**INVITATION TO BID – RFP 2022-0811-001**

**MORGAN COUNTY LANDFILL SOUTH CELL PHASE 2 CONSTRUCTION**

**July 26, 2022**

**Re: Invitation to Bid-South Cell Phase 2 at the Morgan County Landfill Morgan County, Colorado**

**To: Interested Synthetic Lining Installation Contractors**

The Morgan County Landfill owned and operated by Morgan County, Colorado is located approximately 4.5 miles northeast of Fort Morgan, Colorado. Morgan County is requesting bids from interested geosynthetic lining installation contractors for the construction of Phase 2 of the South Disposal Cell at the Morgan County Landfill. The synthetic lining portion of the project is anticipated to begin on or around November 14, 2022 and includes construction of approximately 6 acres of landfill disposal cell area lined with GCL, HDPE and a geocomposite drainage layer.

Included with this bid invitation are the following documents to assist in preparing your bid:

1. Instructions to Bidders (earthworks and geosynthetic contractors separate)
2. Plan Drawings Plates 1, 2, and 3
3. Scope/Schedule/Bid Forms
4. Construction Quality Assurance Plan dated May 2019 (Revised March 2021)
5. Sample Construction Contract (earthworks and geosynthetic contractors separate)

Particularly note Form A (the second sheet) on the Scope/Schedule/Bid Form that provides the bid quantities for your use in submitting a bid for all costs associated with purchase, transport, and installation of reinforced GCL liner and 60-mil textured (both sides) HDPE liner meeting the specifications in the Contract Documents. **Please note that the bid quantities are the pay quantities and ONLY reflect the 3D area to be covered. The quantities shown DO NOT include scrap, lap, or waste, so please provide a unit rate on the bid sheet that covers the actual quantities required to cover the area shown. Bidders may include their own form with their bid itemizing any and all anticipated costs.** In addition, the HDPE, GCL, and geocomposite drainage layer require conformance testing following manufacture and American Environmental Consulting (AEC) will be responsible for coordinating the collection of samples

at the manufacturing facility and paying for this testing, so do not include costs associated with conformance testing in your bid. **All times listed in this ITB are MST.**

**Bids are due August 10, 2022 by 4:00 p.m. and two hard copies, sealed bid clearly marked on the outside of the envelope "RFP 2022-0811-001" shall be submitted to the address listed below. Please include standard product data sheets of the proposed materials and an installation schedule with your bid so that Morgan County can evaluate your ability to meet project requirements as well as any other costs you anticipate such as mobilization, standby rates, per diem, etc.**

Karla Powell,
Morgan County Administrative Services Manager
218 West Kiowa Avenue
Fort Morgan, CO 80701
kpowell@co.morgan.co.us
(970) 542-3501

**Bids received after the date and time stated above and/or without RFP 2022-0811-001 clearly marked on the outside of the envelope will not be accepted as a responsible bid by Morgan County. Electronic bids will not be accepted**. Bids will be opened at a public meeting on **August 11, 2022** at 9:00 a.m. Location of bid opening will be at 218 W. Kiowa Ave, Fort Morgan, Colorado, Morgan County Commissioner's Office, and an option to attend via Zoom Meetings will be made available.

Vendors and/or Public will be able to view the bid opening via Zoom Meeting. To watch and/or listen to the meeting but not participate, connect via Zoom Conferencing Access:
**https://us02web.zoom.us/j/89946403072?pwd=VUFpR0RXU1NsRnRLRHMzai9qa21oZz09**
or listen via phone: 1-312-626-6799, Meeting ID: **899 4640 3072**
Meeting Passcode**: 227523**

Questions must be submitted to Ms. Karla Powell by email and will be accepted through **August 8, 2022** at 4:00 p.m. Questions and answers will be posted on Bid Net and the County website by **August 9, 2022** at 4:00 p.m.

Presentation of tabulations and selection of the winning bid will be determined at the Board of County Commissioners meeting on **September 6, 2022** with a Notice of Award to follow shortly thereafter.

Bidders may submit a request for the AutoCAD drawing files to Ms. Karla Powell by email.

Mr. Michael Bucari-Tovo will act as the Construction Project Manager. His contact information is below.

