross sections shall be spaced on intervals not exceeding 25 feet. Survey points along each cross section shall be obtained on intervals no greater than 10 feet.

4. Anchor trench backfill is incidental to geosynthetic liner installation, see Article 4.

5. Placed fill materials shall be measured for purpose of payment using one or a combination of the methods listed below.

   - Average of actual thickness multiplied by actual area of installation

     This method shall be used where the material design thickness is constant and the material is to be placed over an area of not less than 0.5 acres (such as prepared sub-grade).

     Actual thickness at each certification point shall be determined based on certification survey data of the upper and lower surfaces of the material. The average thickness shall be the average of the thicknesses at all constructed certification point locations. For materials where certification is not required, spot elevations shall be obtained prior to placement of material and on the final approved surface of the material. Unless otherwise approved or directed by the Owner, spot elevations shall be obtained in a grid pattern with a nominal distance of 100 feet between grid nodes. The elevation of the lower and upper surfaces shall be made at the same grid node

locations. Additional survey points shall collected at grade breaks and grade deflections.

Actual area of installation shall be determined by surveying the perimeter of the area where material has been placed and approved. Survey points of the perimeter shall be obtained on intervals not exceeding 50 feet. Area shall be based on “Plan View” without adjustment for slopes.

- Design cross-sectional area multiplied by actual length of installation

  This method shall be used for linear components having a constant cross section (such as berms and cover soil in ditches).

  The cross-sectional area shall be based on the Design Drawings. If a deviation from the design drawings has been approved by the Owner, the cross-sectional area shall be based on the approved deviation.

  Length of installation shall be based on field measurements made along the centerline of the installed material.

- Average End Area Calculation

  This method shall be used where the methods described above do not apply. This method generally applies to materials with a non-constant design thickness or non-constant cross-sectional areas (such as structural fill beneath prepared sub-grade).

  Cross sections of the area of fill placement shall be made prior to fill placement. Cross Sections of the final approved fill surface shall be made at the same locations as the pre-fill placement cross section locations. The volume calculation shall be based on the end areas at the cross section locations. Cross section spacing and spacing between points along cross section shall meet the same requirements stated for measurements of stockpiled material.

- Contractor Proposed Alternate Method

  Contractor may propose alternate methods of measurement than those described above. Request for alternate measurement methods must be submitted to and approved by Owner prior to initiation of item to which the alternate would apply.

ARTICE 4 – GEOSYNTHETIC MATERIALS

4.1 GEOCOMPOSITE LINER SYSTEM

A. This item of work includes providing all labor, equipment, and materials necessary to furnish and install the Geocomposite Liner System to be installed upon the prepared subgrade. This item also includes performance of an electrical leak location survey and all associated repairs following placement of the leachate collection system and drainage layer. All work shall be in accordance with the Drawings, these Specifications, the Construction Quality Control Plan, and the Manufacturer's recommendations.

B. The Geocomposite Liner System shall include the following components:

1. Geosynthetic Clay Liner (GCL);
2. Textured Geomembrane Liner (GMX); and,
3. Nonwoven Geotextile.
4. Permanent Turf Reinforcement Mat (TRM)
5. Temporary TRM

C. Material Requirements

1. Geosynthetic Clay Liner – Refer to CQC Plan
2. Textured Geomembrane Liner – Refer to CQC Plan
3. Nonwoven Geotextile – Refer to CQC Plan.
4. Permanent TRM – The permanent TRM shall be a rolled erosion control product similar to P300 as manufactured by North American Green. If an equivalent TRM is provided by another manufacturer, the alternate product must meet or exceed the performance of the P300 mat.
5. Temporary TRM – The temporary TRM shall be a rolled erosion control product similar to C125 as manufactured by North American Green. If an equivalent TRM is provided by another manufacturer, the alternate product must meet or exceed the performance of the C125 mat.

D. Manufacturer's Documentation – For each material, the Contractor shall provide manufacturer's documentation as described in the Construction Quality Control Plan for the following:

1. Qualifications;
2. Certification of Property Values;
3. Quality Control Certificates; and,
4. Labeling.

E. Shipment and Storage

1. During shipment and storage, material rolls shall be protected from moisture including precipitation, snow, and other inundation. Material rolls shall be protected from exposure to ultra-violet light, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. GCL and geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrapping

protecting shall remain in-place until immediately prior to deployment. The materials shall not be exposed to precipitation prior to or during installation.

2. Material rolls shall be stored away from high-traffic areas. The designated storage area shall be flat, dry and stable. Rolls shall not be stacked on end.

3. The Owners Representative shall observe material rolls upon delivery and prior to installation. Any deviation from the above requirements shall be reported to the Owner. Any damaged rolls shall be rejected and replaced at no cost to the Owner.

F. Testing

1. The Owners Representative shall be responsible for the completion of material conformance testing as described in the Construction Quality Control Plan.

2. Interface testing (ASTM D5321) of soil/geosynthetic and geosynthetic/geosynthetic interfaces has been completed by the Engineer for the materials specified in the CQC Plan. Contractor is responsible for performing additional testing if a request is made for an 'approved equal.' Engineer will provide normal stress testing levels and strength requirements at time of request.

3. The Contractor shall be responsible for the completion of seam and installation testing as described in the most recent version of the Manufacturer's Installation Quality Assurance Manual and/or Installation Guidelines.

4. Electrical Leak Location Survey

Contractor shall retain a qualified liner integrity sub-contractor to perform an Electric Leak Location Survey. Survey shall be completed after the non-woven geotextile and drainage layer have been installed above the flexible membrane liner. The intent of the survey is to identify and repair any damage to the flexible membrane liner during the installation of the liner or placement of the overlying drainage layer and pipe network. Any damaged areas identified by the leak detection survey will be exposed and repaired. Repairs, and QA/QC of repairs, shall be in accordance Sections 3.2.7, 3.3.7 and 3.4.7 of the CQC Plan.

a. Preparation for Survey
Areas to be surveyed shall be left exposed on the edges to prevent measurement interference from electrical current flowing off the edges of the flexible membrane liner. If adequate natural moisture is not present in the material overlying the flexible membrane liner for testing, water shall be added to provide ample conductivity. The Contractor is responsible for providing adequate survey conditions for the electrical leak location survey contractor. The Contractor is also responsible for coordinating the survey with the electrical leak location survey contractor such that

excavation of soils above the geocomposite liner system is avoided when isolating the survey area.

b. Test Survey
Survey to be performed in accordance with the most recent version of ASTM D7007, *Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earthen Materials.*

i. Prior to beginning the survey, a leak detection distance test must be performed as specified in ASTM D7007. The test should be performed using an artificial or actual hole with a diameter no greater than 0.25 inches.

ii. If this is not attainable, the Owner's Representative and the Owner should be notified in writing prior to beginning the survey. The notice should provide reasons the maximum hole dimension cannot be met for the survey including modifications that could be made to achieve this targeted hole size.

The Quality Assurance Inspector will observe the performance test procedures, method, and results and verify that the performance test and sensitivity of leak detection is satisfactory for the purposes of detecting damage to the flexible membrane liner caused by leachate collection system installation.

In accordance with ASTM D7007, all repair areas must be re-checked following repair to verify all leaks were found.

c. Leak Location Survey
The Quality Assurance Inspector shall observe the leak location survey and verify the following:

i. Leak location area is properly identified and marked;
ii. Leak location area is carefully excavated by hand;
iii. Leak is visually identified, marked and repaired.
iv. Leak area is re-checked following repair.
v. Leak location and repair is noted on the as-built (record drawings);
vi. Drainage layer material is carefully replaced over the excavated leak area.

G. Handling and Placement - Handling and placement of the geocomposite liner system materials shall be in accordance with the manufacturer's recommended procedures and the CQC Plan. Where discrepancies exist, the CQC Plan shall govern. Rolls shall be handled in such a manner as to minimize damage to the material being deployed and underlying materials, and shall comply with the following:

H. Use of Equipment - Equipment used for placement of drainage layer and other materials upon the geocomposite liner system shall conform to the following maximum ground pressure limitations:

Max Equipment Ground Pressure (psi)	Thickness of Material above liner (inches)
Equipment not permitted	< 12
<5	12 - 18
5 – 10	18 - 24
>10	> 24

I. Seams and Overlap – Seam and overlap requirements for the GCL, Geomembrane and Geotextile are included in the CQC Plan in their respective sections. Seam and overlap requirements for permanent and temporary turf reinforcement mats shall follow the manufacturer's guidelines.

J. Repair – Repair requirements for the GCL, Geomembrane and Geotextile are included in the CQC Plan in their respective sections. Repair requirements for permanent and temporary turf reinforcement mats shall follow the manufacturer's recommendations.

4.2 PVC GEOMEMBRANE

A. This item of work includes providing all labor, equipment, and materials necessary to furnish and install the PVC geomembrane portion of the final cap system. All work shall be in accordance with the Drawings, these Specifications, the Construction Quality Control Plan, and the Manufacturer's recommendations.

B. Materials Requirements - The PVC geomembrane shall be 30 mil as manufactured by Watersaver Company, Inc or approved equal. If an equivalent material is provided by another manufacturer, the alternate product must meet or exceed the requirements listed in the following table.

PVC Geomembrane Property Requirements

PROPERTY	TEST METHOD	UNIT	REQUIRED VALUE
Thickness	ASTM D 5199	mil	30 +/- 1.5
Tensile Properties Strength at Break Elongation Modulus @ 100%	ASTM D 822 min	 lb/in % lb/in	 73 380 32
Tear Strength	ASTM D 1004 min	lbs	8
Dimensional Stability	ASTM D 1204 Max Chg	%	3
Low Temperature Impact	ASTM D 1970 Pass	Degrees F	-20
Specific Gravity	ASTM D 792 Typical	g/cc	1.2
Water Extraction % loss (max)	ASTM D 1239 Max Loss	%	0.15
Average Plasticizer Molecular Weight	ASTM D 2124		400
Volatility Loss	ASTM D 1203 Max Loss	%	0.7
Soil Burial Break Strength Elongation Modulus at 100%	G160 Max Chg	 % % %	 5 20 20
Hydrostatic Resistance	ASTM D 751 min	psi	100
Seam Strengths Shear Peel	ASTM D 822 min	 lbs/in lbs/in	 58.4 15

C. Manufacturer's Documentation - The Contractor shall provide manufacturer documentation as described in the Construction Quality Control Plan for the following:

1. Qualifications;
2. Certification of Property Values;
3. Quality Control Certificates; and,
4. Labeling.

D. Shipment and Storage

During shipment and storage, the PVC Geomembrane shall be protected from exposure to ultra-violet light, precipitation, snow or other inundation such as; mud,

dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geomembrane rolls shall be wrapped in plastic sheets or otherwise protected. Wrapping shall remain on the PVC Geomembrane rolls until immediately prior to roll deployment. Geomembrane shall not be exposed to precipitation prior to being installed. During cold weather, geomembrane materials must be protected from freezing.

E. Testing

1. Conformance Testing - The Owners Representative shall be responsible for the completion of material conformance testing as described in the Construction Quality Control Plan.

2. Installation Testing - The Contractor shall be responsible for the completion of installation testing as described in the Manufacturer's most recent version of the Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes.

F. Handling and Placement - The PVC Geomembrane shall be handled and placed in accordance with the manufacturer's recommendations and guidelines as detailed in the most recent version of the manufacturer's Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes. The Contractor shall handle rolls in such a manner as to minimize damage, and shall comply with the following:

1. After the wrapping has been removed, the PVC Geomembrane shall not be exposed to sunlight for more than one (1) hour, or more than the time specified by the manufacturer, prior to deployment.
2. The PVC Geomembrane shall be securely anchored, and then rolled down the slope in such a manner as to continually keep the panel in tension.
3. In the presence of wind, the geomembrane shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlaying material. Sandbags shall be filled with fine grained material, and placed with care to prevent damage to the geomembrane.
4. The PVC Geomembrane shall be kept continually under tension to minimize the presence of wrinkles.
5. Cut shall be completed using an approved geomembrane cutter only.
6. During placement of the PVC Geomembrane, care shall be taken not to entrap stone, excessive dust, or moisture that could damage the geomembrane or hamper subsequent seaming.
7. After installation, the entire surface of the PVC Geomembrane shall be examined, and any foreign objects shall be removed.
8. The PVC Geomembrane shall be covered with soil within 48 hours of deployment.
9. Equipment used to place the PVC Geomembrane shall be such as to cause no damage to the geomembrane and allow for minimal slippage of the geomembrane on the underlying waste.

G. Seams and Overlap – Lateral panel seams shall be overlapped and joined in accordance with the manufacturer's recommendations and guidelines as detailed in the most recent version of the manufacturer's Quality Standards for Manufacture,

Pre-Assembly, and Installation of Geomembranes. A non-joined shingle overlap seam may be used on the upslope edges of each panel provided that the upslope end of the downslope panel is installed in an anchor trench and a minimum overlap length of 4 feet is maintained.

H. Repair - Repair to damaged areas shall be in accordance with the manufacturer's recommendations and guidelines as detailed in the most recent version of the manufacturer's Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes.

I. Placement of Materials on the PVC Geomembrane - The Contractors shall place materials on or against the PVC Geomembrane in the following manner:

1. Cause no damage to the geomembrane;
2. Allow minimal slippage of the geomembrane on the underlying waste; and,
3. Membrane cover material shall be pushed onto and spread across the PVC Geomembrane using equipment having ground pressures:

Max Equipment Ground Pressure (psi)	Thickness of Material above Geomembrane (inches)
Equipment not permitted	< 12
<5	12 - 18
5 – 10	18 - 24
>10	> 24

4.3 GEOCOMPOSITE DRAINAGE LAYER

A. This item of work includes providing all labor, equipment, and materials necessary to furnish and install the geocomposite drainage layer portion of the final cap system. All work shall be in accordance with the Drawings, these Specifications, the Construction Quality Control Plan, and the Manufacturer's recommendations.

B. Materials Requirements - The geocomposite drainage layer shall consist of a triplanar geonet with nonwoven geotextile fabric bonded to both sides of the geonet. The geocomposite shall be Tendrain 370-2 as manufactured by Tenax Corporation or approved equal. The geocomposite shall meet or exceed the following material characteristics.

Material Properties, Test Methods, and Manufacturer Frequency of Testing for Geocomposite Drainage Layer

PROPERTY	TEST METHOD	REQUIRED VALUE (minimum average roll)
Geocomposite		
Transmissivity, m^2/sec	ASTM D 4716	0.0028
Ply Adhesion, lb/in	ASTM D 7005	1.0
Geonet Core (prior to lamination with Geotextile)		
Thickness, mil	ASTM D 5199	250
Tensile Strength (MD), lb/ft	ASTM D 5035	625
Carbon Black Content, %	ASTM D 1603	2.0
Geotextile (prior to lamination with Geonet)		
Grab Tensile Strength, lb	ASTM D 4632	160
Grab Elongation, %	ASTM D 4632	50
Tear Strength, lb	ASTM D 4632	60
Puncture Strength, lb	ASTM D 4833	85
AOS, US Sieve, mm	ASTM D 4751	70
Permittivity, sec^{-1}	ASTM D 4791	1.1
Flow Rate, gpm/ft^2	ASTM D 4491	85
UV Resistance, % after 500 hours	ASTM D 4355	70

Note: Transmissivity at gradient of 0.1, normal load of 1,000 psf.

C. Manufacturer's Documentation - The Contractor shall provide manufacturer documentation as described in the Construction Quality Control Plan for the following:

- Qualifications;
- Certification of Property Values;
- Quality Control Certificates; and,
- Labeling.

D. Shipment and Storage - During shipment and storage, the geocomposite shall be protected from ultraviolet light exposure, precipitation, snow or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geocomposite rolls shall not be exposed to precipitation prior to being installed. During cold weather, geocomposites must be protected from freezing.

E. Testing

1. Conformance Testing - The Owners Representative shall be responsible for the completion of material conformance testing as described in the Construction Quality Control Plan.

2. Installation Testing - The Contractor shall be responsible for the completion of installation testing as described in the Manufacturer's most recent version of the Installation Quality Assurance Manual.

F. Handling and Placement - The Contractor shall handle geocomposite in such a manner as to minimize damage, and shall comply with the following:

- Wrapping for the geocomposites shall remain in-place until immediately prior to installation of the materials.
- On slopes, the geocomposites shall be rolled down the slope in such a manner as to continually keep the panels in tension.
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement, and shall remain until replaced with the appropriate overlying material.

G. Seams and Overlaps - Each component of the geocomposite will be secured or seamed to the like component of adjacent panels.

- Lateral edges of the geonet along the length of the geocomposite roll shall be butted against the lateral edge of the adjacent geonet.
- The butt edges of the adjacent geonets shall be joined by use of cable ties spaced not more than every 5 feet along the roll length.
- Fabric shall be continuously sewn.
- Adjoining geocomposite rolls ends shall be shingled, with the up-slope geonet overlapping the down-slope geonet a minimum of 12 inches across the roll width.
- Shingled geonets shall be cable tied on intervals not exceeding 6 inches.

H. Repair - Prior to covering the deployed geocomposite, each roll shall be inspected for damage. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with Subsection G of this Item.

I. Placement of Material on Geocomposite - The Contractor shall place materials on or against the geocomposite in the following manner:

- Cause no damage to the geocomposite.
- Allow minimal slippage of the geocomposite on underlying layers.
- Equipment used for the installation and burial of the geocomposite shall conform to the requirements as described for Placement of Materials on the PVC Geomembrane section of this specification.

4.4 MEASUREMENT

A. Measurement

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Geosynthetic materials shall be measured for purpose of payment by a field survey of the actual area of material installed and approved. The survey shall be along the perimeter of the material with survey points obtained on intervals no greater than 50 feet and shall include a point at all corners. Where edges of material are embedded in anchor trenches, the survey shall be made along the inside (landfill or ditch side) of the anchor trench. The area for purposes of payment shall be the plan view area. No adjustments to the area shall be made for: slopes; embedment; overlap, seaming, repairs, cut-off or wasted material; material installed beyond the design limits; material not installed; or, material rejected by the Owner.

3. Turf reinforcement mats shall be measured for the purpose of payment by the actual area of material installed and approved. The area for purposes of payment shall be the plan view area. No adjustments to the area shall be made for: slopes; embedment; overlap, seaming, repairs, cut-off or wasted material; material installed beyond the design limits; material not installed; or, material rejected by the Owner.

ARTICLE 5 – GRAVITY DRAINED COLLECTION AND DISCHARGE PIPES

A. This item of work includes furnishing all labor, equipment, and materials necessary to provide and install the collection and outlet pipes for the leachate collection system and final cap system as depicted on the Drawings and described herein. Additionally, the work shall conform to the requirements Construction Quality Control Plan included as Attachment 41 of the Permit to Install for the landfill.

B. The work to be performed as part of this Article specifically includes:

1. Leachate lateral pipes;
2. Leachate collector pipes;
3. Leachate outlet pipes;
4. Leachate system cleanouts;
5. Leachate pipe connection Cell 1 to Cell 2;
6. Chimney drains;
7 Cap drainage collector pipes; and.
8. Cap drainage outlet pipes.

C. Materials

1. Leachate Lateral, Leachate Collector, Leachate Outlet, Leachate Cleanout, and Cap Pipes – Listed pipes shall be "PE 4710 HDPE Pipe, DR 11." The pipe shall be as specified in the CQC Plan. Leachate outlet pipes and leachate cleanout pipes shall be non-perforated; all other listed pipes shall be perforated, as specified on the drawings.