Mr. Michael Bucari-Tovo
Construction Project Manager
American Environmental Consulting
8191 Southpark Lane, Unit 107
Littleton, Colorado 80120
mbucari@aecdenver.com
303-948-7733 office
678-782-1900 mobile

The Morgan County Landfill is in need of the additional disposal airspace from this Phase 2 project and it is in the best interest of Morgan County to receive bid prices and schedules that are aggressive, but realistic as possible. We appreciate your interest in this project and look forward to receiving your bids.

# INSTRUCTIONS TO BIDDERS

1. A "Bid" is a responsive, conforming, unconditional, complete, legible, and properly executed offer by a Bidder to provide the work specified in the Request for Bids for the compensation specified.

2. Bids shall be clearly marked with the work name, contact person, email & physical mailing address and telephone number of the Bidder.

3. It shall be the responsibility of the Bidder to ensure that the Bid is in proper form and in the County's possession by or before the time and date designated in the Request for Bids. Bids will not be accepted after the designated time and date. Any Bid received late will be returned to the Bidder unopened, if possible.

4. If a mistake is made or discovered during or after the Bid review, the County reserves the right to determine which party made the mistake and whether the mistake is material and, after these determinations, the County, in its sole reasonable discretion, shall decide whether to accept or reject the Bid. No advantage shall be taken by any party of manifest clerical errors or omissions in any Bid and the Contract Documents. Bidders shall notify the County immediately of any errors or omissions that are encountered.

5. Any interlineation, alteration, or erasure shall be initialed by the Bidder. On the Bid, the price of each item shall be stated in numerals and words; in case of conflict, the words shall control. In the case of conflict between the indicated sum of any addition of figures and the correct sum, the correct sum shall control.

6. The County shall not reimburse any Bidder for any cost incurred in preparing a Bid or attending equipment demonstrations, inspections, pre-bid conferences, or interviews.

7. Any amplification, clarification, explanation, interpretation, or correction of a Bid shall be made only by written addendum, and a copy of the addendum shall be mailed or delivered to each person receiving a Request for Bids. The County is not responsible for any amplification, clarification, explanation, or interpretation or correction of a Bid not contained in written addenda.

8. Bids by corporations shall be executed in the corporate name by the president or a vice-president (or a corporate officer accompanied by evidence of authority to sign), and the corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown. Bids submitted by partnerships shall be executed in the partnership name and signed by a partner, and the legal address of the partnership shall be shown. Bids submitted by limited liability companies shall be executed in the company's name and signed by a member, and the legal address of the company shall be shown. Names and titles shall be typed or printed below each signature.

9. Any Bid received as a result of this request is prepared at the Bidder's expense and becomes County property. Bids are public records under Colorado Open Records Act. If Bidder considers any information confidential, Bidder shall mark such information as "Confidential".

10. The submission of a Bid shall be conclusive evidence and a legal admission that the Bidder: (1) has no questions, complaints, or objections in connection with the Contract Documents, subject to any requests made by the Bidder for amplification, clarification, explanation, interpretation, or correction; (2) has no questions, complaints, or objections as to the completeness, sufficiency, scope, or detail of the Bid; and (3) has full knowledge of the scope, nature, quality, and quantity of the equipment to be provided, the performance criteria, the requirements of the contract, the site and conditions of delivery, and applicable law.

11. The project will be awarded to the lowest responsible and responsive Bidder complying with the terms and conditions, guidelines, and specifications presented in the Bid Request and these Instructions to Bidders. The County reserves the right to determine, in its sole reasonable discretion, whether any Bid meets the needs or purposes intended and is within the approved budget. The County does not base its award on prices alone. Also to be considered are: quality of product; past experience with the Bidder or any subcontractors, consultants, products or suppliers; qualifications of the Bidder and/or subcontractors or suppliers; services offered; warranties; maintenance considerations; long-range costs; delivery; and similar conditions.

12. This project includes a preference for Colorado labor, pursuant to C.R.S. § 8-17-101 *et seq.*, Keep Jobs in Colorado Act. Bidders seeking a waiver of this preference shall submit such a request with the Bid.