2. Cap Drainage Outlet Pipes – Cap drainage outlet pipes shall be solid wall, schedule 40 PVC pipe of the diameter depicted on the Drawings.

3. Fittings - Pipe fittings and couplings shall be compatible with the pipe material to which they shall be connected or to which they shall join.

4. Clean-Out Riser Pipe – The clean-out riser pipe connection and associated fittings shall be compatible with the pipe material to which they shall be connected or to which they shall join. The pipe shall be non-perforated HDPE pipe of the diameter depicted on the Drawings.

5. Leachate Pipe Connection Cell 1 to Cell 2 – The connection and associated fittings shall be compatible with the pipe material to which they shall be connected or to which they shall join. The Cell 1 outlet pipe is ADS, N-12, 12-inch diameter pipe. The Cell 2 connection pipe is HDPE DR11, 12-inch diameter. Connection shall be made using HDPE to Corrugated PE Coupling, manufactured by ISCO.

6. Chimney Drain – The chimney drain pipe connection and associated risers, fittings, and extensions shall be compatible with the pipe material to which they shall be connected or to which they shall join. The vertical sections of the chimney drain shall be perforated, while horizontal segments shall be non-perforated. The diameter of the pipe shall be as depicted on the

Drawings. All DR11 chimney drain vertical risers shall be factory fabricated with a flange for future pipe connections.

7. Bedding Stone – Pipe bedding stone shall be No. 57 size stone in accordance with KYTC Section 805 or approved equal. Material shall consist of uncrushed natural river gravel; crushed aggregate is not permitted.

8. Filter Fabric - Filter fabric shall be Type II Fabric in accordance with KYTC Section 843.

D. Handling and Placement

1. The Contractor shall handle and place piping materials in accordance with manufacturer's instructions and in such a manner so as to minimize damage.

2. The Contractor shall inspect the interior of all pipe segments and fittings, and completely remove all dirt, gravel, sand, debris, or other foreign material prior to placement.

3. If bracing of the piping is required to facilitate burial of the pipe with bedding stone or drainage layer, bracing shall be accomplished by means of weights, ropes, or other suitable means which will not damage either the piping or liner system. The use of driven stakes or other means which could penetrate the liner, is strictly prohibited

E. Joints - All joints shall be made in accordance with the manufacturer's instructions and the CQC Plan.

1. N-12 pipe for chimney drain riser pipe and lateral chimney drain inlet relocation runs shall be made by use of either couplings or bell and socket pipe.

2. Discharge pipe joints in cover system (PVC Pipe) shall be solvent welded and welds shall be made only when temperatures are above 40°F and conditions are dry.

3. The method of joining for HDPE DR11 pipe shall be the heat butt fusion method of high density polyethylene pipe per ASTM F2620 and shall be performed in strict accordance with the pipe manufacturer's recommendations, subject to the Engineer's approval. Butt fusion welds shall exhibit a uniform melt bead. All field welds shall be made with fusion equipment equipped with a Data Logger. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the Quality Control records provided to the Owner's Representative.

F. Equipment Traffic – Equipment used for the installation of the leachate collection system shall conform to the requirements for equipment traffic for Geosynthetic Liner installation. Equipment used for the installation of the cap drainage system piping shall conform to the requirements for equipment traffic for PVC Geomembrane installation.

G. Testing – Testing requirements are included in the CQC Plan.

I. Surveying – Surveying shall be completed as necessary to install the piping systems as depicted on the Drawings. Submittal of select survey data shall be required to document the work. Documentation shall include submittal of the northing, easting, elevation, and description of survey points obtained at the following locations:

1. upstream terminal end of each pipe;
2. all changes of horizontal or vertical pipe grade;
3. downstream discharge points; and,
4. points on intervals of not exceeding 250 feet between all locations described as items 1, 2, and 3 above.

The survey points collected to fulfill the requirements described above shall be the top of the installed pipe.

J. Measurement

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Pipe materials shall be measured for purpose of payment by a field survey of the actual length of pipe installed and approved. Location of survey points shall be as described in Paragraph I of this Article.

3. Pipe cleanouts shall be measured per each cleanout installed and approved.

4. Cell to Cell connections shall be measured per each connection installed and approved. The Cell 2 to Cell 1 connection shall include removal of the Cell 1 perimeter berm at the Cell 1 non-perforated outlet pipe and installation of drainage layer aggregate on all sides of the existing pipe as a replacement for the excavated material.

5. Chimney drain connection to the leachate collection system shall be measured per each connection.

ARTICLE 6 - DRAINAGE LAYER

A. This item of work includes furnishing all labor, equipment, and materials necessary to provide and install the drainage layer and drainage protection layer as depicted on the Drawings and described herein. Additionally, the work shall conform to the requirements of Sections 4.4 “Drainage Layer” of the Construction Quality Control Plan included as Attachment 41 of the Permit to Install for the landfill.

B. The Owners may, at their own discretion, provide some, all, or none of the drainage layer material for use by the Contractor. If the Owner has provided drainage layer material, use of the Owner provided material shall take priority over Contractor provided material.

C. Materials

1. Drainage Layer

   The drainage layer material shall be granular material free of inorganic fines with a minimum permeability of 1×10^{-3} cm/sec. The drainage layer material will consist of the following:

   - aggregate material consistent with the requirements of KYTC Section 804.09, Underdrains, Embankment Drainage Blanket, and Natural Sand for Drainage and Backfill.

2. Drainage Protection Layer

   The drainage protection layer shall be ash material provided by Owner. This material will be excavated from the existing landfills on the Owner’s property.

D. Handling and Placement - Materials shall be pushed onto and spread across the liner system. Particular care shall be taken in the placement of material around the leachate collection system pipes to prevent movement of or damage to the pipe. Any pipe which is damaged shall be replaced at the Contractors expense.

E. Equipment Traffic – Equipment used for the installation of the drainage layer shall conform to the requirements for equipment traffic for Geosynthetic Liner installation (Section 3.3.8 of the CQC Plan).

F. Testing

1. Aggregate - The Owners Representative shall collect representative samples of the drainage layer material from on-site stockpiles at a rate of at least one (1) sample per every five-thousand (5,000) cubic yards of material to be placed. Each sample will be tested to determine the permeability in accordance with ASTM D-2434. Continued use of the aggregate is contingent upon the materials meeting the permeability requirement specified above.

2. Placement – The contractor shall verify that material meets the design required thickness by excavation of pits on intervals not less than 1 per acre.

The pits shall be hand-dug and care shall be taken so as not to damage the underlying liner system during the digging of the pits. The Owners Representative shall be present during the excavation of the verification pits.

G. Measurement

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement, including calculations, shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Measurement for payment shall be based on field survey. Calculation of volume of material placed shall be the average actual thickness multiplied by actual area of installation

   Actual thickness at each certification point shall be determined based on certification survey data of the upper and lower surfaces of each material type. The average thickness shall be the average of the thicknesses at all constructed certification point locations. For materials where certification is not required, spot elevations shall be obtained prior to placement of material and on the final approved surface of the material. Unless otherwise approved or directed by the Owner, spot elevations shall be obtained in a grid pattern with a nominal distance of 100 feet between grid nodes. The elevation of the lower and upper surfaces shall be made at the same grid node locations. Additional survey points shall collected at grade breaks and grade deflections.

   Actual area of installation shall be determined by surveying the perimeter of the area where material has been placed and approved. Survey points of the perimeter shall be obtained on intervals not exceeding 50 feet. Area shall be based on “Plan View” without adjustment for slopes.

ARTICLE 7 – ROADWAYS

7.1 PERMANENT HAUL ROADS ABOVE WASTE

A. This item of work includes furnishing all labor, equipment, and materials necessary to construct the permanent haul roads on the surface of the landfill as shown on the Drawings and described herein. The work includes but is not necessarily limited to excavation; grading; providing, hauling, placement, and compaction of materials; and, construction of the concrete drainage channel adjacent to the haul road.

B. Materials

1. Structural fill shall consist of and be placed in accordance with requirements of Article 3.2 of these Specifications.

2. Granular Wearing Surface material shall consist of KYTC Section 805.06, Crushed Stone Base. The Owner may, at their own discretion, provide some, all, or none of the granular material for use by the Contractor. If the Owner has provided granular material, use of the Owner provided material shall take priority over Contractor provided material.

3. Granular Base material shall consist of KYTC Section 805, Gradation Size No 2. The Owner may, at their own discretion, provide some, all, or none of the granular material for use by the Contractor. If the Owner has provided granular material, use of the Owner provided material shall take priority over Contractor provided material.

4. Geogrid shall be biaxial of the size indicated on the drawings as manufactured by US Fabric or approve equal.

5. Concrete shall be non-structural Class A concrete and shall be placed in accordance with KYTC Section 500.

C. Placement

1. Granular Wearing Surface material shall be placed in accordance with KYTC Section 302.

2. Granular Base Material shall be placed in lifts not exceeding 12 inches. Each lift shall be compacted with a minimum of four coverages of a steel drum roller, having a minimum weight of 10 tons.

D. Compaction and Testing

1. Structural fill testing shall be in accordance with requirements of Article 3.2 of these Specifications.

2. Granular Wearing Surface material shall be compacted to a minimum of 98 percent of maximum dry density as determined by the "Standard" compaction test (ASTM D698) with a moisture content between minus two (-2) and plus

two (+2) percent of optimum moisture. Compaction testing shall be completed by the Owner's representative at a rate of not less than 1 test per 2000 cubic yards of material placed.

3. Granular Base Material shall be compacted to a minimum density of 80 percent of relative density as determined by ASTM D4253 and ASTM D4254. Testing shall be accomplished by proofroll of the completed base material and visual observation and acceptance by the Engineer.

4. Slump and air-entrainment tests shall be performed in accordance with Section 8.1 Concrete Structures – General. All costs associated with making, transporting, and testing the concrete cylinders shall be at the Owners' expense.

7.2 PERMANENT HAUL ROADS OFF LANDFILL

A. This item of work includes furnishing all labor, equipment, and materials necessary to construct the permanent haul roads off of the landfill as shown on the Drawings and described herein. The work includes but is not necessarily limited to excavation; grading; and, providing, hauling, placement, and compaction of materials.

B. Materials

1. Structural fill shall consist of and be placed in accordance with requirements of Article 3.2 of these Specifications.

2. Granular Wearing Surface material shall consist of KYTC Section 805.06, Crushed Stone Base. The Owner may, at their own discretion, provide some, all, or none of the granular material for use by the Contractor. If the Owner has provided granular material, use of the Owner provided material shall take priority over Contractor provided material.

3. Granular Base material shall consist of KYTC Section 805, Gradation Size No 2. The Owner may, at their own discretion, provide some, all, or none of the granular material for use by the Contractor. If the Owner has provided granular material, use of the Owner provided material shall take priority over Contractor provided material.

4. Geogrid shall be biaxial of the size indicated on the drawings as manufactured by US Fabric or approve equal.

C. Placement

1. Geogrid shall be installed and panels overlapped and joined as per manufactures recommendations.

2. Granular Wearing Surface material shall be placed in accordance with KYTC Section 302.

3. Granular Base Material shall be placed in lifts not exceeding 12 inches. Each lift shall be compacted with a minimum of six coverages of a vibratory roller, having a minimum weight of 10 tons.

D. Compaction and Testing

1. Structural fill testing shall be in accordance with requirements of Article 3.2 of these Specifications.

2. Granular Wearing Surface material shall be compacted to a minimum of 98 percent of maximum dry density as determined by the "Standard" compaction test (ASTM D698) with a moisture content between minus two (-2) and plus two (+2) percent of optimum moisture. Compaction testing shall be completed by the owner's representative at a rate of not less than 1 test per 2000 cubic yards of material placed.

3. Granular Base Material shall be compacted to a minimum density of 80 percent of relative density as determined by ASTM D4253 and ASTM D4254. Testing shall be accomplished by proofroll of the completed base material and visual observation and acceptance by the Engineer.

7.3 SERVICE ROAD

A. This item of work includes furnishing all labor, equipment, and materials necessary to construct the service roads as shown on the Drawings and described herein. The work includes but is not necessarily limited to excavation; grading; and, providing, hauling, placement, and compaction of materials.

B. Materials

1. Structural fill shall consist of and be placed in accordance with requirements of Article 3.2 of these Specifications.

2. Fabric shall be woven and conform to the requirements of KYTC for the specified material. Adjacent panels shall be joined by sewing.

3. Granular material shall consist of KYTC Section 805.06, Crushed Stone Base and be placed in accordance with KYTC Section 302. The Owner may, at their own discretion, provide some, all, or none of the granular material for use by the Contractor. If the Owner has provided granular material, use of the Owner provided material shall take priority over Contractor provided material.

C. Testing

1. Structural fill testing shall be in accordance with requirements of Article 3.2 of these Specifications.

2. Granular material shall be compacted to a minimum of 98 percent of maximum dry density as determined by the "Standard" compaction test

(ASTM D698) with a moisture content between minus two (-2) and plus two (+2) percent of optimum moisture. Compaction testing shall be completed by the owner's representative at a rate of not less than 1 test per 2000 cubic yards of material placed.

7.4 SEDIMENT POND ACCESS ROAD

A. This item of work includes furnishing all labor, equipment, and materials necessary to construct the Sediment Pond Access Roads as shown on the Drawings and described herein. The work includes but is not necessarily limited to excavation; grading; and, providing, hauling, placement, and compaction of materials.

B. Materials

1. Structural fill shall consist of and be placed in accordance with requirements of Article 3.2 of these Specifications.

2. Geogrid shall be biaxial of the size indicated on the drawings as manufactured by US Fabric or approve equal.

3. Granular materials shall conform to the requirements of KYTC Section 805. Owner may, at their own discretion, provide some, all, or none of the granular material for use by the Contractor. If the Owner has provided granular material, use of the Owner provided material shall take priority over Contractor provided material.

C. Testing

1. Structural fill testing shall be in accordance with requirements of Article 3.2 of these Specifications.

2. Granular Material shall be compacted to a minimum density of 80 percent of relative density as determined by ASTM D4253 and ASTM D4254. Testing shall be accomplished by proofroll of the completed base material and visual observation and acceptance by the Engineer.

7.5 MEASUREMENT

A. <u>Measurement</u>

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Measurement for purpose of payment shall be a field survey of the actual length of installed and approved road. Survey shall be along the centerline of roads with survey points obtained on intervals no greater than 50 feet. Where

roads intersect, the starting point of intersecting road shall be the intersection of the centerlines. Measurement shall be the plan view lengths, without adjustment for slopes.

3. Excavation and structural fill associated with road construction shall not be included for measurement and payment under this Article. Excavation and structural fill shall be measured and paid as per Article 3.

ARTICLE 8 – CONCRETE STRUCTURES

8.1 GENERAL

A. All concrete and concrete work shall conform to the latest edition of ACI 318, "Building Code Requirements for Reinforced Concrete" and KYTC Section 601. All formwork shall be in accordance with KYTC Section 601 and the plans. All concrete work shall be performed in strict accordance with cold and hot weather concrete guidelines as outlined in ACI 306R.

B. Subgrade - A soil bearing pressure of 3000 psf is required for all structures, prior to placement of concrete. No concrete shall be poured in an excavation containing water, frozen subgrade or unsuitable soil conditions. Prior to placement of concrete, all foundations excavations are to be observed and approved by the Owners representative.

C. Mix Design – Mix designs for all cast-in-place concrete shall be in accordance with KYTC Section 601 for Class A concrete. Concrete that does not meet these requirements may be rejected and replaced at the Contractor's expense. All admixtures used in the concrete shall be stated on the concrete delivery tickets.

D. Admixtures - Concrete slump should be achieved at the batch plant. No water is to be added at the site. Chlorides shall not be used in concrete.

E. Testing - Field and laboratory testing and sampling for concrete shall be performed by the Owners representative. The Contractor shall notify the Owner or their representative at least 48-hours prior to placement.

Six (6) concrete cylinders will be taken for every 50 cubic yards placed or each day. One cylinder is to be broken at 7 days, 3 cylinders are to be broken at 28 days, and 2 cylinders will be held for future compressive strength testing, if necessary. For precast items, Contractor shall provide manufactures certification for strength and admixtures.

F. Reinforcing Steel - A minimum cover of 2-inches shall be provided for protection of reinforcing steel in all locations, unless specified differently on the plans. All reinforcing steel shall be epoxy coated Grade 60 and conform to ASTM A615. All reinforcing steel shall be placed in accordance with ODOT Item 509. All exposed concrete edges shall be chamfered 1-1/4 inches, except where otherwise noted by the Engineer.

Reinforcing steel shown on the details shall be adjusted accordingly including cutting and/or bending to facilitate the placement or passage of pipes and any other required penetration or embedment.

8.2 CULVERTS

A. This item of work includes furnishing all labor, equipment, and materials necessary to install Reinforced Concrete Circular Pipe Culverts in accordance with KYTC Section 701 and Precast Reinforced Concrete Box Culverts in accordance with KYTC Section 611.

B. Materials

Concrete Pipe Culverts – AASHTO M-170, Class IV. Requirement of a Class IV reinforced concrete pipe culvert assumes Type 1 installation and a minimum of 2 feet of pipe cover.

Box Culverts – in accordance with KYTC Section 611, Box culverts joints to be constructed in accordance with ASTM C990.

Precast concrete culverts: various nominal sizes shown on the drawings.

C. Box Culvert Material Specifications

1. Loading: HL-93

2. Design Specifications: AASHTO LRFD Bridge Design Specification, 7th Addition.

3. All precast reinforced concrete box culverts shall conform to the latest edition of ASTM C 1433 or ASTM C 1577. Details not conforming to these standards shall be submitted for approval along with design calculations using "Boxcar" or other approved design program. The designs shall be prepared and stamped by a Professional Engineer licensed and in good standing for which the project is located.

4. Joints for precast sections shall be tongue and groove type and shall be sealed with mastic or sand/cement grout.

5. Lifting holes shall be filled with concrete plug after the box sections are in place.

6. End sections for precast units shall be cast-in-place in accordance with plan details. Cost to be included in linear foot cost of precast culvert. Wing walls can be cast-in-place or precast units. Curbs shall 12" wide for fill heights less than 18 inches. Rebar dowels are permitted into the top of the box culvert as a suitable connection either epoxy or cast in place. For fill heights greater than 18 inches, use a 1'-9" curb width.

7. Joint sealant and primer shall be included in the cost per linear foot of box culvert.

D. Handling and Placement – Per KYTC Sections 611 and 701 and KYTC Standard Drawings. Erect the culvert in accordance with the manufacturer's recommendations. Unless otherwise directed, install the culvert in a straight line between the control points identified, at a constant rate of slope based on the slope distance and control point invert elevations.

E. Foundation Preparation and Backfilling – Proofroll subgrade to satisfaction of Engineer. Provide bedding and backfill per KYTC Standard Drawings.

F. Submittals – Box Culvert Manufactures Data/Certifications

8.3 HEADWALLS

A. This item of work includes furnishing all labor, equipment, and materials necessary to install Headwalls at Box Culvert entrance and exit points in accordance with the KYTC Section 710 and the Kentucky Standard Drawing RDH-1000-02.

B. Materials – Precast Box Culvert Headwalls: various nominal sizes based on size of abutting headwall shown on the drawings

C. Handling and Placement – Per KYTC Standard Drawings.

D. Foundation Preparation and Backfilling – Proofroll subgrade to satisfaction of Engineer. Provide bedding and backfill per KYTC Standard Drawings.

E. Submittals – Box Culvert Headwall Manufactures Data/Certifications

8.4 CONCRETE RUNOFF CHANNELS

A. This item of work includes furnishing all labor, equipment, and materials necessary to install concrete runoff channels, including aprons, at selected locations within the landfill and the Sediment Pond Inlet Channel. Locations of the channels are shown in the drawings.

B. Materials – Concrete and reinforcing steel per Section 8.1. Install waterstop and joint filler per drawing notes.

C. Foundation Preparation and Backfilling – Proofroll subgrade to satisfaction of Engineer. Provide bedding and backfill per KYTC Standard Drawings.

D. Testing - Field and laboratory testing and sampling for concrete shall be performed by the Owners representative. The Contractor shall notify the Owner or their representative at least 48-hours prior to placement.

E. Submittals – Concrete mix design and reinforcing steel shop drawings at least 14 days prior to beginning formwork installation. Submit concrete mix design for each concrete type. Submit separate mix designs when admixtures are required for, hot and cold weather concrete work and air-entrained concrete.

8.5 MANHOLES

A. This item of work includes furnishing all labor, equipment, and materials necessary to install leachate collection system manholes as depicted on the Drawings and as described herein.

B. Materials

1. Manhole – Manholes shall be in accordance with the requirements for KYTC Type "B" Standard Manhole. Manhole shall be a pre-cast concrete unit.

2. Manhole Frame and Lid – The frame and lid for the manhole shall be in accordance with the requirements of KYTC for Type 1 Manhole Frame and Lid.

C. Shipment and Storage – Shipment and storage shall be consistent with the requirements for the "Leachate Collection System".

D. Handling and Placement – Handling and placement shall be consistent with the requirements for "Leachate Collection System".

E. Joints – Joints shall be consistent with the requirements for the "Leachate Collection System".

8.6 MEASUREMENT

A. Measurement

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement, including where appropriate calculations, shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Measurement of concrete to be paid on a volume basis shall be the delivery tickets. Material rejected, material wasted, and material used for purposes other than the pay item shall be excluded from payment.

3. Measurement of concrete structures to be paid per each item shall be a count of the installed and approved structures.

4. Measurement of concrete pipes to be paid on a linear foot basis shall be based on a field survey of the installed and approved pipe. Survey points shall be the invert of the inlet and outlet of each pipe.

ARTICLE 12 – VEGETATIVE COVER

A. This item of work includes providing all labor, equipment, and materials necessary to furnish and install a permanent vegetative cover in accordance with the Drawings, these Specifications, and the Construction Quality Control Plan. This item of work includes the following areas:

- Final cover grades;
- Temporary cover grades;
- Ditches;
- Perimeter Berms;
- Designed slopes draining to ditches.

B. Material Requirements and Application Rates

1. Seed

The following seed mix shall be sown at a minimum rate of 80 pounds per acre for the establishment of a vegetative cover:

30% *Festuca arundinacea, 'Fawn'* (Tall Fescue, 'Fawn')
24% *Lolium multiflorum* (Annual Ryegrass)
16% *Phleum pretense, 'Climax'* (Timothy, 'Climax')
14% *Trifolium hybridum* (Alsike Clover)
10% *Lotus cornculatus 'Norcen'* (Bird's Foot Trefoil, 'Norcen')
4% *Trifolium pretense, Medium, Variety Not Stated* (Red Clover, Medium, Variety Not Stated)
2% *Agrostis alba* (Redtop)

In fall and winter applications after October 15, add 30 pounds per acre of winter rye (*Secale cereale*).

The specified seed mix is identified as 'Non-Native Good Value Mine Mix' and is available from Ernst Seeds. Alternative seed mixes must be approved by the Engineer.

The varieties of grass seed to be furnished shall bear a tag on each bag showing species, lot number, grower's name, the percent of purity, the percent of germination, and the weed content. Tags shall be provided to the Owners Representative.

All seeds shall be free from noxious weeds and under no condition shall the total weed content of any lot of seed or seed mixture exceed one-half of one percent by weight.

No seed shall be utilized which has a mix date older than one year. The Owner reserves the right to test, reject, or approve any and all seed after delivery.

2. Fertilizer

Commercial grade 10-10-10 fertilizer shall be applied at a minimum rate of 500 pounds per acre, if necessary based on unacceptable performance as determined by Subpart D of this specification (Article 12). Contractor may, at their discretion, apply fertilizer during planting for improved performance.

3. Mulch

Mulch shall be applied at a minimum rate of 2 tons per acre. All mulch material shall be free from mature seedbearing stalks, roots, and noxious or prohibited weeds. Alfalfa, clover, and salt grass hay are not acceptable. Straw mulch shall include baled wheat, oats, or straw. Mulch shall be dry and reasonably free of weeds, stalks, or other foreign material.

C. Handling and Placement - Establishment of a vegetative cover shall begin as soon as possible after the placement of soil cover materials or completion of excavation, filling, and grading.

Fertilizer shall be spread uniformly over all areas to be seeded and the areas then loosened by discing, harrowing, or other approved methods immediately prior to seeding. The soil shall be loosened to a depth of approximately three inches.

Seed shall be sown immediately following preparation of the area for seeding. Seed shall be sown by methods which provide for uniform distribution of the seed mix. After broadcasting or otherwise applying the seed, the surface of the seedbed shall be raked, culti-packed, or brush dragged very lightly. All raking shall be done in a direction parallel to contour lines.

Mulch shall be applied to the sown area within 24 hours of seeding and spread to a uniform depth. A mechanical blower may be used to apply mulch material, provided the machine has been specifically designed and approved for this purpose. Machines which cut mulch into short pieces shall not be permitted. Mulch shall be placed in a moist condition or shall be sprinkled immediately after placement.

D. Inspection and Repair - The Owners Representative shall inspect and document the vegetative cover between the period of 5 and 7 months after the sowing of seed and again between the period of 11 and 13 months after the sowing of seed. If during the second inspection any areas larger then 100 square feet having has less than 40% vegetative cover are identified, the Contractor shall revegetate the areas within 30 days of the completion of the inspection. If erosion or other damage occurs prior to the establishment of satisfactory vegetative cover, such damage shall be repaired at no additional cost to Owner.

E. Measurement

1. Contractor shall be responsible for making measurements of materials for purpose of payment. Documentation of measurement shall be submitted with request for payment. Owner may, at his discretion, verify Contractor measurements.

2. Measurement for purpose of payment shall be a field survey of the perimeter of the actual areas of work completed and accepted. Survey points around

the perimeter shall be obtained on intervals no greater than 50 feet. Measurement shall be plan view area without adjustment for slopes.

ARTICLE 15 – EROSION AND SEDIMENT CONTROL

A GENERAL

1. SECTION INCLUDES

This item of work includes furnishing all labor, equipment, and material necessary for minimization of erosion and control of sediment resulting from earth disturbing activities. The work includes but is not necessarily limited to:

a. Development of a Storm Water Pollution Prevention Plan (SWPPP) including selection of type and location of Erosion and Sediment (E&S) control measures in conformance with KYTC Section 212 "Erosion Control" and Section 213 “Water Pollution Control.”

b. Implementation of the SWPPP including installation of E&S control measures. .

c. Inspection of E&S control measures, including preparation of required documentation.

d. Maintenance of E&S control measures including but not limited to, sediment removal and replacement of defective or inadequate devices throughout the contract period.

e. Removal of and off-site disposal of E&S control measures at the completion of the contract period.

2. DEFINITIONS

Erosion and sedimentation control includes installation of temporary control measures, maintenance and replacement of those measures as needed, and removal of those measures at the completion of work. Erosion and sedimentation control also includes establishment of temporary vegetative cover for overwintering of project, extended delays in work, or any area that will not be graded or re-worked for 21 days or greater. Erosion and sedimentation control does not include establishment of permanent vegetative cover or installation of permanent erosion control measures. Permanent vegetative cover is included in Article 2, *Mobilization*¸ and Article 12, *Vegetative Cover.*

3. SUBMITTALS

a. Contractor shall submit the Erosion and Sediment Control Plan to the Owner for review and comment not less than 45 days prior to initiation of earth disturbing activities

b. Contractor shall review, sign, and return to Owner the Erosion and Sediment Control Plan not less than 30 days prior to initiation of earth disturbing activities.

4. REFERENCES AND RELATED ARTICLES

   a. Kentucky Division of Water – most recent edition of Best Management Practices for Storm Water Control Manual.

   b. Owner provided Erosion and Sediment Control details in construction drawings

   c. Contractor prepared Storm Water Pollution Prevention Plan

   d. Best Management Practices, Pollution Prevention Plan, Duke Energy, East Bend Station.

5. MATERIALS

   a. As identified in:

   - Owner provided Erosion and Sedimentation Control Drawings, and/or;
   - Contractor developed/modified Erosion and Sedimentation Control Drawings, and/or;
   - Contractor provided SWPPP.

6. EXISTING EROSION AND SEDIMENT CONTROLS

   a. The existing landfill sediment pond and existing soil stockpile runoff pond may be used as E&S control measures. Contractor is not required to perform maintenance for the existing landfill sediment pond. Maintenance of the stockpile runoff pond is required, as specified under Part B of this Article.

   b. Existing ditches and diversion berms may be used as E&S control measures. Contractor is required to improve, inspect, and maintain existing ditches and diversion berms.

B EXECUTION

1. The Storm Water Pollution Prevention Plan and associated erosion and sedimentation control drawings shall be on-site at all times throughout the contract period.

2. Erosion and sedimentation control measures shall be installed in accordance with the Storm Water Pollution Prevention Plan and the erosion and sedimentation control drawings prior to initiation of earth disturbing activities. As construction progresses, additional erosion and sedimentation control measures shall be installed in accordance with the Storm Water Pollution Prevention Plan and the erosion and sedimentation control drawings or as needed based on contractors work.

3. Erosion and sedimentation control measures shall be inspected and maintained by the Contractor as per the Erosion and Sediment Control Plan and the SWPPP. Inspection reports shall be submitted by the Contractor to the Owner in accordance with the frequency requirements included in the SWPPP.

4. Contractor shall consider temporary construction activities in SWPPP preparation such as, but not necessarily limited to, staging areas, stockpile areas, and access roads.

5. All erosion and sedimentation control measures which have not been designated by the Owner to remain, shall be removed at the completion of the contract work.

6. Contractor is to remove all accumulated sediment from ditches and the soil stockpile runoff pond at the completion of the project. Contractor shall remove sediment during the project as determined necessary by the Owner for functional operation of the ditches and pond.

C. MEASUREMENT

1. Measurement for purpose of payment shall be based the percent complete of the overall construction schedule.

APPENDIX 3

CONSTRUCTION QUALITY CONTROL PLAN

EAST BEND STATION

WEST LANDFILL

ADDENDUM 1-ATTACHMENT 41

Construction Quality Control Plan

West Special Waste Landfill
East Bend Station
Boone County, Kentucky

Prepared for

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Union, KY 41091

Prepared by

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6190 Enterprise Court
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April 2018

TABLE OF CONTENTS

1.0 GENERAL

The following Addendum No. 1 to the East Bend Station Construction Quality Control (CQC) Plan for the West Special Waste Landfill at the East Bend Generating Station in Boone County, Kentucky has been developed in support landfill construction. The approved CQC Plan for the West Landfill was most recently revised in September, 2015. The September, 2015 version of the CQC Plan is superseded where noted within Addendum 1. If the section is not included in Addendum 1, then there are no changes to the CQC Plan section.

1.4 Responsibility and Authority

The principal parties involved in the CQC include the Permitting Agency, the Owner, the Engineer, the Owners Representative, the Soils CQC Laboratory, the Geosynthetics CQC Laboratory, and the Contractor. The general responsibilities and authorities of each of these parties where they deviate from the CQC Plan are described herein.

1.4.5 Soils CQC Laboratory

The testing laboratory shall be accredited through the AASHTO accreditation program (AAP) for the laboratory testing performed for the project. The testing laboratory shall be current with the accreditation at the time the laboratory testing is performed

1.4.6 Geosynthetics CQC Laboratory

The testing laboratory shall be accredited through the Geosynthetics Institute accreditation program and shall be included on their 'List of Accredited Laboratories and their Accredited Test Methods,' available on their website at the time the laboratory testing is performed.

1.5 Project Meetings

1.5.4 Progress Meetings

The Owners Representative or the Owner will also prepare and distribute meeting minutes, as determined during the pre-construction meeting.

2.0 SUBGRADE PREPARATION

2.3 Materials

Topsoil is defined as soil containing greater than 3% organics as determined by ASTM D2974.

3.0 GEOCOMPOSITE LINER SYSTEM

3.2 Geosynthetic Clay Liner

3.2.1 Material Requirements

GCL shall be one of the following polymer modified products:

- Resistex Plus FLW-9 DN, manufactured by CETCO,
- Product to be determined, manufactured by GSE, or
- Product to be determined, manufactured by Agru America.

The GCL materials listed have been pre-approved for this project. No other GCL will be considered. The selected GCL shall be installed, tested, and meet material characteristics and quality per Table 3.1 of the CQC Plan.

Table 3.1
Geosynthetic Clay Liner Property Requirements

- Minimum peel strength shall be 3.5 lb/in (ASTM D6496).
- Hydrated internal shear strength shall be measured at 200 psf normal stress for a specimen hydrated for 48 hours.

3.2.2 Manufacturer's Documentation

Table 3.2
Quality Control Testing Frequency Requirements for GCL

- Grab Strength (Tensile) shall be performed using ASTM D6768.
- Peel Strength shall be performed using ASTM D6496.
- Hydrated Internal Shear Strength shall be performed using ASTM D6243

3.2.4 Conformance Testing of GCL

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3.2.4.1 Sample Collection

Owners Representative may arrange for in-plant conformance sampling of the GCL by the Geosynthetics CQC Laboratory or the manufacturer of the product. Owners Representative shall inventory rolls received on-site to verify manufacturing and conformance sampling.

3.3 Textured Geomembrane Liner

3.3.1 Materials Requirements

The geomembrane liner shall be White Textured as manufactured by GSE Lining Technologies, Inc. or approved equal. The geomembrane shall be 60 mil, textured (both sides), HDPE, with a white surface on at least one side. The liner shall be installed, tested and meet material characteristics and quality per Table 3.3.

Table 3.3
HDPE Textured Geomembrane Liner Property Requirements

- Asperity Height shall be measured using Test Method ASTM D7466
- Carbon Black Content shall be measured using Test Method ASTM D4218

3.3.3 Shipment and Storage

During shipment and storage, the GMX shall be protected from exposure to ultra-violet light, precipitation, snow or other inundation such as; mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geomembrane storage on-site shall follow the manufacturer's recommendations.

Table 3.4
Quality Assurance/Quality Control Testing Frequency for the GMX

- Asperity Height shall be measured using Test Method ASTM D7466
- Carbon Black Content shall be measured using Test Method ASTM D4218

3.3.4 Conformance Testing GMX

3.3.4.1 Sample Collection

The Owners Representative may arrange for in-plant conformance sampling of the GMX by the Geosynthetics CQC Laboratory or the manufacturer of the product. In-plant sampling would be coordinated with the manufacturer. Owners Representative shall inventory rolls received on-site to verify manufacturing and conformance sampling.

3.4 Nonwoven Geotextile

3.4.3 Shipment and Storage

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls shall not be exposed to precipitation prior to being installed. Geotextile storage on-site shall follow the manufacturer's recommendations.

3.4.4 Conformance Testing of Geotextile

Prior to the deployment of the rolls of geotextile, the Owners Representative or the manufacturer, shall remove and forward samples to the Geosynthetics CQA Laboratory for testing to verify conformance with the fabric property values.

3.4.6 Seams and Overlaps

Geotextiles shall be continuously sewn using thread, which is as chemically and UV resistant as the geotextile, or geotextile can be seamed using the opposing pressure roller (OPR) method.

3.4.7 Repair

Any holes or tears in the geotextile shall be repaired by the Contractor. Repair may be made with sewing or heat bonding. Heat bonding method requires approval of Owner's Representative.

4.0 LEACHATE COLLECTION SYSTEM

The leachate collection system piping has been changed from the CQC plan in its entirety. As such, Section 4.2 of this addendum supersedes all of Section 4.2 of the CQC Plan.

4.2 Piping System

4.2.1 Material Requirements

The pipe and associated fittings and joints shall meet material acceptance, and construction quality requirements as stated in this section of the CQC Plan. The pipe, fittings, and joints shall be provided by manufacturers familiar with the design intent of the leachate collection system. The quality of all materials, process of manufacturer, and the finished products, shall be subject to the inspection and approval of the Owners Representative, and the Owner.

4.2.1.1 HDPE Pipe

The pipe shall be PE 4710 HDPE Pipe, DR 11.

4.2.1.1.1 Base Resin (HDPE Material)

HDPE material used for the manufacture of HDPE pipe and fittings under this specification shall be produced from approved pipe material base resin that is high density, high molecular weight polyethylene (HDPE) pipe grade resin with the nominal physical properties:

- Equivalent to Type III, Category 5, Class C, Grade PE 4710 in accordance with ASTM D3350.
- Equivalent to cell classification PE445574C in accordance with ASTM D3350.
- As outlined in Table 4.1 below.

The material shall be listed by PPI (Plastics Pipe Institute, a division of the Society of the Plastics Industry) in PPI TR-4 with a 73ºF hydrostatic design basis of 1,600 psi and a 140ºF hydrostatic design basis of 800 psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D 2837 testing.

The resin shall contain not less than 97% of the base polymer and not less than 2% carbon black as defined in ASTM D3350, Class C to impart maximum weather resistance.

The pipe material shall contain no more than 3% carbon black, anti-oxidants, and heat stabilizers combined, and no other additives, fillers or extenders.

The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and the co-extruded resin.

4.2.1.1.2 Physical Appearance

All pipes shall have good appearance qualities.

The pipe shall be homogeneous throughout and the surfaces shall be smooth and uniform with no visible defects.

The pipes shall be free of visible cracks, holes, voids, nicks, cuts, gouges, scratches, blisters, gels, undispersed ingredients, any signs of contamination by foreign inclusions, or other defects that may affect the wall integrity or the pipe's serviceability.

4.2.1.1.3 Physical Properties

Pipe and fitting dimensions, workmanship, standard dimension ratio (SDR) and corresponding pressure rating shall be in accordance with the requirements of ASTM F714.

HDPE piping shall have a Standard Dimension Ratio (SDR) as specified on the Drawings.

The chemical and corrosion resistance of the PE pipe and all fittings shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources and equal to or greater than that of the 60 mil HDPE geomembrane specified.

All mechanical fasteners or fittings shall be stainless steel.

At a minimum, the pipe material shall meet the properties presented in Table 4.1.