13. The County reserves the right to conduct such investigations as it deems necessary to assist in the evaluation of any Bid to establish the experience, responsibility, reliability, references, reputation, qualifications, or financial ability of any Bidder, manufacturer or supplier. The purpose of such investigation is to satisfy the County that the Bidder has the experience, resources, and commercial reputation necessary to supply the specified equipment and to perform the necessary warranty and product support in accordance with the Contract Documents in the prescribed manner and time.

14. The final award shall be made by the Board of County Commissioners in the best interests of Morgan County. Morgan County may grant a 5% preference to local businesses. A local shall be a business which maintains a physical place of business in Morgan County.

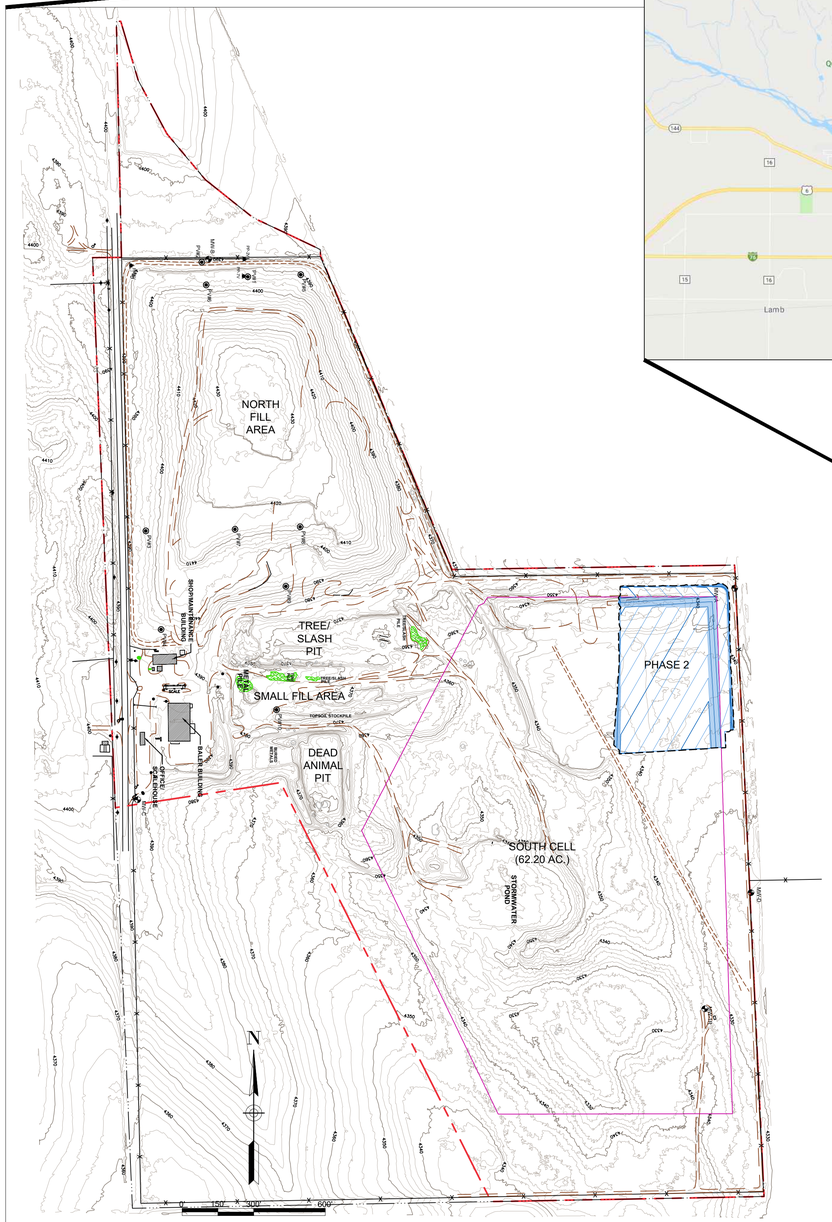
15. The County reserves the right, if it deems such action to be in its best interests, to reject any and all Bids or to waive any irregularities or informalities therein. Any incomplete, false, or misleading information provided by any Bidder shall be grounds for rejection of the Bid. If Bids are rejected, the County further reserves the right to investigate and accept the next best Bid in order of ranking, or to reject all Bids and re-solicit for additional Bids.