Table 4.1
Required Pipe and Base Resin Physical Properties

PROPERTY	TEST METHOD	UNIT	REQUIRED VALUE
Material Designation	PPI-TR4		PE 4710
Cell Classification	ASTM D3350		445574C
Material Classification	ASTM D3350		Type III, Category 5, Class C
Density	ASTM D1505		≥0.945 g/cm^3
Melt Index	ASTM D1238 (Condition E)	g/10min	<0.1
Carbon Black Content/Color; UV Stabilzer	ASTM D1603	% range	2 to 3
Flexural Modulus	ASTM D790 2% Secant	psi	>125,000
Tensile Strength @Yield	ASTM D638 (Type IV, 2 ipm) [1]	psi	>3,500
Elongation @ Yield	ASTM D638 (Type IV, 2 ipm) [1]	%	>8
Ultimate Elongation @ Break	ASTM D638	%	>400
Slow-Crack-Growth (SCG) Resistance	ASTM F1473 (PENT) 80 °C	hrs	>500
Compressive Strength at Yield	ASTM D695	psi	>1,000
Slow Crack Resistance (SCG) (PENT test)	ASTM F1473	hours	>100
Hydrostatic Design Basis @ 73.4°F (23°C) 140°F (60°C)	ASTM D2837	psi	>1,600 >1,000
Low Temperature Brittleness	ASTM D746	°F(°C)	< - 103 (-75)
Linear Thermal Expansion Coefficient	ASTM D696	in/in/°F	8 x 10^{-5}

Notes:

1. Dumb-bell tested at a rate of strain of 2 inches/minute (ipm)

4.2.1.2 Fittings

All fittings specified on the Drawings, or otherwise, needed to make pipe connections (ex: 90º elbow) shall be in accordance with ASTM D2513 and ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabrication from HDPE pipe conforming to this specification.

The fittings shall be fully pressure rated and provide a working pressure equal to that of the pipe.

The fittings shall be manufactured from the same base resin type and cell classification as the pipe itself as specified in Part 4.2.1.1 of this Section. The fittings shall be homogeneous throughout and free from cracks, scratches, holes, foreign inclusions, voids, or other injurious defects.

Molded socket fittings shall not be used.

Pre-fabricated fittings:

- Shall not be permitted unless molded fittings are not available from the pipe Manufacturer, and only after obtaining specific approval from the Engineer.
- Shall be made using pipe segments meeting all base resin, physical, and property requirements presented in Part 4.2.1.1 of this Section.
- All pipe segments in a pre-fabricated fitting shall be pressure rated to exceed by 20% the highest pipe pressure rating to which they are intended to be connected.

4.2.1.3 Joints

The method of joining for high density polyethylene pipe shall be the heat butt fusion method of high density polyethylene pipe per ASTM D2657 and shall be performed in strict accordance with the pipe manufacturer's recommendations, subject to the Engineer's approval.

The butt fusion equipment used in joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400-450 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 psi. The butt fusion joining will produce a joint with weld strength equal to or greater than the tensile strength of the pipe itself. Al field welds shall be made with fusion equipment equipped with a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records provided to the Owner's Representative.

4.2.1.4 Perforations

The perforations shall be pre-fabricated by the Manufacturer. The HDPE pipe sections shall be perforated as shown on the Drawings. Perforations shall be cleanly cut, identical in geometry and evenly spaced. Perforations shall be drilled along entire pipe length.

4.2.2 Manufacturer's Documentation

The Contractor shall submit documentation which demonstrates that the property values of the pipe, fittings, joints, and manholes meet the design specifications, and that quality control measures are taken during manufacturing.

The Contractor or Supplier shall submit a complete description of and data indicating the pipe material and pipe accessories proposed for use conform to the standards of Table 4.1 found in Part 4.2.1.1 of this Section. The submittal shall be received by the Engineer for approval at least two weeks prior to installation.

The contractor shall submit the manufacturer's installation instructions.

4.2.2.1 Qualifications

The pipe, fittings and joints shall be provided by manufacturers who are specialists in the manufacture of piping systems. Each manufacturer shall have a minimum of five (5) years of experience, and shall show evidence of at least five (5) satisfactory installations for similar application.

4.2.2.2 Quality Control Certificates

Prior to the installation of the leachate collection system piping, the manufacturer shall provide the Owners Representative the following information:

- Certification of the analysis for the HDPE resin.
- Certify products meet or exceed specified requirements specified in Table 4.1 found in Part 4.2.2.1 of this Section

The Owners Representative shall verify that:

- The property values certified by the piping system manufacturer meet the design specifications.
- The measurements of properties by the piping system manufacturer are properly documented, and that the test methods used are acceptable.

Any deviation shall be noted by the Owners Representative and reported to the Owner.

4.2.2.3 Labeling

The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding 5 feet:

- Name and/or trademark of the pipe manufacturer.

- Pipe series designation.
- Nominal pipe size.
- Standard dimension ratio (SDR).
- The letters PE followed by the polyethylene grade per ASTM D3350, followed by the Hydrostatic Design basis in 100's of psi (e.g. PE 4710).
- Manufacturing Standard Reference (e.g. ASTM F714-1).
- A production code from which the date and place of manufacture can be determined.

4.2.3 Shipment and Storage

During shipment and storage, the interior of the piping components shall be protected from dirt and foreign matter, and the materials shall be protected from mud, dirt, dust, punctures, cutting, or any other damaging or deleterious conditions. The materials shall be stored on heavy wood blocking or platforms off the ground.

The Owners Representative shall observe the materials upon delivery and prior to installation. Any materials that are cracked, gouged, chipped, dented, or otherwise damaged will not be approved by the Owners Representative, shall be removed from the site, and replaced by the Contractor at no cost to the Owner. Scratches greater than 6 inches in length and gouges exhibiting a depth in excess of 8 percent of the wall thickness of the pipe shall be cause for rejection of pipe or fittings to the extent designated by the Engineer. The Owners Representative shall note any deviation from the above requirements and shall report deviations to the Owner.

Packaging, handling, and shipment shall be in accordance with the manufacturer's standards, instructions, and recommendations.

4.2.4 Joining Process

Pipes, fittings, and joints shall be joined by the Contractor using the procedures outlined below and the manufacturer's recommendations, unless otherwise specified.

4.2.4.1 Preparation

Delivered piping system materials shall be examined by the Contractor who will verify that the materials are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to joining, the Contractor shall verify that the joining surface area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

The method of joining for high density polyethylene pipe shall be the heat butt fusion method of high density polyethylene pipe per ASTM D2657 and shall be performed in strict accordance with the pipe manufacturer's recommendations, subject to the Engineer's approval. The heat fusion

equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer.

All joints shall be made by trained technicians qualified by the Manufacturer and using equipment and controlled procedures approved by the Manufacturer.

All pipe joints shall be stronger than the pipe itself under both tension and hydrostatic loading conditions.

The joints shall be leak-tight, homogeneous and uniform throughout.

Pipe joints shall exhibit a uniform melt bead and the protrusion of the melt bead on the pipe interior shall be removed prior to installation.

Properly executed electrofusion fittings may be used. Extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications or fabrications where shear or structural strength is important, as determined by the Engineer. Mechanical joint adapters, flanges, unions, grooved-couplers, transition fittings, and some mechanical couplings may be used to mechanically connect HDPE pipe with approval by the Engineer. Refer to the manufacturer's recommendations.

4.2.4.2 Weather Conditions

Pipes shall be connected in accordance with weather constraints specified by the manufacturer of the pipe and the manufacturer of the fusion equipment.

4.2.4.3 General Procedures

Quality control by the Owners Representative will include testing, monitoring and/or inspecting:

- The HDPE pipe and fittings for correct size, SDR rating; workmanship, and fabrication.
- Damage during installation.
- The installation, alignment and welding of all pipe, and fittings.
- Backfilling of the pipe.

Any deviation shall be noted by the Owners Representative and reported to the Owner. HDPE pipes and other miscellaneous items shall be subject or rejection on account of failure to conform to these specifications.

4.2.5 Handling and Placement

The contractor shall handle and place piping materials in such a manner as to minimize damage, and shall comply with the following:

Install piping to the lines and grades shown in the Approved Permit or design plans, sloping piping uniformly between elevations shown.

Install piping as per the manufacturer's instructions.

Inspect interior of all pipe and fittings, and completely clean all dirt, gravel, sand, debris, or other foreign material from the pipe interior before it is placed.

Fused segments of pipe shall be handled so as to avoid damage to the pipe.

Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred.

Spreader bars are recommended when lifting long fused sections.

Pipe shall be fused in lengths not to exceed that which can be moved and placed easily and safely, causing no damage to the fused pipe or welds.

4.3 Aggregate

4.3.1 Material Requirements

The aggregate material will be a well-graded, clean rock obtained from a source included on the Kentucky Transportation Cabinet (KYTC) Aggregate Source List and shall be free from fines, frozen material, and deleterious substances.

The aggregate material shall be consistent with the requirements for KYTC Section 805 for Gradation Size No. 57. Material shall consist of uncrushed natural river gravel. Crushed aggregate is not permitted.

4.4 Drainage Layer

4.4.1 Material Requirements

Pond ash is not permissible as drainage layer.

The material shall be consistent with the requirements of KYTC Section 804.09 Underdrains, Embankment drainage Blanket, and Natural Sand for Drainage Blanket.

6.4 Storage of Records

All handwritten data sheet originals, especially those containing signatures, shall be stored by the Owners Representative in a safe repository on-site. Other reports may be stored by any standard method that allows for easy access. Electronic files shall be readily available for the Owner upon their request.

ATTACHMENT 41

Construction Quality Control Plan

West Special Waste Landfill
East Bend Station
Boone County, Kentucky

Prepared for

Duke Energy
139 E. Fourth Street
Cincinnati, Ohio 45201

Prepared by

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March 2007

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D. Geocomposite Drainage Layer – Tenax, Installation Recommendations for Tendrain Geonets and Geocomposites.

1.0 GENERAL

1.1 Introduction

This Construction Quality Control (CQC) Plan for the West Special Waste Landfill at the East Bend Generating Station in Boone County, Kentucky has been developed in accordance with Section J, Attachment 41 of the Application for a Special Waste Landfill Permit (DEP 7094 A) and as required by regulations set forth in 401 KAR 45:110, Section 2. The purpose of this plan is to outline the procedures to be used to certify the design and construction of the following items:

- Subgrade preparation;
- Geocomposite liner system;
- Leachate collection system; and,
- Final Cap System.

For the purpose of this permit application, the CQC Plan is written using generic terminology (i.e., "Permitting Agency", "Owner," or "Owners Representative" versus actual names or entities).

1.2 Scope of the CQC Plan

For each of the constructed components of the landfill, this CQC Plan describes, as applicable, the following:

- Material Requirements;
- Installation Procedures;
- Sampling and testing procedures to be used in the field, and in the lab;
- Required test parameters and frequency;
- Procedures to be followed if a test fails;
- The management structure, experience, & training of the testing personnel; and,
- Contingency plans for anticipated and unanticipated construction difficulties.

1.3 References to Standards

The CQC Plan includes references, where appropriate, to test procedures of the following organizations:

American Concrete Institute (ACI).
American National Standards Institute (ANSI).
American Society for Testing and Materials (ASTM).
Concrete Reinforcing Steel Institute (CRSI).
Institute of Electrical and Electronic Engineers (IEEE).
Joint Industrial Council (JIC).
National Electric Code (NEC).
National Sanitary Foundation (NSF).
Standards of National Electrical Manufacturers Association (NEMA).

1.4 Responsibility and Authority

~~The principal parties involved in the CQC include the Permitting Agency, the Owner, the Engineer, the Owners Representative, the Soils CQC Laboratory, the Geosynthetics CQC Laboratory, and the Contractor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings. It is understood that the Owner may also serve as the Contractor for selected construction elements.~~ Superseded by Addendum 1

1.4.1 Permitting Agency

The Permitting Agency is authorized to issue the permit for construction of the landfill, based on review and acceptance of the permit application, as well as regulatory responsibility for the design, operation, construction, and closure of the landfill. The Permitting Agency is the Kentucky Department of Environmental Protection (KDEP).

1.4.2 Owner

The Owner is responsible for coordinating the permitting, design, and construction of the landfill. The Owner is responsible for all correspondence with the Permitting Agency. The Owner also manages the activities of the Engineer, and the Owners Representative. This responsibility includes compliance with the permit, and the submission of CQC documentation demonstrating that the facility was constructed in accordance with the design specifications. The Owner is also responsible for procuring a Contractor(s) as required for landfill construction.

The Owner has the authority to select, and dismiss parties charged with permitting, design, construction, and CQC. The Owner has the authority to accept or reject permitting documents, design plans and specifications, CQC Plans, and CQC reports. The Owner also has the authority to accept or reject the Contractor's materials and/or workmanship.

1.4.3 Engineer

The Engineer is the firm, retained by the Owner, responsible for preparing permit and design documents for acceptance by the Permitting Agency. These documents include forms, narratives, CQC Plan, and any design plans and technical specifications, which support the permitting, and design of the landfill. The permit and design documents provide minimum specifications, and are the governing document when a material specification contradiction arises.

During construction, the Engineer may be requested to clarify discrepancies in the documents or the CQC Plan, and may approve substantive changes to the design plans or specifications of the facility. Substantive changes include any changes that modify or impact the technical basis for any engineered component of the facility design.

The Engineer for this project is BBC&M Engineering, Inc., Dublin, Ohio.

1.4.4 Owners Representative

The Owners Representative is responsible for observing and documenting on-site activities related to the permit documents, design plans, technical specifications, and the CQC Plan. In general, the responsibilities and authorities of the Owners Representative include:

- Complete understanding of the permit documents, design plans, and specifications in relation to all aspects of the CQC Plan.
- Scheduling, coordinating, and performing CQC activities.
- Performing independent on-site observation of the work in progress to assess compliance with the CQC Plan, permit documents, design plans, and technical specifications.
- Recognizing and reporting deviations from the CQC Plan, permit documents, design plans, and technical specifications to the Owner.
- Secure documents that approve changes to the CQC Plan, permit documents, design plans, and technical specifications.
- Verifying that test equipment meets testing and calibration requirements, and that the tests are conducted according to standardized procedures.
- Recording and maintaining test data.
- Identifying CQC tested work that should be accepted, rejected, or further evaluated.
- Verifying that corrective measures are implemented.
- Documenting and reporting CQC activities.
- Collecting the data needed for record documentation.
- Maintaining open lines of communications with other parties involved in the construction.

The Owners Representative CQC personnel will be on-site as needed to complete to construction observation, testing, and reporting in accordance with, and at the frequencies described in, this Construction Quality Control Plan. During major construction activities including, subgrade preparation, geosynthetic liner installation, and leachate collection system installation, the Owners Representative CQC personnel will generally be on-site on a full time basis.

The Owners Representative is responsible for issuing certification reports for major construction activities. Construction activities requiring certification reports include the following:

- Prepared Subgrade;
- Geocomposite Liner System; and,
- Leachate Collection System and Drainage Layer.

These certifications shall bear the seal of a Professional Engineer registered in the state of Kentucky. Section 5.0 addresses documentation, and construction certification requirements in detail.

The Certifying Professional Engineer is responsible for conducting random inspections to verify the following:

- adequacy of the work being completed by the Owners Representative's CQC personnel;
- adequacy of the Contractor's work;
- conformance of the construction to the design plans and technical specifications; and,
- absence of defects or damage to the materials used for the construction of the landfill systems.

The frequency of such random inspections is a function of the type and quantity of construction activity being completed; generally, for each 20 days that the Owners Representative's CQC personnel are on-site, the Certifying Professional Engineer will complete one random inspection. Random inspections occure so that, at a minimum, the Certifying Engineer can observe the following:

- Surface of the prepared subgrade prior to installation of the liner system;
- Surface of geosynthetic liner system prior to installation of leachate collection system; and,
- Surface of the lechate collection system drainage layer prior to placement of waste.

1.4.5 Soils CQC Laboratory

The soils CQC Laboratory is responsible for the performing the laboratory testing to determine compliance with specific characteristics of the soil materials. The Soils CQC Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Soils CQC Laboratory will be reported to the Owners Representative. ~~The testing laboratory shall meet the "Recommended Requirements for Independent Laboratory Qualifications" latest edition, published by the American Council of Independent Laboratories.~~ Superseded by Addendum 1

1.4.6 Geosynthetics CQC Laboratory

The Geosynthetics CQC Laboratory is responsible for performing the laboratory testing required to determine specific characteristics of the geosynthetic materials. The Geosynthetics CQC Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Geosynthetics CQC Laboratory will be reported to the Owners Representative. ~~The testing laboratory shall meet the "Recommended~~ Superseded by Addendum 1

~~Requirements for Independent Laboratory Qualifications" latest edition, published by the American Council of Independent Laboratories.~~ Superseded by Addendum 1

1.4.7 Contractor

The Contractor, including any subcontractors, is responsible for constructing the components of the landfill. The Contractor may be either the Owner of the landfill, or a construction firm retained by the Owner.

1.5 Project Meetings

To achieve a high degree of quality during construction, clear, open channels of communication are essential. All meetings will be open to representatives of the Permitting Agency. The following meetings may be held as appropriate.

1.5.1 Resolution Meeting

Following the completion of the contract documents, and selection of an Owners Representative for the project, a Resolution Meeting may be held, at the discretion of the Owner. This meeting shall include the involved parties, including the Owner, Engineer, and the Owners Representative. The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties, and delays in construction, and to present the CQC Plan to the parties involved. In particular, requirements for testing, repair, etc., should be known and accepted. The meeting may include the following activities:

- Distribute relevant documents.
- Review critical design details of the project.
- Review the CQC Plan.
- Make appropriate modifications to the CQC Plan.
- Review protocols for testing and reporting.
- Confirm the methods for documenting and reporting, and for distributing documents and reports.
- Confirm the lines of authority and communication.

The Owners Representative will document the meeting. The Resolution Meeting may be combined with the Pre-Construction Meeting described below.

1.5.2 Pre-Construction Meeting

A Pre-Construction Meeting will be held at the project site. The meeting will be attended by the Owner, the Engineer, the Owners Representative, the Contractor, and other involved parties, and address the following topics:

- Lines of Communication.
- Distribution of Documents.
- Site Requirements.
- Construction.
- Construction Quality Assurance Plan.

- Project Deliverables.
- Invoicing Procedures and Hierarchy.

1.5.3 Daily Meetings

Whenever necessary, daily meetings will be held between the Owners Representative, Contractor, and other involved parties. Those attending will discuss, plan, coordinate the work, and CQC activities to be completed that day. The Owners Representative will document the meeting as part of the Owners Representative's daily record keeping requirements.

1.5.4 Progress Meetings

A weekly progress meeting will be held between the Owners Representative, Contractor, and other parties. At the Owner's discretion, this meeting may be held once every two (2) weeks, based on the current and projected rate of work. Those attending will discuss current progress, planned activities for the next week, and new business or revisions to the work as part of the Owners Representative's daily record keeping requirements. ~~The Owners Representative will also prepare and distribute meeting minutes~~.

Superseded by Addendum 1

1.5.5 Problem or Work Deficiency Meetings

A special meeting will be held when and if a problem or deficiency, which would impact the construction schedule, is present or likely to occur. The meeting will be attended by the Contractor, affected subcontractors, Owner, and Owners Representative. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency.
- Review alternative solutions.
- Implement an action plan to resolve the problem or deficiency.

The meeting will be documented by the Owners Representative, as per the Owners Representative's daily record keeping requirements. The Owners Representative will also prepare meeting minutes.

1.6 Experience and Training of Key Personnel and Organizations

The following qualifications shall be required of the key personnel and organizations involved in the construction of the landfill.

1.6.1 Owners Representative

The Owners Representative shall be a qualified engineer/engineering firm with experience in construction quality assurance and quality control, particularly on projects involving similar landfill construction. The Owners Representative shall designate a Certifying Engineer who is a Professional Engineer registered in the state of the permitting site. The Certifying Engineer shall be solely responsible for the CQC personnel and their activities, as well as the preparation of the

certification reports to certify the project has been constructed in accordance with the CQC Plan, permit documents, Approved Permit, design plans, and technical specifications. The Owners Representative shall be capable of assigning technically qualified personnel for on-site monitoring, as needed. The firm designated as the Owners Representative, shall possess a thorough knowledge of earthwork and/or landfill construction.

1.6.2 Soils CQC Laboratory

The soils CQC Laboratory shall be pre-qualified by the Owner. The soils CQC Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQC Plan. The soils CQC Laboratory shall demonstrate that it follows the standard test methods listed in the CQC Plan and maintains the appropriate calibrated equipment to perform the tests. The Soils CQC Laboratory shall also demonstrate to the Owners Representative that it adheres to a formal in-house quality control program, and can provide the required analytical documentation and reports.

1.6.3 Geosynthetics CQC Laboratory

The Geosynthetics CQC Laboratory shall be experienced in performing laboratory tests to determine geosynthetic characteristics as required by the CQC Plan. The Geosynthetics CQC Laboratory shall demonstrate that it follows the standard test methods listed in the CQC Plan, and maintains the appropriate calibrated equipment to perform the tests. The Geosynthetics CQC Laboratory shall also demonstrate to the Owners Representative that it adheres to a formal in-house quality control program, and can provide the required analytical documentation and reports.

1.6.4 Contractor

The Contractor shall be capable of assigning the personnel and equipment required to perform the work within the schedule. The Contractor shall be a specialist in earthwork construction, and shall be capable of demonstrating, to the satisfaction of the Owner, successful completion of similar sized landfill construction projects.

The Contractor's subcontractors shall be pre-qualified and approved by the Owner, and shall be specialists in their area of work. The subcontractors shall also be capable of demonstrating, to the satisfaction of the Owner, successful completion of similar sized construction projects.

2.0 SUBGRADE PREPARATION

2.1 Introduction

This section addresses CQC activities associated with the subgrade preparation including proofrolling and construction of the subgrade preparation layer. The subgrade preparation includes the placement of a 24-inch thick layer of controlled compacted fill (structural fill) beneath all areas where the geocomposite liner system is to be installed.

2.2. Subgrade Proofrolls

Following excavation of the materials to a depth of 24-inches below the elevation of the geocomposite liner system and prior to the placement of any structural fill, the exposed soil subgrade shall be proofrolled. In areas where the placement of fill material is required to attain an elevation 24-inches below the elevation of the geocomposite liner system, both the foundation soils for the fill and the surface of the fill shall be proofrolled prior to placement of the structural fill for the prepared subgrade.

All proofrolls shall be completed using a minimum 100,000 pound loaded four (4) tire scraper with a minimum capacity of 20 cubic yard or approved equal. The KDEP, Division of Waste Management must be notified at least 48 hours prior to proofrolling operations.

2.3 Materials Additional definition included in Addendum 1

The structural fill shall be constructed of the following materials:

- In-organic soils with a maximum particle size of 3-inches. Topsoil shall not be used.
- The soil shall have a maximum clod size of four (4) inches or half the lift thickness, whichever is less.
- The soil shall be free of stones, debris, and other deleterious material.

2.4 Placement and Compaction

- Topsoil shall be removed prior to fill placement.
- Horizontal benches shall be excavated onto slopes to receive fill so that fill can be placed in horizontal lifts.
- The fill shall not be placed on a frozen subgrade, nor shall snow, ice or frozen material be incorporated into the fill.
  Fill shall not be placed in standing water.
- If the top surface of the preceding layer of fill becomes too dry to permit a suitable bond, the surface shall either be removed or scarified, and moistened by sprinkling water and discing, to achieve acceptable moisture content prior to placement of the next layer of fill.
- The soil shall be placed in loose lifts not exceeding 8-inches in thickness.
- The soil shall be compacted to at least ninety-eight (98) percent of the maximum Standard Proctor, using ASTM D-698.

- The soil shall be placed and compacted at a moisture content ranging between 2 percentage points below optimum and 2 percentage points above optimum based on the laboratory test results from ASTM D-698.

The landfill floor and drainage channel construction will be protected from erosion during construction. Temporary erosion protection measures may include temporary seeding with the addition of lime, fertilizer, and mulch to promote growth. It will also include installing silt fencing and straw bales at select locations to disrupt the erosive nature of surface water runoff. All construction surfaces shall be maintained so that the surface will be free draining, thereby minimizing the potential for ponding.

2.5 Construction Testing

Additional testing included in Addendum 1

Moisture content and density testing will be performed by the Owners Representative in the field using a nuclear densitometer. The nuclear densitometer tests will be performed at a minimum rate of nine (9) tests per lift per acre. The frequency of testing may be increased at the discretion of the Owners Representative or the Owner when visual observations of construction performance indicate a potential problem. The nuclear densitometer shall be operated following procedures outlined in ASTM D-2922. The location of each test shall be recording using the permit drawing coordinate system (KY State Plain North, 1601, NAD 83); additionally, the cell number, phase number (if appropriate), and lift number for the test shall also be recorded.

2.5.1 Test Results

Compliance with all material and moisture-density requirements identified in Sections 2.3 and 2.4 of this CQC Plan, shall be required for all areas and all lifts. If an area(s) fail to achieve the moisture-density requirements as determined by field testing, the Owners Representative shall direct the Contractor to implement the contingency plan described in Section 2.6 of this CQC Plan. Contingency work shall continue until such time as all areas achieve the specified moisture-density requirements. If any areas remain in non-compliance after the implementation of the requirements of Section 2.6, the Owners Representative, and the Engineer, shall evaluate whether the areas represented by the failing test(s) should be excavated and replaced with new soil material. For the purpose of certification, not less than 98% of all areas tested much achieve the specified moisture-density requirements.

2.5.2 Test Reports

The Owners Representative shall report the results of the field-testing to the Owner and note any discrepancies. The Owner shall report the results of the field-testing to the Permitting Agency as part of the certification report described in Section 5.0 of this CQC Plan.

2.6 Contingency Plan for Anticipated Construction Difficulties

In general, anticipated construction difficulties may include the following:

- *Incorrect Moisture Content and/or Insufficient Density*. Based on the nuclear densitometer testing, the moisture content may be dry of optimum or too wet of optimum. In addition, the in-place soil may be at a density less than 98 percent of Standard Proctor.

  To correct this situation, water may be added and worked into the soil or the soil may be allowed to dry out prior to completing the lift. The Contractor may also increase the number of passes on each lift by the compaction equipment, change the compactor type or weight, or reduce the lift thickness.

- *Weather Damage*. The compacted subgrade layer will not be placed, compacted, or tested during inclement weather. In particular, inclement weather includes continuous rainfall, standing water on the in-place lift, freezing conditions, or other weather conditions, which prevent the appropriate construction of the subgrade layer.

  Excessive rainfall may damage the in-place compacted subgrade layer or result in water ponding on the layer. If the damage is severe, the soil will be removed and a new lift placed. For less severe damage, the compacted subgrade layer will be allowed to dry, and will then be retested with the nuclear densitometer. If the dried subgrade fails to meet compaction/moisture requirements, discing and recompaction in-place may be required. The subgrade layer construction should be constructed such that its surface will be free draining, thereby minimizing the potential for ponding.

  The compacted subgrade layer will be placed so as to be protected from freeze-thaw conditions. This may require the placement of a sacrificial layer of material over newly compacted material. The sacrificial layer shall be removed prior to placement of additional compacted subgrade fill material. New compacted subgrade fill material shall not contain frozen material. New compacted subgrade fill material shall not be placed on a frozen subgrade or on frozen prior placed compacted subgrade fill material. If the freeze/thaw damage is severe, the soil will be removed and a new lift placed. For less severe damage, the compacted subgrade layer will be allowed to thaw, and will then be retested. If the thawed subgrade fails to meet compaction/moisture requirements, discing and recompaction in-place may be required.

2.7 Contingency Plan for Unanticipated Construction Difficulties

Anticipated construction difficulties, which may occur during subgrade preparation, have been described in Section 2.6 of this CQC Plan. Notification of unanticipated defects in workmanship, and repairs and retesting during the subgrade layer construction will be as described in the following Sections.

2.7.1 Notification

The Owners Representative shall notify the Contractor immediately upon discovering a defect in the workmanship. After determining the extent and nature of the defect, the Owners Representative shall notify the Owner. The Owner or Owners Representative will immediately notify the Permitting Agency if continued construction difficulties are encountered. This notification will include identifying the proposed solution to the construction difficulty.

2.7.2 Repairs and Retesting

The Contractor shall correct the deficiency to the satisfaction of the Owners Representative, the Owner, and the Permitting Agency. If a design criterion cannot be met, or unusual weather conditions hinders the work, then the Owners Representative shall develop and present to the Owner suggested solutions for approval.

After the Contractor has repaired a deficiency, the Owners Representative shall visually examine the area. The defect will be corrected before any additional work is performed by the Contractor in the area of the deficiency.

3.0 GEOCOMPOSITE LINER SYSTEM

3.1 Introduction

This section addresses the CQC activities associated with the geocomposite liner system materials used as a containment layer in landfill floor. The geocomposite liner system shall include three components:

1) geosynthetic clay liner (GCL);
2) textured 60-mil HDPE geomembrane liner (GMX); and,
3) nonwoven geotextile (GT) protective layer.

3.2 Geosynthetic Clay Liner

A geosynthetic clay liner (GCL) will be placed over the prepared subgrade.

3.2.1 Material Requirements

Superceded by Addendum 1

~~GCL shall be Bentomate SDN as manufactured by Colloid Environmental Technologies Company (CETCO) or approved equal. The GCL shall be installed, tested, and meet material characteristics and quality per Table 3.1. If an equivalent GCL is provided by another manufacturer, the alternate product must meet or exceed the requirements listed on Table 3.1 and described in Section 3.2.2 through 3.2.8 of this CQC Plan.~~

Table 3.1
Geosynthetic Clay Liner Property Requirements

PROPERTY	TEST METHOD	UNITS	REQUIRED VALUE	
Bentonite Material				
Free Swell	ASTM D5890	ml/2g	24	MARV
Fluid Loss	ASTM D5891	ml	18	Max ARV
Finished GCL				
Bentonite Mass/Unit Area[(1)]	ASTM D5993	Lb/sf	0.75	MARV
Grab Strength [(2)]	ASTM D6768	lb/in	22.5	MARV
Peel Strength [(3)]	ASTM D6496	lb/in	~~2.5~~	
Index Flux [(4)]	ASTM D5887	m^3/m^2 /s	1×10^{-8}	Max ARV
Hydraulic Conductivity[(4)]	ASTM D5887	Cm/sec	5×10^{-9}	Max ARV
Hydrated Internal Shear Strength Modified by Addendum 1	ASTM D5321 ASTM D6243	Psf	500	

Modified by Addendum 1

Notes:

(1) Oven-dried measurement. The 0.75 lb. Bentonite mass equates to 0.84 lb. When indexed to 12% moisture.
(2) Measured at maximum peak, in weakest principal direction. Elongation provided for reference only. Modified to use a four-inch grip.
(3) Modified to use a four-inch grip. The maximum peak strength of five specimens averaged.
(4) De-aired, de-ionized tap water @ 5 psi maximum effective confining stress and 2 psi head pressure. Permameter test parameters of ASTM D5887. Provide the weekly test data for production run and 20 weeks preceding production.

MARV – Minimum Average Roll Value

Max ARV – Maximum Average Roll Value

3.2.2 Manufacturer's Documentation

3.2.2.1 Qualifications

The GCL manufacturer shall be a specialist in the manufacture of GCL, and shall have produced a minimum of five million (5,000,000) square feet during the previous five (5) years.

3.2.2.2 Certification of Property Values

Prior to the delivery of the GCL materials to the site, the GCL manufacturer shall provide the Owners Representative with the following information:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in the Table 3.1 and 3.2.
- A certification that the property values given in the properties sheet are "minimum average roll values" and are guaranteed by the GCL manufacturer.

The Owners Representative shall verify that:

- The property values certified by the GCL manufacturer meet the design specifications.
- The measurements of properties by the GCL manufacturer are properly documented, and that the test methods used are acceptable.

3.2.2.3 Quality Control Certificates

The GCL manufacturer shall provide the Owners Representative with a quality control certificate. The certificate shall be signed by a responsible party employed by the GCL manufacturer. The GCL shall not be delivered to the site until the certification has been provided by the manufacturer. The quality control certificate shall include:

- Lot/roll number and identification.
- Sampling procedures and results of quality control tests.

Any deviation shall be noted by the Owners Representative and reported to the Owner.

3.2.2.4 Labeling

The GCL manufacturer shall identify (label) all rolls of GCL. Each GCL roll shall have a weatherproof label that contains, at a minimum, the following information:

- Manufacturer's name.
- Product identification.
- Lot Number.
- Roll Number.
- Roll Weight.

- Roll Dimensions.

In addition, if any special handling of the GCL is required, it shall be so marked on the top surface of the GCL roll. Rolls without proper identification shall be rejected by the Owners Representative. The Owners Representative shall examine rolls upon delivery, and any deviation from the above requirements shall be reported to the Owner.

3.2.3 Shipment and Storage

During shipment and storage, the GCL rolls shall be protected from moisture including precipitation and snow, or other inundation such as: mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. GCL rolls shall be wrapped in plastic sheets or otherwise protected. Wrapping protecting the GCL rolls should be removed less than one (1) hour prior to unrolling the geosynthetic clay liner. The rolls shall not be exposed to precipitation prior to or during installation.

Rolls should be stacked to prevent sliding or rolling from the stacks. Rolls should be stacked no higher than four rolls. Stacking may be five rolls high if a stinger is utilized and if the roll cores are stable. Rolls should never be stacked on end.

GCL rolls should be stored at the job site away from high-traffic areas, but close to the active work area to minimize handling. The designated storage area should be flat, dry and stable. Moisture protection of the GCL is provided by its packaging; however, an additional tarpaulin or plastic sheet is recommended to provide extra protection.

The Owners Representative shall observe rolls upon delivery and prior to installation. Any deviation from the above requirements shall be reported to the Owner. Any damaged rolls shall be rejected and replaced at no cost to the Owner.

3.2.4 Conformance Testing of GCL

Prior to the deployment of the rolls of GCL, the Owners Representative shall remove and forward samples to the Geosynthetics CQC Laboratory for testing to verify conformance with the GCL property values as identified in Table 3.1.

Table 3.2
Quality Control Testing Frequency Requirements for GCL

PROPERTY	TEST METHOD	MANUFACTURER TESTING FREQUENCY (minimum)	OWNERS REPRESENTATIVE TESTING FREQUENCY (minimum)
Bentonite Material			
Free Swell	ASTM D5890	1/110,000 lb	N/A
Fluid Loss	ASTM D5891	1/110,000 lb	N/A

Finished GCL			
Bentonite Mass/Unit Area	ASTM D5993	1/40,000 sf	1/100,000 sf
Grab Strength	~~ASTM D4632~~ ~~ASTM D6768~~	1/200,000 sf	N/A
Peel Strength	~~ASTM D4632~~ ~~ASTM D6496~~	1/40,000 sf	1/100,000 sf
Index Flux	ASTM D5887	1/week (1)	N/A
Hydraulic Conductivity	ASTM D5887	1/week (1)	1/1,000,000 sf
Hydrated Internal Shear Strength	~~ASTM D5321~~ ~~ASTM D6243~~	Periodically	N/A

Notes:

Modified by Addendum 1

(1) Manufactures QA results for Index Flux and Hydraulic Conductivity shall be submitted for the week(s) the material on-site was manufactured and for the previous 20 weeks.

3.2.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the Owners Representative, rolls shall be selected for sampling at a minimum frequency as shown in Tables 3.1 and 3.2. If the material is shipped in identifiable lots or manufacturing runs, sample selection shall be adjusted to assure that the minimum frequency is met, and that each different lot or manufacturing run is represented by at least one (1) sample. If a roll is not identifiable by roll number, the Owners Representative shall inform the Owner immediately. If the roll cannot be tracked, the Owner shall reject the roll.

~~Owners Representative may arrange for in-plant conformance sampling of the GCL by the Geosynthetics CQC Laboratory. In-plant sampling would be coordinated with manufacturer. Owners Representative shall inventory rolls received on-site to verify manufacturing and conformance sampling.~~

Superseded by Addendum 1

Samples will be taken across the entire width of the roll, and will not include the first three (3) linear feet. Unless otherwise specified, samples will be three (3) feet long, along the roll width. Owners Representative will mark the machine direction on the samples with an arrow.

3.2.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

- If the average test values for the sample meet all of the GCL property values given in the design specifications, and the manufacturer's guaranteed minimum values, the sample passes.
- If the average test value for the sample does not meet one (1) or more of the required values, additional evaluation procedures will be implemented by the Owners Representative. Additional tests required for further evaluation shall be done at no expense to the Owner.

- For the failing parameter(s), perform two (2) additional tests on the sample. These tests may be performed by another Geosynthetics CQC Laboratory at the discretion of the Owners Representative and the Owner.

- If the average test values for each of the two (2) additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.

- If one (1) or more of the average test values do not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll, and test for failed parameter(s). If one (1) or either of these tests do not meet requirements, the roll(s) will be rejected and the Owners Representative shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

3.2.5 Handling and Placement

The Contractor shall handle GCL rolls in such a manner as to minimize damage, and shall comply with the following:

- After the wrapping has been removed, the GCL shall not be exposed to conditions of high precipitation or high humidity.
- At the top of slopes, the GCL shall be securely anchored, and then rolled down the slope in such a manner as to continually keep the GCL panel in tension.
- In the presence of wind, GCL panels shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlaying material. Sandbags shall be filled with fine grained material, and must be placed with care to prevent damage to the GCL.
- GCL shall be kept continually under tension to minimize the presence of wrinkles.
- GCL shall be cut using an approved GCL cutter only. If in-place, special care must be taken to protect other materials from damage that could be caused by the cutting of the GCL.
- During placement of the GCL, care shall be taken not to entrap materials or moisture that could damage the GCL, or hamper subsequent installation.
- After installation, the entire surface of the GCL shall be examined, and any foreign objects shall be removed.

The Owners Representative shall note any deviation and report it to the Owner.

3.2.6 Seams and Overlap

GCL rolls shall be deployed with the roll (panel) aligned such that the machine direction is aligned with the slope. Seam overlap shall be obtained by either,

overlapping adjacent panels, placing a salvage section of GCL over the seam, or other process as approved by the manufacturer. Example overlapping procedures are contained in the CETCO-Geosynthetic Clay Liners Specification Guidelines (Appendix B). The Owners Representative shall witness and record installation and CQC procedures.

3.2.7 Repair

Only those repair methods approved by the manufacturer are acceptable. Example repair procedures are contained in the CETCO-Geosynthetic Clay Liners Specification Guidelines (Appendix B). The Owners Representative shall observe any repair, note any deviation with the above requirements, and report them to the Owner.

3.2.8 Placement of Materials on GCL

The Contractors shall place materials on or against the GCL liner in the following manner:

- Cause no damage to the GCL.
- Allow minimal slippage of the GCL on underlying subgrade.
- Equipment used for placing the overlying HDPE geomembrane on the GCL shall be limited to all terrain vehicles (ATV's) and shall conform to the following restrictions:

  Written approval from the Manufacture is provided by the Contractor to the Owner stating that such use would not impact the material warranty.

  The Contractor accepts sole responsibility for any damage to the GCL caused by equipment traffic and will repair or replace any damaged section at no cost to the Owner. If more than three repairs are required because of use of the ATV's, authorization to use ATV's will be suspended.

  All ATV's will be inspected by the Owner's field representative. No ATV leaking fuel or oil will be permitted to operate within the landfill cells.