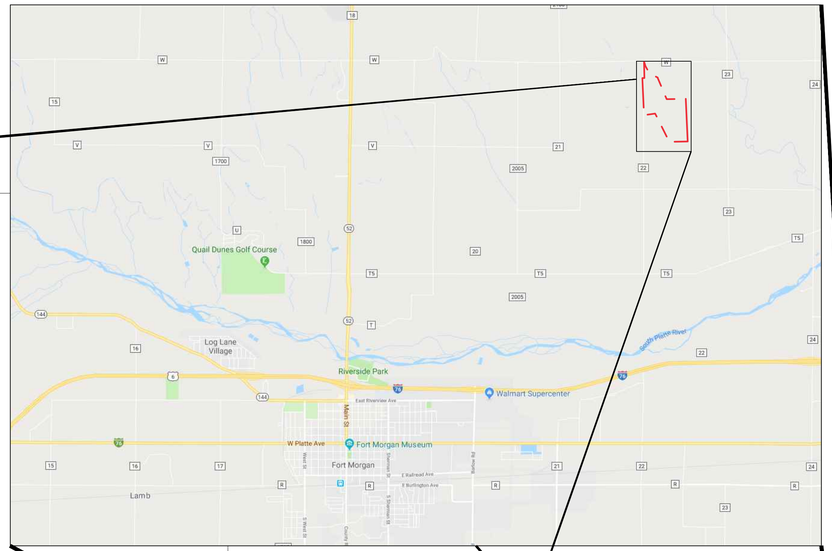
16. No Bid shall include federal excise taxes or state or local sales or use taxes.

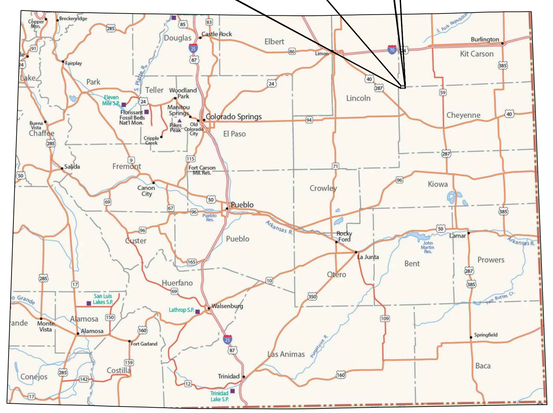
17. In the event of any claim, suit, or demand which may result from any Bid, or the award of any contract as a result of submission of a Bid, Colorado law shall govern any such claim, suit, or demand and the rights and duties of the parties.

18. Any Bid received as a result of this request is prepared at the Bidder's expense and becomes County property and is therefore a public record upon opening by the County. No Bid may be withdrawn for a period of 60 days after the deadline for Bids.

# MORGAN COUNTY LANDFILL
# SOUTH CELL PHASE 2 CONSTRUCTION




LIST OF PLATES:

| | |
|---|---|
| NO. 1 | COVER SHEET |
| NO. 2 | DESIGN TOP OF SUBGRADE |
| NO. 3 | GEOSYNTHETICS DETAILS |

PREPARED FOR:
MORGAN COUNTY BOARD OF COMMISSIONERS
218 W. KIOWA, P.O. BOX 596
FORT MORGAN, CO 80701

PREPARED BY:
AMERICAN ENVIRONMENTAL CONSULTING, LLC
8191 SOUTHPARK LANE
LITTLETON, COLORADO 80120

PLATE 1
COVER
MORGAN COUNTY LANDFILL
MORGAN COUNTY, COLORADO

| | |
|---|---|
| CLIENT: MORGAN COUNTY | |
| PROJECT: MCLF SOUTH CELL PHASE 2 CONSTRUCTION | |
| PROJECT NO: | DATE COMPLETED: 07/2022 |
| DESIGNED BY: AEC | APPROVED BY: MBT |
| DRAWN BY: MBT | DWG NAME: 01_MCLF_2022_SOUTH CELL_PHASE 2_COVER.dwg |
| REVISION: | REVISED BY: DATE: |
| 0 ISSUED FOR SYNTHETICS BIDDING | |

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.