  ATV's shall not be refueled within the limits of the landfill cells.

  ATV's shall be equipped with shallow tread tires, with less than 5 psi tire pressure.

  ATV's shall be operated at less than 5 mph. Sudden starts, stops, and turns shall be prohibited.

No more GCL should be deployed than can be covered by HDPE geomembrane within a working shift.

3.3 Textured Geomembrane Liner

A textured geomembrane liner (GMX) is to be placed over the geosynthetic clay liner (GCL) as described in Section 3.1.

3.3.1 Materials Requirements

Superseded by Addendum 1

~~The geomembrane liner shall be HD Textured as manufactured by GSE Lining Technologies, Inc. or approved equal. The geomembrane shall be 60 mil, textured, HDPE. The liner shall be installed, tested and meet material characteristics and quality per Table 3.3.~~

Table 3.3
HDPE Textured Geomembrane Liner Property Requirements

PROPERTY	TEST METHOD	UNIT	REQUIRED VALUE	
Resin Properties				
Density	ASTM D1505/ ASTM D792	g/cm^3	0.932	MARV
Melt Flow Index	ASTM D1238 *(190/2.16)*	g/10 min.	1.0	MAX ARV
Roll Properties				
Thickness	ASTM D5994	mils	57 (1)	
Density	ASTM D1505/ ASTM D792	g/cm^3	0.94	MARV
Asperity Height	~~GRI GM 12~~	mils	20(2)	
Tensile Properties(3) Yield Strength	ASTM D6693 *(Type IV specimen; speed = 2 inches/min.)*	lbs/inch	126	MARV
Break Strength		lbs/inch	90	MARV
Yield Elongation		%	12	MARV
Break Elongation		%	100	MARV
Tear Resistance	ASTM D1004	lbs	42	MARV
Puncture Resistance	ASTM D4833	lbs	90	MARV
Carbon Black Content	~~ASTM D1603~~	%	2.0 -3.0	
Carbon Black Dispersion(4)	ASTM D5596		(4)	
Notched Constant Tensile Load	ASTM D5397 *(Appendix)*	hrs	300	Minimum
Oxidative Induction Time (OIT) – Standard	ASTM D3895	min	100	Minimum

Notes:

Modified by Addendum 1

(1) Lowest individual for 8 out of 10 values ≥ 54 mil; lowest individual for any of 10 values ≥ 51 mil.
(2) Lowest individual for 8 of 10 readings ≥ 18 mil and lowest individual reading ≥ 15 mil.
(3) Tensile properties shall be in both principal directions (machine and cross-machine).

(4) Dispersion only applies to near-spherical agglomerates. 9 of 10 views shall be Category 1 or 2; no more than one view shall be Category 3.

MARV – Minimum Average Roll Value
Max ARV – Maximum Average Roll Value

3.3.2 Manufacturer's Documentation

3.3.2.1 Qualifications

The GMX manufacturer shall be a specialist in the manufacture of geomembranes, and shall have produced a minimum of five million (5,000,000) square feet during the previous five (5) years.

3.3.2.2 Certification of Property Values

Prior to the delivery of the GMX materials to the site, the manufacturer shall provide the Owners Representative with the following information:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in Tables 3.3 and 3.4.
- A certification that the property values given in the properties sheet are "minimum average roll values" and are guaranteed by the GMX manufacturer.

The Owners Representative shall verify that:

- The property values certified by the GMX manufacturer meet the design specifications.
- The measurements of properties by the GMX manufacturer are properly documented, and that the test methods used are acceptable.

3.3.2.3 Quality Control Certificates

The GMX manufacturer shall provide the Owners Representative with a quality control certificate. The certificate shall be signed by a responsible party employed by the GMX manufacturer. The GMX shall not be delivered to the site until the certification has been provided by the manufacturer. The quality control certificate shall include:

- Lot/roll number and identification
- Sampling procedures and results of quality control tests

Any deviation shall be noted by the Owners Representative, and reported to the Owner.

3.3.2.4 Labeling

The GMX manufacturer shall identify all rolls of geomembrane using a weatherproof label that contains the following:

- Manufacturer's name.
- Product identification.
- Lot Number.

- Roll Number.
- Roll Weight.
- Roll Dimensions.

In addition, if any special handling of the GMX is required, it shall be so marked on the top surface of the GMX. Rolls without proper identification shall be rejected by the Owners Representative. The Owners Representative shall examine rolls upon delivery, and any deviation from the above requirements shall be reported to the Owner.

3.3.3 Shipment and Storage

During shipment and storage, the GMX shall be protected from exposure to ultra-violet light, precipitation, snow or other inundation such as; mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. GMX rolls shall be wrapped in plastic sheets or otherwise protected. Wrapping shall remain on the GMX rolls until immediately prior to roll deployment. GMX shall not be exposed to precipitation prior to being installed. During cold weather, GMX must be protected from freezing.

The Owners Representative shall observe rolls upon delivery and prior to installation. Any deviation from the above requirements shall be reported to the Owner. Any damaged rolls shall be rejected and replaced at no cost to the Owner.

Table 3.4
Quality Assurance/Quality Control Testing Frequency for the GMX

PROPERTY	TEST METHOD	MANUFACTURER TESTING FREQUENCY (minimum) [3]	OWNERS REPRESENTATIVE TESTING FREQUENCY (minimum) [4]
Resin Property			
Density	D1505/D 792	One Per Resin Batch	N/A
Melt Flow Index	D1238	One Per Resin Batch	N/A
Roll Property			
Thickness	D 5994	One Per Roll	Every Sample submitted
Density	D1505/D 792	1/200,000 lb (approx. 1/600,000 sf)	N/A
Asperity Height	~~GRI GM 12~~	One Every 2nd Roll [1]	Every Sample submitted
Tensile Properties [2] Yield Strength Break Strength Yield Elongation Break Elongation	D 6693	1/20,000 lb (approx. 1/60,000 sf)	1/100,000 sf
Tear Resistance	D 1004	1/45,000 lb (approx.1/135,000 sf)	1/200,000 sf

Modified by Addendum 1

Puncture Resistance	D 4833	1/45,000 lb (approx.1/135,000 sf)	1/200,000 sf
Carbon Black Content	~~D 1603~~	1/20,000 lb (approx. 1/60,000 sf)	N/A
Carbon Black Dispersion	D 5596	1/45,000 lb (approx. 1/135,000 sf)	N/A
Notched Constant Tensile Load	D 5397	1/200,000 lb (approx. 1/600,000 sf)	N/A
Oxidative Induction Time (OIT)	D3895	1/200,000 lb (approx. 1/600,000 sf)	N/A

Modified by Addendum 1

Notes:
(1) Alternate the measurement side for double sided textured sheets, indicating on the sample results which side was tested.
(2) Machine Direction (MD) and Cross Machine Direction (CD) average values should be on the basis of 5 test specimens each direction.
  (i) Yield Elongation is calculated using a gage length of 1.3 inches.
  (ii) Break Elongation is calculated using a gage length of 2.0 inches.
(3) Manufacturers QC testing requirements are based on weight (e.g., tensile properties are measured every 20,000 lbs). Units have been converted to approximate square feet, based on nominal thickness and minimum density of liner material.
(4) Third Party conformance testing based on actual square foot produced for proposed installation

3.3.4 Conformance Testing GMX

Prior to the deployment of the rolls of GMX, the Owners Representative shall remove and forward samples to the Geosynthetics CQC Laboratory for testing to verify conformance with the textured geomembrane property values.

3.3.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the Owners Representative, rolls shall be selected for sampling at a minimum frequency of as shown in Table 3.4. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met, and that each different lot or manufacturing run is represented by at least one (1) sample. If a roll is not identifiable by roll number, the Owners Representative shall inform the Owner immediately. If the roll cannot be tracked, the Owner shall reject the roll.

Superseded by Addendum 1

~~The Owners Representative may arrange for in-plant conformance sampling of the GMX by the Geosynthetics CQC Laboratory. In-plant sampling would be coordinated with the manufacturer. Owners Representative shall inventory rolls received on-site to verify manufacturing and conformance sampling.~~

Samples will be taken across the entire width of the roll, and will not include the first three (3) linear feet. Unless otherwise specified, samples will be three (3) feet long, along the roll width. Owners Representative will mark the machine direction on the samples with an arrow.

3.3.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

- If the average test values for the sample meet all of the property values given in the design specifications, and the manufacturer's guaranteed minimum values, the sample passes.
- If the average test value for the sample does not meet one (1) or more of the required values, additional evaluation procedures will be implemented by the Owners Representative. Additional tests required for further evaluation shall be done at no expense to the Owner.

  - For the failing parameter(s), perform two (2) additional tests on the sample. These tests may be performed by another Geosynthetics CQC Laboratory at the discretion of the Owners Representative and the Owner.
  - If the average test values for each of the two (2) additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.

  - If one (1) or more of the average test values do not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll, and test for failed parameter(s). If one (1) or either of these tests do not meet requirements, the roll(s) will be rejected and the Owners Representative shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

3.3.5 Handling and Placement

The GMX shall be handled and placed in accordance with the manufacture's recommendations and guidelines as detailed in the "GSE Geomembranes Installation Quality Assurance Manual" included as Appendix A of this CQC Plan, or the most current version of the document as available from the manufacturer of the GMX. The Contractors shall be responsible for all sample collection and testing detailed in the "GSE Geomembranes Installation Quality Assurance Manual".

The Contractor shall handle rolls in such a manner as to minimize damage, and shall comply with the following:

- After the wrapping has been removed, a GMX shall not be exposed to sunlight for more than one (1) hour, or more than the time specified by the GMX manufacturer.
- On slopes, the GMX shall be securely anchored, and then rolled down the slope in such a manner as to continually keep the GMX panel in tension.
- In the presence of wind, GMX shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlaying material. Sandbags

shall be filled with fine grained material, and placed with care to prevent damage to the GMX.

- GMX shall be kept continually under tension to minimize the presence of wrinkles.
- GMX shall be cut using an approved geomembrane cutter only. If in-place, special care must be taken to protect other materials from damage that could be caused by the cutting of the GMX.
- During placement of the GMX, care shall be taken not to entrap stone, excessive dust, or moisture that could damage the GMX, generate clogging of drains or filters, or hamper subsequent seaming.
- After installation, the entire surface of the GMX shall be examined, and any foreign objects shall be removed.
- Equipment used for placing the GMX on the GCL shall be in accordance with the requirements of Section 3.2.8 of this CQC Plan.

The Owners Representative shall note any deviation and report it to the Owner.

3.3.6 Seams and Overlap

Field seaming and overlap shall be as described in the "GSE Geomembranes Installation Quality Assurance Manual" as Appendix A of this CQC Plan, or the most current version of the document as available from the manufacturer of the GMX. The Contractors shall be responsible for all sample collection and testing detailed in the "GSE Geomembranes Installation Quality Assurance Manual". The Owners Representative shall witness and record installation equipment testing and seaming CQC procedures.

3.3.7 Repair

Repair to damaged areas shall be as described in the "GSE Geomembranes Installation Quality Assurance Manual" as Appendix A of this CQC Plan, or the most current version of the document as available from the manufacturer of the GMX. The Contractors shall be responsible for all sample collection and testing detailed in the "GSE Geomembranes Installation Quality Assurance Manual". The Owners Representative shall observe any repair, note any deviation with the above requirements, and report them to the Owner.

3.3.8 Placement of Materials on geomembranes

The Contractors shall place materials on or against the GMX in the following manner:

- Cause no damage to the GMX.
- Allow minimal slippage of the GMX on underlying layers.
- Equipment used for placing the overlying material on the GMX shall conform to the following maximum ground pressure limitations:

Max Equipment Ground Pressure (psi)	Thickness of Material above GMX (inches)
Equipment not permitted	< 12
<5	12 - 18
5 – 10	18 - 24
>10	> 24

3.4 Nonwoven Geotextile

Geotextile material shall be installed as a protective layer above the Textured Geomembrane Liner.

3.4.1 Material Requirements

The geotextile shall be nonwoven, needle-punched, polypropylene fabric similar to NW32 as manufactured by GSE Lining Technologies, Inc. or approved equal. The geotextile fabric shall be inert to biological degradation, and naturally encountered chemicals, alkalis, and acids. Table 3.5 presents the minimum material properties, test methods, and test frequencies.

TABLE 3.5

Material Properties, Test Methods, and Frequency of Testing for Nonwoven Geotextile

PROPERTY	TEST METHOD	TESTING FREQUENCY (minimum)	REQUIRED VALUE (minimum)
Mass per Unit Area, oz/yd2 (gm/m2)	ASTM D 5261	1 every 90,000 ft^2	32 (1,080)
Grab Tensile Strength, lb (N)	ASTM D 4632	1 every 90,000 ft^2	600 (2,640)
Grab Elongation, %	ASTM D 4632	1 every 90,000 ft^2	50
Puncture Strength, lb (N)	ASTM D 4833	1 every 90,000 ft^2	350 (1540)
Trapezoidal Tear Strength, lb (N)	ASTM D 4533	1 every 90,000 ft^2	270 (1,190)
UV Resistance (% retained after 500 hours)	ASTM D 4355	not applicable	70

Note: The property values listed are in the weaker principal direction. All values listed are Minimum Average Roll Values (MARV) except UV resistance which is a minimum value.

3.4.2 Manufacturer's Documentation

3.4.2.1 Qualifications

The geotextile manufacturer shall be a specialist in the manufacture of geotextile fabric, and shall have produced a minimum of five million (5,000,000) square feet during the previous five (5) years.

3.4.2.2 Certification of Property Values

Prior to the delivery of the geotextile materials to the site, the geotextile manufacturer shall provide the Owners Representative with the following information:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in the QA/QC Plan.
- A certification that the property values given in the properties sheet are "minimum average roll values," and are guaranteed by the geotextile manufacturer.

The Owners Representative shall verify that:

- The property values certified by the geotextile manufacturer meet the design specifications.
- The measurements of properties by the geotextile manufacturer are properly documented, and that the test methods used are acceptable.

3.4.2.3 Quality Control Certificates

The geotextile manufacturer shall provide the Owners Representative with a quality control certificate. The certificate shall be signed by a responsible person employed by the geotextile manufacturer. The geotextiles shall not be delivered to the site until the certification has been provided by the manufacturer. The quality control certificate shall include:

- Lot/roll numbers and identification.
- Sampling procedures, and results of quality control tests.

3.4.2.4 Labeling

The geotextile manufacturer shall identify all rolls of geotextile with a weatherproof label that contains the following:

- Manufacturer's name
- Product identification
- Lot number
- Roll number
- Roll weight
- Roll dimensions

In addition, if any special handling of the geotextile is required, it shall be so marked on the top surface of the geotextile. Rolls without proper identification shall be rejected by the Owners Representative. The Owners Representative shall examine rolls upon delivery, and any deviation from the above requirements shall be reported to the Owner.

3.4.3 Shipment and Storage

Superseded by Addendum 1

~~During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow or other inundation, mud, dirt, dust, puncture,~~

Superseded by Addendum 1

~~cutting, or any other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls shall not be exposed to precipitation prior to being installed. During cold weather, geotextiles must be protected from freezing.~~

The Owners Representative shall observe rolls upon delivery and prior to installation. Any deviation from the above requirements shall be reported to the Owner. Any damaged rolls shall be rejected and replaced at no cost to the Owner.

Superseded by Addendum 1

3.4.4 Conformance Testing of Geotextile

~~Prior to the deployment of the rolls of geotextile, the Owners Representative shall remove and forward samples to the Geosynthetics CQA Laboratory for testing to verify conformance with the fabric property values.~~

3.4.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the Owners Representative, rolls shall be selected for sampling according to the frequencies presented on Table 3.5. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met, and that each different lot or manufacturing run is represented by at least one (1) sample. If a roll is not identifiable by roll number, the Owners Representative shall inform the Owner immediately. If the roll cannot be tracked, the Owner shall reject the roll.

Samples will be taken across the entire width of the roll, and will not include the first three (3) linear feet. Unless otherwise specified, samples will be three (3) feet long, along the roll width. The Owners Representative will mark the machine direction on the samples with an arrow.

3.4.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

- If the average test values for the sample meet all of the fabric property values given in the design specifications, and the manufacturer's guaranteed minimum values, the sample passes.
- If the average test value for the sample does not meet one (1) or more of the required values, additional evaluation procedures will be implemented by the Owners Representative. Additional tests required for further evaluation shall be done at no expense to the Owner.
- For the failing parameter(s), perform two (2) additional tests on the sample. These tests may be performed by another Geosynthetics CQA Laboratory at the discretion of the Owners Representative, and the Owner.

- If the average test values for each of the two (2) additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.

If one (1) or more of the average test values do not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll, and test for failed parameter(s). If one (1) or both of these tests do not meet requirements, the roll(s) will be rejected and the Owners Representative shall determine further testing protocol, and criteria for identifying the limits of rejected rolls.

3.4.5 Handling and Placement

The Contractor shall handle geotextiles in such a manner as to minimize damage, and shall comply with the following:

- Wrapping for the geotextile shall remain in-place until immediately prior to installation of the materials.
- On slopes, the geotextiles shall be securely anchored, and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension.
- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement, and shall remain until replaced with the appropriate overlying material.
- Sandbags shall be filed with fine grained material, and must be handled with care to prevent rupture.
- Geotextiles shall be kept continually under tension to minimize the presence of wrinkles in the geotextile.
- Geotextiles shall be cut using an approved geotextile cutter only. If in-place, special care must be taken to protect other materials from damage that could be caused by the cutting of the geotextiles.
- During placement of the geotextile, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming.
- After installation, the entire surface of the geotextile shall be examined, and harmful foreign objects, such as needles, shall be removed.
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The Owners Representative shall note any deviation, and report it to the Owner.

3.4.6 Seams and Overlaps

Superseded by Addendum 1

~~Geotextiles shall be continuously sewn using thread, which is as chemically and UV resistant as the geotextile. Thread shall be approved by the Owners Representative. Spot sewing is not permitted, except for repairs, and thermal bonding shall not be permitted without written approval of the Owners Representative.~~ Geotextiles shall be overlapped a minimum of six (6) inches prior to seaming. No horizontal seams shall be on side slopes steeper than twenty

(20) percent, except as part of a patch, without approval of the Owners Representative.

The Owners Representative shall note any deviation, and report it to the Owner.

3.4.7 Repair

Modified by Addendum 1

Any holes or tears in the geotextile shall be repaired by the Contractor as follows:

- On slopes steeper than twenty (20) percent: A patch made from the same geotextile shall be sewn into place no closer than two (2) inches from any edge. Should any horizontal tear exceed ten (10) percent of the width of the roll, that roll shall be removed from the slope and replaced.
- On slopes less than or equal to twenty (20) percent: A patch made from the same geotextile shall be sewn in place with a minimum of twenty-four (24) inches overlap in all directions.

Care shall be taken to remove any soil or other material that may have penetrated the torn geotextile. The Owners Representative shall observe any repair, note any deviation with the above requirements, and report them to the Owner.

3.4.8 Placement of Material on Geotextiles

The Contractor shall place materials on or against the geotextile filter fabric in the following manner:

- Cause no damage to the geotextile.
- Allow minimal slippage of the geotextile on underlying layers.
- Equipment used for placing the overlying material shall not be driven directly on the geotextile.

4.0 LEACHATE COLLECTION SYSTEM

4.1 Introduction

This section addresses the material components and construction standards associated with the leachate collection system. The system will include: 8-inch diameter perforated HDPE leachate laterals, 12-inch diameter perforated HDPE collector pipes; and, 12-inch diameter non-perforated HDPE outlet pipes.

4.2 Piping System

Superseded by Addendum 1

4.2.1 Material Requirements

The pipe and associated fittings and joints shall meet material acceptance, and construction quality requirements as stated in this section of the CQC Plan. The pipe, fittings, and joints shall be provided by manufacturers familiar with the design intent of the leachate collection system. The quality of all materials, process of manufacturer, and the finished products, shall be subject to the inspection and approval of the Owners Representative, and the Owner.

4.2.1.1 Pipe

PE pipe shall consist of Advance Drainage Systems, HDPE N-12, and shall be double wall, corrugated, perforated pipe, or equal. PE pipe shall comply with the following standards:

- ASTM F 405 F477
- ASTM AASHTO M252, ASTM D 3212

The raw material shall contain a minimum of two (2) percent carbon black that is well dispersed throughout the pipe material. The piping system shall contain no recycled compound except that generated in the manufacturer's own plant, and from resin of the same specification from the same raw material supplier.

4.2.1.2 Fittings

Pipe fittings shall be furnished by the manufacturer of the pipe with which they are used, and shall conform to the requirements of ASTM D 3212 for standard fittings.

4.2.1.3 Joints

PE Pipe joints shall be made using either bell and socket pipe or couplings using only manufacturer approved methods, and equipment.

4.2.2 Manufacturer's Documentation

Pipe manufacturers shall submit documentation which demonstrates that the property values of the pipe, fittings, joints, and manholes meet the design specifications, and that quality control measures are taken during manufacturing.

4.2.2.1 Qualifications

Superseded by Addendum 1

The pipe, fittings and joints shall be provided by manufacturers who are specialists in the manufacture of piping systems. Each manufacturer shall have a minimum of five (5) years of experience, and shall show evidence of at least five (5) satisfactory installations for similar application.

4.2.2.2 Certification of Property Values

Prior to the installation of the leachate collection system piping, the manufacturers shall provide the Owners Representative the following information:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in the CQC Plan.
- A list of quantities and descriptions of materials other than the base resin which comprise the piping system.
- A certification that property values given in the properties sheet are minimum values, and are guaranteed by the pipe manufacturer.

The Owners Representative shall verify that:

- The property values certified by the piping system manufacturer meet the design specifications.
- The measurements of properties by the piping system manufacturer are properly documented, and that the test methods used are acceptable.

4.2.2.3 Quality Control Certificates

The piping system manufacturer shall provide the Owners Representative with a quality control certificate for each lot/batch of pipe provided. The quality control certificate shall be signed by a responsible party employed by the piping system manufacturer, such as the Production Manager. The quality control certificate shall include:

- Lot/batch numbers and identification.
- Sampling procedures and results of quality control tests.

The Owners Representative shall:

- Verify that the quality control certificates have been provided at the specified frequency for all lots/batches of piping material, and that each certificate identifies the pipe lot/batch related to it.
- Review the quality control certificates, and verify that the certified properties meet the design specifications.

Any deviation shall be noted by the Owners Representative and reported to the Owner.

4.2.2.4 Labeling

The PE piping shall be stamped, marked, or identified by the Manufacturer at the spaced interval of not more than 10 feet with the following information:

Superseded by Addendum 1

- Manufacturer's name.
- Date and place of manufacturer.
- Nominal pipe size.
- Manufacturing standard reference, e.g., ASTM F 714085.

4.2.3 Shipment and Storage

During shipment and storage, the interior of the piping components shall be protected from dirt and foreign matter, and the materials shall be protected from mud, dirt, dust, punctures, cutting, or any other damaging or deleterious conditions. The materials shall be stored on heavy wood blocking or platforms off the ground.

The Owners Representative shall observe the materials upon delivery and prior to installation. Any materials that are cracked, gouged, chipped, dented, or otherwise damaged will not be approved by the Owners Representative, shall be removed from the site, and replaced by the Contractor at no cost to the Owner. The Owners Representative shall note any deviation from the above requirements and shall report deviations to the Owner.

4.2.4 Joining Process

Pipes, fittings, and joints shall be joined by the Contractor using the procedures outlined below, unless otherwise specified.

4.2.4.1 Preparation

Delivered piping system materials shall be examined by the Contractor who will verify that the materials are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to joining, the Contractor shall verify that the joining surface area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

Any deviation shall be noted by the Owners Representative and reported to the Owner.

4.2.4.2 Weather Conditions

Bell joints, couplings, and fittings shall be connected in accordance with weather constraints specified by the manufacturer.

4.2.4.3 General Procedures

The Owners Representative shall verify that the manufacturer's joining procedures have been followed by the Contractor and are generally consistent with ASTM D 2321. Any deviation shall be noted by the Owners Representative and reported to the Owner.

4.2.5 Handling and Placement

The contractor shall handle and place piping materials in such a manner as to minimize damage, and shall comply with the following:

Superseded by Addendum 1

Install piping to the lines and grades shown in the Approved Permit or design plans, sloping piping uniformly between elevations shown.

Install piping as per the manufacturer's instructions.

Inspect interior of all pipe and fittings, and completely clean all dirt, gravel, sand, debris, or other foreign material from the pipe interior before it is placed.

4.3 Aggregate

Aggregate material shall be installed as part of the leachate system. The purpose for this material is to provide bedding and cover for the pipe.

The aggregate material shall meet requirements related to material characteristics, and construction quality. Laboratory test shall be performed prior to the installation of the material to evaluate whether the installed material meets the requirements of the approved permit and construction documents with regard to material acceptance and construction quality.

4.3.1 Material Requirements

Superseded by Addendum 1

The aggregate material will be a well graded, clean rock obtained from a source included on the Kentucky Transportation Cabinet (KYTC) Aggregate Source List and shall be free from fines, frozen material, and deleterious substances.

The aggregate material shall be consistent with the requirements for KYTC Section 805 for Gradation Size No. 57.

4.3.2 Sampling and Testing Procedures

If aggregate material is obtained from a source included on the KYTC Aggregate Source List, sampling and testing of the aggregate described herein will not be required. If aggregate is obtained from a source not included on the KYTC Aggregate Source List, the sampling and testing described below and in Sections 4.3.2.1 and 4.3.2.2 shall be required.

Before the aggregate material is delivered to the site, the material will be pre-qualified to verify that it meets the material specifications, which are described in Section 4.3.1.

Representative aggregate samples will be collected from on-site stockpiles at a rate of at least one (1) sample per every three-thousand (3,000) cubic yards of material that will be used in the construction. Each sample will be tested in the Soils CQC Laboratory to determine the following soil properties:

- Grain size distribution in accordance with ASTM D-422 for the sieve method.
- Recompacted permeability in accordance with ASTM D 2434.

In addition to the above laboratory testing, the Contractor shall submit a sample of the proposed aggregate material to the Owners Representative for review. The Contractor shall also identify the proposed source for the aggregate material.

4.3.2.1 Test Results

The results of the pre-qualification testing shall be evaluated in accordance with the following procedure:

If the test values for each sample meet or exceed the material requirements identified in Section 4.3.1 of this CQC Plan, the sample passes.

If the test values for each sample do not meet the material requirements in Section 4.3.1, additional evaluation procedures will be implemented by the Owners Representative. Additional tests required for further evaluation shall be completed at the expense of the Contractor.

- For the failing parameter(s), perform one (1) additional test on the sample. These tests may be performed by another Soils CQC Laboratory at the discretion of the Owners Representative, and the Owner.

- If the retest values for the additional test meet or exceed the material requirements, the sample passes.

- If the retest values for the additional test do not meet or exceed the material requirements, two (2) new samples will be collected from the stockpile and tested for the failing parameter(s). If both samples meet or exceed the material requirements, the samples pass and the material is approved.

- If one (1) or both of the samples fail for one (1) or more of the material requirements, the Owners Representative will direct the Contractor to identify a new source for the material, or to propose an aggregate source having a different grade.

4.3.2.2 Test Reports

The soils CQC Laboratory shall report the results of all testing to the Owners Representative. The Owners Representative shall review the results, verify the suitability of the material for use in the construction, and submit the results to the Owner.

4.3.3 Construction

The Owners Representative shall visually observe the placement of the aggregate material. At the discretion of the Owners Representative or the Owner, additional samples may be collected during placement to verify that the material meets the material requirements in Section 4.3.1 of this CQC Plan. The test results from any such samples will be collected, analyzed, and the results reported as described in Section 4.3.2.1.

4.4 Drainage Layer

The drainage layer shall be a 24-inch deep drainage media placed over the top of the geocomposite liner system. The drainage layer material will be coarse pond ash generated from coal combustion at the East Bend Generating Station or other suitable material provided by the Contractor.

4.4.1 Material Requirements

Superseded by Addendum 1

~~The pond ash, drainage layer material shall be bottom ash free of other inorganic fines that may be entrained in the excavated pond ash. If off-site material is used, the material shall be consistent with the requirements of KYTC Section 804.09 Underdrains, Embankment drainage Blanket, and Natural Sand for Drainage Blanket.~~

Drainage layer material shall have a minimum permeability of 1×10^{-3} cm/sec.

4.4.2 Handling and Placement

The drainage layer material stockpiled for use as a drainage layer shall be stockpiled in a location and in a manner to preclude the intrusion or contamination from foreign materials. The bottom ash should be pushed onto and spread across the geocomposite liner system using equipment having ground pressures consistent with the requirements described in Section 3.3.8. Particular care should be taken in the placement of bottom ash near the leachate pipe to preclude damage to the pipe.

4.4.3 Testing

The Owners Representative shall collect representative aggregate samples from on-site stockpiles at a rate of at least one (1) sample per every five-thousand (5,000) cubic yards of material that will be used in the construction. Each sample will be tested in the Soils CQC Laboratory to determine the bottom ash permeability in accordance with ASTM D-2434.

4.4.3.1 Test Reports

Refer to Section 4.3.2.2.

4.5 Contingency Plan for Unanticipated Construction Difficulties

During the construction of the various components of the leachate collection system, unanticipated construction difficulties can occur. In general, some of the reasons for unanticipated construction difficulties are as follows:

Weather: Inclement weather includes continuous rainfall, freezing conditions, or other weather conditions which prevent the appropriate installation of materials. The components of the leachate collection system will not be installed during inclement weather.

Interruption of transport or shipping.

Equipment break-down or lack of specialized equipment.

Material failing CQC testing.

4.5.1 Notification

The Owners Representative shall notify the Contractor immediately upon discovering a defect in the workmanship. After determining the extent and nature of the defect, the Owners Representative will immediately notify the Owner who shall in turn notify the Permitting Agency if continued construction difficulties are encountered. This notification will include identifying the proposed solution to the construction difficulty.

4.5.2 Repairs and Retesting

The Contractor shall correct the deficiency to the satisfaction of the Owners Representative, Owner, and the Permitting Agency. If a design criterion cannot be met, or unusual weather conditions hinder the work, then the Owners Representative shall develop and present to the Owner, a suggested solution for approval.

5.0 FINAL CAP SYSTEM

5.1 Introduction

This section addresses the material components and construction standards associated with the final cap system. The final cap system shall include the following components:

1) PVC Geomembrane;
2) Geocomposite Drainage Layer;
3) Piping System;
4) Aggregate;
5) Soil Cover; and,
6) Vegetatative Cover.

5.2 PVC Geomembrane

A PVC geomembrane is to be placed directly on the waste material where waste has reached final grades.

5.2.1 Materials Requirements

The PVC geomembrane shall be 30 mil as manufactured by Watersaver Company, Inc or approved equal. The geomembrane shall meet or exceed the material characteristics and quality per Table 5.1.

Table 5.1
PVC Geomembrane Property Requirements

PROPERTY	TEST METHOD	UNIT	REQUIRED VALUE
Thickness	ASTM D 5199	mil	30 +/- 1.5
Tensile Properties	ASTM D 822 min		
Strength at Break		lb/in	73
Elongation		%	380
Modulus @ 100%		lb/in	32
Tear Strength	ASTM D 1004 min	lbs	8
Dimensional Stability	ASTM D 1204 Max Chg	%	3
Low Temperature Impact	ASTM D 1970 Pass	Degrees F	-20
Specific Gravity	ASTM D 792 Typical	g/cc	1.2
Water Extraction % loss (max)	ASTM D 1239 Max Loss	%	0.15
Average Plasticizer Molecular Weight	ASTM D 2124		400
Volatility Loss	ASTM D 1203 Max Loss	%	0.7
Soil Burial	G160 Max Chg		
Break Strength		%	5
Elongation		%	20
Modulus at 100%		%	20
Hydrostatic Resistance	ASTM D 751 min	psi	100
Seam Strengths	ASTM D 822 min		

Shear		lbs/in	58.4
Peel		lbs/in	15

5.2.2 Manufacturer's Documentation

5.2.2.1 Qualifications

The PVC Geomembrane manufacturer shall be a specialist in the manufacture of geomembranes, and shall have produced a minimum of five million (5,000,000) square feet during the previous five (5) years.

5.2.2.2 Certification of Property Values

Prior to the delivery of the PVC Geomembrane materials to the site, the manufacturer shall provide the Owners Representative with the following information:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in Tables 5.1 and 5.2.
- A certification that the property values given in the properties sheet are "minimum average roll values" and are guaranteed by the manufacturer.

The Owners Representative shall verify that:

- The property values certified by the PVC Geomembrane manufacturer meet the design specifications.
- The measurements of properties by the PVC Geomembrane manufacturer are properly documented, and that the test methods used are acceptable.

5.2.2.3 Quality Control Certificates

The PVC Geomembrane manufacturer shall provide the Owners Representative with a quality control certificate. The certificate shall be signed by a responsible party employed by the manufacturer. The PVC Geomembrane shall not be delivered to the site until the certification has been provided by the manufacturer. The quality control certificate shall include:

- Lot/roll number and identification
- Sampling procedures and results of quality control tests

Any deviation shall be noted by the Owners Representative, and reported to the Owner.

5.2.2.4 Labeling

The PVC Geomembrane manufacturer shall identify all rolls using a weatherproof label that contains the following:

- Manufacturer's name.
- Product identification.

- Lot Number.
- Roll Number.
- Roll Weight.
- Roll Dimensions.

In addition, if any special handling of the PVC Geomembrane is required, it shall be so marked on the top surface of the geomembrane. Rolls without proper identification shall be rejected by the Owners Representative. The Owners Representative shall examine rolls upon delivery, and any deviation from the above requirements shall be reported to the Owner.

5.2.3 Shipment and Storage

During shipment and storage, the PVC Geomembrane shall be protected from exposure to ultra-violet light, precipitation, snow or other inundation such as; mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geomembrane rolls shall be wrapped in plastic sheets or otherwise protected. Wrapping shall remain on the PVC Geomembrane rolls until immediately prior to roll deployment. Geomembrane shall not be exposed to precipitation prior to being installed. During cold weather, geomembrane materials must be protected from freezing.

The Owners Representative shall observe rolls upon delivery and prior to installation. Any deviation from the above requirements shall be reported to the Owner. Any damaged rolls shall be rejected and replaced at no cost to the Owner.

Table 5.2
Quality Control Testing Frequency for the PVC Geomembrane

PROPERTY	TEST METHOD	MANUFACTURER TESTING FREQUENCY (MINIMUM)	OWNERS REPRESENTATIVE TESTING FREQUENCY (MINIMUM)
Thickness	ASTM D 5199	1 every 60,000 ft^2	1 every 100,000 ft^2
Tensile Properties	ASTM D 822 min		
Strength at Break		1 every 60,000 ft^2	1 every 100,000 ft^2
Elongation		1 every 60,000 ft^2	1 every 100,000 ft^2
Modulus @ 100%		1 every 60,000 ft^2	1 every 100,000 ft^2
Tear Strength	ASTM D 1004 min	1 every 60,000 ft^2	1 every 500,000 ft^2
Dimensional Stability	ASTM D 1204 Max Chg	1 every 60,000 ft^2	n/a
Low Temperature Impact	ASTM D 1970 Pass	1 every 60,000 ft^2	n/a
Specific Gravity	ASTM D 792 Typical	1 every 60,000 ft^2	1 every 100,000 ft^2
Water Extraction % loss (max)	ASTM D 1239 Max Loss	1 every 60,000 ft^2	n/a
Average Plasticizer Molecular Weight	ASTM D 2124	1 per each lot delivery	n/a

Volatility Loss	ASTM D 1203 Max Loss	1 every 60,000 ft^2	n/a
Soil Burial Break Strength Elongation Modulus at 100%	G160 Max Chg	 Annually Annually Annually	 n/a n/a n/a
Hydrostatic Resistance	ASTM D 751 min	Annually	n/a
Seam Strengths Shear peel	ASTM D 822 min	 Start and end of each shift	 n/a (1) n/a (1)

Notes: (1) conformance testing of manufacturers seams not require, Contractor destructive and non-destructive testing of field seams shall be in accordance with Manufacturers recommendations (see installation guidelines in Appendix C).

5.2.4 Conformance Testing of PVC Geomembrane

Prior to the deployment of the rolls of PVC Geomembrane, the Owners Representative shall remove and forward samples to the Geosynthetics CQC Laboratory for testing to verify conformance with the property values.

5.2.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the Owners Representative, rolls shall be selected for sampling at a minimum frequency of as shown in Table 5.2. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met, and that each different lot or manufacturing run is represented by at least one (1) sample. If a roll is not identifiable by roll number, the Owners Representative shall inform the Owner immediately. If the roll cannot be tracked, the Owner shall reject the roll.

The Owners Representative may arrange for in-plant conformance sampling of the PVC Geomembrane by the Geosynthetics CQC Laboratory. In-plant sampling would be coordinated with the manufacturer. Owners Representative shall inventory rolls received on-site to verify manufacturing and conformance sampling.

Samples will be taken across the entire width of the roll, and will not include the first three (3) linear feet. Unless otherwise specified, samples will be three (3) feet long, along the roll width. Owners Representative will mark the machine direction on the samples with an arrow.

5.2.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

- If the average test values for the sample meet all of the property values given in the design specifications, and the manufacturer's guaranteed minimum values, the sample passes.

- If the average test value for the sample does not meet one (1) or more of the required values, additional evaluation procedures will be implemented by the Owners Representative. Additional tests required for further evaluation shall be done at no expense to the Owner.

  - For the failing parameter(s), perform two (2) additional tests on the sample. These tests may be performed by another Geosynthetics CQC Laboratory at the discretion of the Owners Representative and the Owner.
  - If the average test values for each of the two (2) additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
  - If one (1) or more of the average test values do not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll, and test for failed parameter(s). If one (1) or either of these tests do not meet requirements, the roll(s) will be rejected and the Owners Representative shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.2.5 Handling and Placement

The PVC Geomembrane shall be handled and placed in accordance with the manufacture's recommendations and guidelines as detailed in the "Watersaver, Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes" included as Appendix C of this CQC Plan, or the most current version of the document as available from the manufacturer of the PVC Geomembrane. The Contractors shall be responsible for all sample collection and testing detailed in the "Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes."

The Contractor shall handle rolls in such a manner as to minimize damage, and shall comply with the following:

- After the wrapping has been removed, the PVC Geomembrane shall not be exposed to sunlight for more than one (1) hour, or more than the time specified by the manufacturer.
- The PVC Geomembrane shall be securely anchored, and then rolled down the slope in such a manner as to continually keep the panel in tension.
- In the presence of wind, the geomembrane shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlaying material. Sandbags shall be filled with fine grained material, and placed with care to prevent damage to the geomembrane.
- The PVC Geomembrane shall be kept continually under tension to minimize the presence of wrinkles.
- Cut shall be completed using an approved geomembrane cutter only.