1,361,500

1,361,000

3,496,500

PERMANENT PERIMETER DRAINAGE DITCH TIES INTO EXISTING DITCH. 18-IN. CULVERT IS ABANDONED.

MMP-11

PERMANENT STORMWATER DRAINAGE DITCH

TIE IN TO EXISTING PHASE 1 LINER & ANCHOR SEE PLATE 3, DETAIL 6

SYNTHETIC LINER ANCHOR TRENCH SEE PLATE 3, DETAIL 4

SOUTH CELL PERMANENT SIDESLOPE

4:1

1.02%

SOUTH CELL PHASE 1

SYNTHETIC LINER ANCHOR TRENCH SEE PLATE 3, DETAIL 4

SOUTH CELL PERMANENT SIDESLOPE

1.74%

SOUTH CELL
PHASE 2
6.19 AC. LINED
5.98 AC. WASTE DISPOSAL

2.0%

1.67%

PHASE 2 TEMPORARY LINER TERMINATION ON SIDESLOPE SEE PLATE 3, DETAIL 5

PHASE 2 TEMPORARY LINER SYSTEM TERMINATION SEE PLATE 3, DETAIL 3

PHASE 1 TEMPORARY SIDESLOPE

3:1

## LEGEND

- 4330 — EXISTING CONTOURS (1 FT. INTERVAL)
- 4330 — PHASE 2 TOP OF SUBGRADE CONTOURS (1 FT. INTERVAL)
- PHASE 2 LIMITS OF GCL & HDPE LINER PLACEMENT
- PHASE 2 LIMITS OF GEOCOMPOSITE
- PHASE 2 ANCHOR TRENCH INBOARD CREST LIMITS
- PHASE 2 APP. LIMIT OF WASTE PLACEMENT / CREST OF SLOPE
- PHASE 2 LIMITS OF TOES & CREST
- PHASE 2 LIMITS OF CONSTRUCTION
- DRAINAGE DITCH TOES
- DRAINAGE DITCH FLOW DIRECTION
- PHASE 1 DRAINAGE CULVERT TO BE ABANDONED
- PERIMETER FENCE
- PROPERTY LIMIT (BY CIVIL ARTS, 4/19/2019)
- CERTIFICATE OF DESIGNATION LIMIT
- MW-D — EXISTING GROUNDWATER MONITORING WELL
- MMP-12 — METHANE MONITORING PROBE (TO BE CONSTRUCTED)

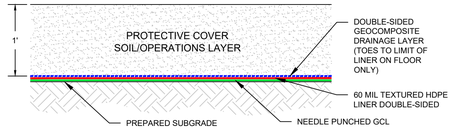
0 15' 30' 60'

CONTOUR INTERVAL: 1'
DATE OF TOPOGRAPHY FLIGHT: 10/17/2019

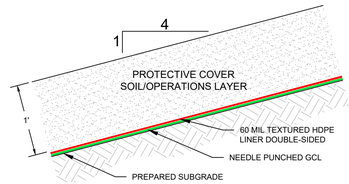
PLATE 2
SOUTH CELL PHASE 2 – DESIGN TOP OF SUBGRADE
MORGAN COUNTY LANDFILL
MORGAN COUNTY, COLORADO

| | |
|---|---|
| CLIENT: MORGAN COUNTY | |
| PROJECT: MCLF SOUTH CELL PHASE 2 CONSTRUCTION | |
| PROJECT NO: | DATE COMPLETED: 6/2022 |
| DESIGNED BY: AEC | APPROVED BY: MBT |
| DRAWN BY: MBT | DWG NAME: 02_MCLF_2022_SOUTH CELL_PHASE 2_SUBGRADE.dwg |
| REVISION: | REVISED BY: DATE: |
| 0 ISSUED FOR SYNTHETICS BIDDING | |

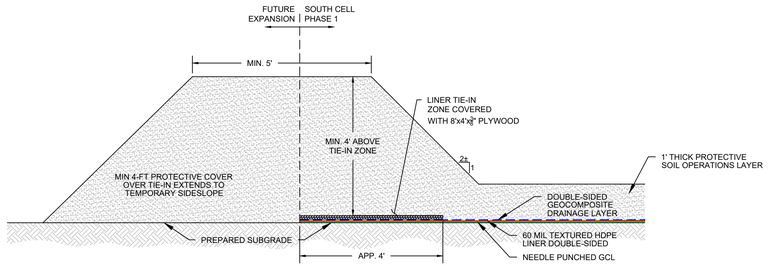
AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.