- During placement of the PVC Geomembrane, care shall be taken not to entrap stone, excessive dust, or moisture that could damage the geomembrane or hamper subsequent seaming.
- After installation, the entire surface of the PVC Geomembrane shall be examined, and any foreign objects shall be removed.
- Equipment used to place the PVC Geomembrane shall be such as to cause no damage to the geomembrane and allow for minimal slippage of the geomembrane on the underlying waste.

The Owners Representative shall note any deviation and report it to the Owner.

5.2.6 Seams and Overlap

Field seaming and overlap shall be as described in the "Watersaver, Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes" included as Appendix C of this CQC Plan, or the most current version of the document as available from the manufacturer of the PVC Geomembrane. The Contractors shall be responsible for all sample collection and testing detailed in the "Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes." The Owners Representative shall witness and record installation equipment testing and seaming CQC procedures.

5.2.7 Repair

Repair to damaged areas shall be as described in the ""Watersaver, Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes" included as Appendix C of this CQC Plan, or the most current version of the document as available from the manufacturer of the PVC Geomembrane. The Contractors shall be responsible for all sample collection and testing detailed in the "Quality Standards for Manufacture, Pre-Assembly, and Installation of Geomembranes." The Owners Representative shall observe any repair, note any deviation with the above requirements, and report them to the Owner.

5.2.8 Placement of Materials on the PVC Geomembrane

The Contractors shall place materials on or against the PVC Geomembrane in the following manner:

- Cause no damage to the geomembrane.
- Allow minimal slippage of the geomembrane on the underlying waste.
- Equipment used for placing the overlying material on the Geomembrane shall conform to the following maximum ground pressure limitations:

Max Equipment Ground Pressure (psi)	Thickness of Material above Geomembrane (inches)
Equipment not permitted	< 12
<5	12 - 18
5 – 10	18 - 24
>10	> 24

5.3 Geocompopsite Drainage Layer

A geocomposite drainage layer shall be installed directly above the PVC geomembrane in areas where the final grade of the landfill cap is less than 15%.

5.3.1 Material Requirements

The geocomposite drainage layer shall consist of a trip-axial geonet with nonwoven geotextile fabric bonded to both sides of the geonet. The geocomposite shall be Tendrain 370-2 as manufactured by Tenax Corporation or approved equal. Table 5.3 presents the minimum material properties, test methods, and manufacturer required test frequencies.

TABLE 5.3

Material Properties, Test Methods, and Manufacturer Frequency of Testing for Geocomposite Drainage Layer

PROPERTY	TEST METHOD	TESTING FREQUENCY (minimum)	REQUIRED VALUE (minimum average roll)
Geocomposite			
Transmissivity, m^2/sec	ASTM D 4716	1 every 200,000 ft^2	0.0028
Ply Adhesion, lb/in	ASTM D 7005	1 every 100,000 ft^2	1.0
Geonet Core (prior to lamination with Geotextile)			
Thickness, mil	ASTM D 5199	1 every 50,000 ft^2	250
Tensile Strength (MD), lb/ft	ASTM D 5035	1 every 50,000 ft^2	625
Carbon Black Content, %	ASTM D 1603	1 every 50,000 ft^2	2.0
Geotextile (prior to lamination with Geonet)			
Grab Tensile Strength, lb	ASTM D 4632	1 every 100,000 ft^2	160
Grab Elongation, %	ASTM D 4632	1 every 100,000 ft^2	50
Tear Strength, lb	ASTM D 4632	1 every 100,000 ft^2	60
Puncture Strength, lb	ASTM D 4833	1 every 100,000 ft^2	85
AOS, US Sieve, mm	ASTM D 4751	1 every 500,000 ft^2	70
Permittivity, sec^{-1}	ASTM D 4791	1 every 500,000 ft^2	1.1
Flow Rate, gpm/ft^2	ASTM D 4491	1 every 540,000 ft^2	85
UV Resistance, % after 500 hours	ASTM D 4355	1 per formulation	70

Note: Transmissivity at gradient of 0.1, normal load of 1,000 psf.

5.3.2 Manufacturer's Documentation

5.3.2.1 Qualifications

The geocomposite manufacturer shall be a specialist in the manufacture of geocomposites, and shall have produced a minimum of five million (5,000,000) square feet during the previous five (5) years.

5.3.2.2 Certification of Property Values

Prior to the delivery of the geocomposite materials to the site, the geocomposite manufacturer shall provide the Owners Representative with the following information:

- A properties sheet including, at a minimum, all specified properties measured using test methods indicated in the QA/QC Plan.
- A certification that the property values given in the properties sheet are "minimum average roll values," and are guaranteed by the geocomposite manufacturer.

The Owners Representative shall verify that:

- The property values certified by the geocomposite manufacturer meet the design specifications.
- The measurements of properties by the geocomposite manufacturer are properly documented, and that the test methods used are acceptable.

5.3.2.3 Quality Control Certificates

The geocomposite manufacturer shall provide the Owners Representative with a quality control certificate. The certificate shall be signed by a responsible person employed by the geocomposite manufacturer. The geocomposites shall not be delivered to the site until the certification has been provided by the manufacturer. The quality control certificate shall include:

- Lot/roll numbers and identification.
- Sampling procedures, and results of quality control tests.

5.3.2.4 Labeling

The geocomposite manufacturer shall identify all rolls of geocomposite with a weatherproof label that contains the following:

- Manufacturer's name
- Product identification
- Lot number
- Roll number
- Roll weight
- Roll dimensions

In addition, if any special handling of the geocomposite is required, it shall be so marked on the top surface of the geocomposite. Rolls without proper identification shall be rejected by the Owners Representative. The Owners Representative shall examine rolls upon delivery, and any deviation from the above requirements shall be reported to the Owner.

5.3.3 Shipment and Storage

During shipment and storage, the geocomposite shall be protected from ultraviolet light exposure, precipitation, snow or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geocomposite rolls shall not be exposed to precipitation prior to being installed. During cold weather, geocomposites must be protected from freezing. The Owners Representative shall observe rolls upon delivery and prior to installation. Any deviation from the above requirements shall be reported to the Owner and materials shall be replaced at no cost to the Owner.

5.3.4 Conformance Testing

Prior to the deployment of the rolls of geocomposite, the Owners Representative shall remove and forward samples to the finished geocomposite material the Geosynthetics CQA Laboratory for testing to verify conformance with the minimum property values.

5.3.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the Owners Representative, rolls shall be selected for sampling according to the frequencies presented on Table 5.3. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met, and that each different lot or manufacturing run is represented by at least one (1) sample. If a roll is not identifiable by roll number, the Owners Representative shall inform the Owner immediately. If the roll cannot be tracked, the Owner shall reject the roll.

Samples will be taken across the entire width of the roll, and will not include the first three (3) linear feet. Unless otherwise specified, samples will be three (3) feet long, along the roll width. The Owners Representative will mark the machine direction on the samples with an arrow.

5.3.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

- If the average test values for the sample meet all of the property values given in the design specifications, and the manufacturer's guaranteed minimum values, the sample passes.

- If the average test value for the sample does not meet one (1) or more of the required values, additional evaluation procedures will be implemented by the Owners Representative. Additional tests required for further evaluation shall be done at no expense to the Owner.
- For the failing parameter(s), perform two (2) additional tests on the sample. These tests may be performed by another Geosynthetics CQA Laboratory at the discretion of the Owners Representative, and the Owner.
- If the average test values for each of the two (2) additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
- If one (1) or more of the average test values do not meet requirements, reject the roll, collect samples from the closest numerical roll on both sides of the failed roll, and test for failed parameter(s). If one (1) or both of these tests do no meet requirements, the roll(s) will be rejected and the Owners Representative shall determine further testing protocol, and criteria for identifying the limits of rejected rolls.

5.3.5 Handling and Placement

The Contractor shall handle geocomposite in such a manner as to minimize damage, and shall comply with the following:

- Wrapping for the geocomposites shall remain in-place until immediately prior to installation of the materials.
- On slopes, the geocomposites shall be rolled down the slope in such a manner as to continually keep the panels in tension.
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement, and shall remain until replaced with the appropriate overlying material.

The Owners Representative shall note any deviation, and report it to the Owner.

5.3.6 Seams and Overlaps

Each component of the geocomposite will be secured or seamed to the like component of adjacent panels.

- Lateral edges of the geonet along the length of the geocomposite roll shall be butted against the lateral edge of the adjacent geonet.
- The butt edges of the adjacent geonets shall be joined by use of cable ties spaced not more than every 5 feet along the roll length.
- Fabric shall be continuously sewn
- Adjoining geocomposite rolls ends shall be shingled, with the up-slope geonet overlapping the down-slope geonet a minimum of 12 inches across the roll width.
- Shingled geonets shall be cable tied on intervals not exceeding 6 inches.

The Owners Representative shall note any deviation, and report it to the Owner.

5.3.7 Repair

Prior to covering the deployed geocomposite, each roll shall be inspected for damage. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with Subsection 5.3.6.

5.3.8 Placement of Material on Geocomposite

The Contractor shall place materials on or against the geocomposite in the following manner:

- Cause no damage to the geocomposite.
- Allow minimal slippage of the geocomposite on underlying layers.
- Equipment used for placing the overlying material shall not be driven directly on the geocomposite.

5.4 Piping System

Construction quality control for the piping system to collect and discharge water from the geonet drainage layer for the final cap system shall be in accordance with the requirements of Section 4.2 of this Construction Quality Control Plan.

5.5 Aggregate

Construction quality control for the aggregate bedding for the piping system for the final cap system shall be in accordance with the requirements of Section 4.3 of this Construction Quality Control Plan.

5.6 Soil Cover

In areas of final cover, a 24-inch thick layer of soil is to be placed over the PVC to provide a growing medium and protection for the PVC Geomembrane.

5.6.1 Materials Requirements

Cover soils shall be of the following material:

- Soils with a maximum particle size of 3-inches. Topsoil mixed with in-organic soils is acceptable for use.
- The soil shall have a maximum clod size of four (4) inches or half the lift thickness, whichever is less.
- The soil shall be free of stones, debris, and other deleterious material.

5.6.2 Handling and Placement

The cover materials shall be stockpiled in a location and in a manner to preclude the intrusion or contamination from foreign materials. The material shall be pushed onto and spread across the PVC Geomembrane using equipment having ground pressures consistent with the requirements described in Section 5.2.8 of

this CQC Plan. Material shall be placed and spread so as to minimize compaction.

5.6.3 Construction Testing

Hand-dug test holes shall be completed by the Owners Representative at a density not less than 5 holes per acre to verify that the required minimum depth of placement has been achieved. The location of each test shall be recording using the permit drawing coordinate system (KY State Plain North, 1601, NAD 83).

5.7 Vegetative Cover

A vegetative cover shall be established on the soil cover to minimize erosion of the soil cover and reduce run-off velocities.

5.7.1 Materials Requirements and Application Rates

5.7.1.1 Seed

Superseded by Article 12.B.1

~~The following seed mix shall be sown at a minimum rate of 150 pounds per acre for the establishment of a vegetative cover:~~

~~2/3 KY 31 fescue; and,~~
~~1/3 winter wheat.~~

The varieties of grass seed to be furnished shall bear a tag on each bag showing species, lot number, grower's name, the percent of purity, the percent of germination, and the weed content. Tags shall be to the Owners Representative.

All seeds shall be free from noxious weeds and under no condition shall the total weed content of any lot of seed or seed mixture exceed one-half of one percent by weight.

No seed shall be utilized which has a mix date older than one year. The Owner reserves the right to test, reject, or approve any and all seed after delivery.

5.7.1.2 Fertilizer

Commercial grade 10-20-10 fertilizer shall be applied at a minimum rate of 500 pounds per acre.

5.7.1.3 Mulch

All mulch material shall be free from mature seedbearing stalks, roots, and noxious or prohibited weeds. Alfalfa, clover, and salt grass hay are not acceptable. Straw mulch shall include baled wheat, oats, or straw. It shall be dry and reasonably free of weeds, stalks, or other foreign material. Mulch shall be applied at a minimum rate of 2 tons per acre.

5.7.2 Handling and Placement

Establishment of a vegetative cover shall begin as soon as possible after the placement of soil cover materials.

Fertilizer shall be spread uniformly over all areas to be seeded and the areas then loosened by discing, harrowing, or other approved methods immediately prior to seeding. The soil shall be loosened to a depth of approximately three inches.

Seed shall be sown immediately following preparation of the area for seeding. Seed shall be sown by methods which provide for uniform distribution of the seed mix. After broadcasting or otherwise applying the seed, the surface of the seedbed shall be raked, culti-packed, or brush dragged very lightly. All raking shall be done in a direction parallel to contour lines.

Mulch shall be applied to the sown area within 24 hours of seeding and spread to a uniform depth. A mechanical blower may be used to apply mulch material, provided the machine has been specifically designed and approved for this purpose. Machines which cut mulch into short pieces shall not be permitted. Mulch shall be placed in a moist condition or shall be sprinkled immediately after placement.

5.7.3 Inspection and Repair

The Owners Representative shall inspect and document the vegetative cover between the period of 5 and 7 months after the sowing of seed and again between the period of 11 and 13 months after the sowing of seed. If during the second inspection any areas larger then 100 square feet having has less than 40% vegetative cover are identified, the areas shall be revegetated within 30 days of the completion of the inspection.

5.7.4 Maintenance

Areas where vegetative cover has been established shall be mowed 2 times per year. Mowing shall occur near the peak of the growing season (June) and at the end of the growing season (September or October). Trees, shrubs, or woody growth shall be cut down when the mowing is performed.

6.0 DOCUMENTATION AND CERTIFICATION

6.1 Introduction

An effective CQC Plan depends largely on recognition of all construction activities that should be monitored, and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality control activities. The Owners Representative shall document that quality control requirements have been addressed and satisfied. The Engineer shall conduct a final inspection on the completed facilities prior to the issuance of each Certification Report.

The Owners Representative shall provide the Owner with signed descriptive remarks, data sheets, and lots to verify that all monitoring activities have been carried out. The Owners Representative shall also maintain, at the job site, a complete file of design plans, design specifications, the CQC Plan, checklists, test procedures, daily logs, and other pertinent documents.

6.2 Daily Recordkeeping

Standard reporting procedures shall include preparation, by the Owners Representative, of a daily report which, at a minimum, shall consist of the following:

Daily summary report including memoranda of meetings and/or discussion with the Owner and/or Contractor(s).
Observation logs.
Test data sheets.

Other forms of daily recordkeeping to be used, as appropriate, include construction problem and solution data sheets, and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Owner.

6.2.1 Daily Summary Report

The Owners Representative shall prepare a Daily Summary Report which shall include the following information:

- An identifying sheet number for cross referencing and document control.
- Date, project name, location, and other identification.
- Weather conditions.
- Information on meetings held or discussions which took place:
  - Names of parties in discussions.
  - Relevant subject matter or issues.
  - Decisions reached.
  - Activities planned and their schedule.
- A reduced-scale site plan showing all proposed work areas and test locations.
- Descriptions and locations of ongoing construction.
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented.

- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found.
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets.
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets.
- Off-site materials received, including quality verification documentation.
- Decisions made regarding acceptance of units of work and/or corrective actions to be taken in instances of substandard quality.
- The Owners Representative's signature.

6.2.2 Observation Logs and Test Data Sheets

The Owners Representatives monitoring staff shall record observations of construction and CQC related activities on project specific logs and data sheets. At a minimum, the logs and data sheets shall include the following information:

- An identifying sheet number for cross referencing and document control.
- Date, project name, location, and other identification.
- Description or title of activity monitored.
- Location of activity and locations of samples collected.
- Locations of field tests performed and their results.
- Results of laboratory tests received.
- Results of monitoring activity in comparison to specifications.
- The Owners Representative's signature.

6.2.3 Construction Problem and Solution Report

Reports describing special construction situations, as required by the Owner, shall be prepared by the Owners Representative, and cross-referenced to specific observation logs and test data sheets. These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control.
- A detailed description of the situation or deficiency.
- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the corrective action taken to address the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signature of the Owners Representative.

The Owner shall be made aware of any significant recurring non-conformance with the design specification. The Owners Representative shall then determine the cause of the non-conformance and recommend appropriate changes in

procedure or specification to the Owner. These changes will be submitted to the Engineer for approval. When this type of evaluation is made, the results shall be documents, and any revision made to procedures, design specifications, or permit specifications will be approved by the Engineer, Owner, and if necessary, the Permitting Agency.

6.2.4 Photographic Reporting Data Sheets

Photographic reporting data sheets, where used, shall be cross-referenced with observation logs, and test data sheets and/or construction problem and solution reports. These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives (and/or digital files) shall be stored in a separate file in chronological order. These records will be presented to the Owner upon completion of the project.

6.2.5 Design and/or Specification Changes

Design and/or permit specification changes may be required during construction. In such cases, the Owners Representative shall notify the Owner. The Owner shall then notify the Permitting Agency, if necessary. Design and/or permit specification changes shall be made only with the written agreement of the Owner and the Engineer.

6.3 Reporting

The Owners Representative shall prepare periodic reports, which summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to document the status of the work. Certifications shall be prepared at the completion of major construction activities. At the completion of the work, final documentation shall be prepared and shall include a professional engineers seal and supporting field and laboratory test results.

6.3.1 Progress Reports

The Owners Representative shall prepare a Progress Report at time intervals established at the pre-construction meeting, and submit the report to the Owner. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control.
- The date, project name, location, and other information.
- A summary of work activities during progress reporting period.
- A summary of construction situation, deficiencies, and/or defects occurring during the progress reporting period.
- A summary of test results, failures, and retests.
- The signature of the Owners Representative's representative.

The Owners Representative shall distribute copies of the Progress Reports as decided upon at the pre-construction meeting.

6.3.2 Certification of Major Construction Activities

At the completion of each of the following major construction items included in the CQC Plan, the Owners Representative shall prepare a certification report for that item, including the following:

- Prepared Subgrade;
- Geocomposite Liner System;
- Leachate collection system and drainage layer; and,
- Final Cap System.

The certification shall describe activities associated with the construction of the item including construction procedures, and observations and tests performed by the CQC personnel. At a minimum, each certification report shall include:

- Summaries of all construction activities.
- Observation logs and test data sheets including sample location plans and supporting field and laboratory test results.
- Construction problems and solutions reports.
- Changes from design and material specifications.
- As-Built Drawings.
- The certification report shall be signed and sealed by a professional engineer registered in Kentucky.

The Certification Report shall include a certification which shall be signed by both the certifying engineer and the owner. The certification statement shall be as follows:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and believe, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of find and imprisonment for such violations."

The as-built drawings shall include scale plans depicting the location of the construction, and details pertaining to the extent of the construction (e.g., depths, plan dimension, elevation, soil component thicknesses, etc.). Surveying and base maps required for development of the as-built drawings shall be prepared by a qualified land surveyor. The drawings shall specifically identify significant deviations for the permit drawings and shall be prepared in the coordinate system used by the permit drawings (KY State Plain North, 1601, NAD 83).

Superseded by Addendum 1

6.4 Storage of Records

~~All handwritten data sheet originals, especially those containing signatures, shall be stored by the Owners Representative in a safe repository on site. Other reports may be stored by any standard method that allows for easy access.~~