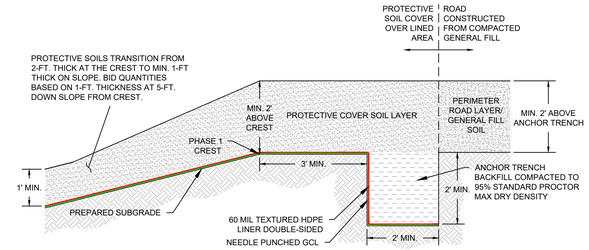

1 / - SECTION THROUGH LINER ON DISPOSAL CELL FLOOR
(NTS)



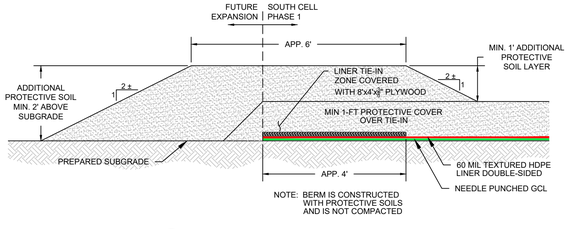

2 / - SECTION THROUGH LINER ON PERMANENT SIDESLOPE
(NTS)



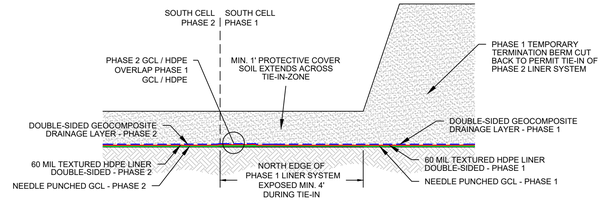

3 / 4 TEMPORARY LINER TERMINATION - WEST SIDE OF PHASE 2
(NTS)




4 / 4 ANCHOR TRENCH DETAIL - NORTH AND EAST SIDES OF PHASE 2
(NTS)




5 / 4 TEMPORARY TERMINATION BERM ON PERMANENT SIDESLOPE
(NTS)




6 / 4 TIE-IN OF PHASE 1 AND PHASE 2 LINER SYSTEMS - SOUTH SIDE OF PHASE 2
(NTS)

PLATE 3
GEOSYNTHETICS DETAILS
MORGAN COUNTY LANDFILL
MORGAN COUNTY, COLORADO

| | |
|---|---|
| CLIENT: MORGAN COUNTY | |
| PROJECT: MCLF SOUTH CELL PHASE 2 CONSTRUCTION | |
| PROJECT NO: | DATE COMPLETED: 07/2022 |
| DESIGNED BY: AEC | APPROVED BY: MBT |
| DRAWN BY: MBT | DWG NAME: 03_MCLF_2022_SOUTH CELL_PHASE 2_DETAILS.dwg |
| REVISION: | REVISED BY: DATE: |
| 0 ISSUED FOR SYNTHETICS BIDDING | |

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.

## SCOPE/SCHEDULE/BID FORMS

In accordance with the terms of this Agreement dated, _____, 2022, CONTRACTOR agrees to perform the Services necessary to accomplish the Work within the Contract Price as follows:

**PROJECT NAME:** Morgan County Landfill South Cell Phase 2 Liner Construction

**PROJECT LOCATION:** Morgan County, Colorado Landfill

Complete the Bid Forms on the following pages.

**INCLUDE A RATE SCHEDULE FOR ALL LABOR AND EQUIPMENT IN THE EVENT UNFORESEEN TASKS MUST BE COMPLETED.**

Performance Bond @ 100 % _____ _____

_____ **TOTAL CONTRACT PRICE:** _____
(written amount)

**ATTACHED DOCUMENTS**

1. Bid Form A
2. Attachment 1 – Qualifications/Exceptions to Contract Documents
3. Attachment 2 – List of Proposed Equipment and Unit Labor Rates
4. Attachment 3 – Geosynthetic Liner System Package Scope of Work
5. Attachment 4 – Waiver Request for Colorado Labor Rates

| **OWNER** | **CONTRACTOR** |
|---|---|
| **Morgan County, Colorado** | Name: |
| By: _____ | _____ |
| Signature Date | Signature Date |
| Name: Jon J. Becker | Name: _____ |
| Authorized Agent's Typed Name | Authorized Agents Typed Name |
| Title: Chaiman | Title: _____ |
| | _____ |
| | Printed Name of Designated Field Superintendent/Foreman |

# FORM A
# SCHEDULE OF BID PRICES
## MORGAN COUNTY LANDFILL SOUTH CELL PHASE 2 LINER CONSTRUCTION

| Task Item | Task Description | Units | Estimated Quantities | Bid Unit Prices ($) | Extended Bid Prices |
|---|---|---|---|---|---|
| 100 | Performance Bond | Lump Sum | | | |
| 200 | Mobilization/Demobilization | Lump Sum | | | |
| 300 | GCL liner/supply/install/test [1] | SF (3D) | 272,938 | | |
| 400 | HDPE liner/supply/install/test [1] | SF (3D) | 272,938 | | |
| 500 | Geocomposite/supply/install[1] | SF (3D) | 219,428 | | |
| **Total Cost ($)** | | | | | |

**(1) Bid quantity is 3D square feet of area covered including anchor trench and does not include lap, scrap, or waste. Geosynthetics Contractor may submit a separate bid sheet with all anticipated line items and costs if not included in above Bid Form.**

**OWNER: MORGAN COUNTY, COLROADO**

SIGNATURE Jon J. Becker

Chairman
TITLE

**CONTRACTOR:**

SIGNATURE

TITLE

**ATTACHMENT NO. 1 TO THE BID FORM**
**AGREEMENT QUALIFICATIONS/EXCEPTIONS TO BID DOCUMENTS**

**PROJECT NAME:** South Cell Phase 2 Liner Construction

**SITE NAME:** Morgan County Landfill

Any qualifications/exceptions to this Agreement that are not listed on this Attachment 1 of the Bid Form will not be valid. This includes qualifications and exceptions to the South Cell Phase 2 Liner Construction. Except as expressly stated herein, the terms and conditions of this Agreement will take precedence over any Supplier terms and conditions. The following project-specific agreement qualifications will apply to this Agreement (if none so state and sign below).

Commercial:

Technical:

I hereby accept the above listed agreement qualifications.

| **Owner** | **Supplier** |
|---|---|
| **MORGAN COUNTY, COLORADO** | |
| By: _____ Signature | By: _____ Signature |
| Name: _____ (Jon J. Becker) | Name: _____ (Authorized Agents Typed Name) |
| Title: Chairman | Title: _____ |
| Date: _____ | Date: _____ |

**ATTACHMENT NO. 2 TO BID FORM**
**LIST OF PROPOSED EQUIPMENT/LABOR RATES**

CONTRACTOR shall provide a list of the proposed equipment dedicated to completion of the work as specified in the contract documents with his bid and as provided below. Also provide any additional applicable equipment available if needed. Provide Unit Billing Rate for each piece of equipment and operator in the event additional or out of scope work needs to be billed on a Time and Materials (T&M) basis as agreed to by OWNER. Use a separate sheet of paper if necessary. Emphasis will be placed on the CONTRACTORS ability to complete the work in accordance with the requirements of the contract documents as quickly as possible. OWNER assumes that the ability of a bidder to complete the work of the contract in the shortest amount of time will be at least in part dependent on the number of pieces of applicable equipment, its efficiency in performing the applicable task, and number and experience of operators and Foreman.

| **EQUIPMENT ITEM** | **USE** | **NO. OF PIECES DEDICATED TO WORK** | **Unit Rate Plus Operator (Out of Scope or T&M work)** |
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**ATTACHMENT NO. 3 TO BID FORM**
**MORGAN COUNTY LANDFILL**
**2022 SOUTH CELL PHASE 2 CONSTRUCTION**
**GEOSYNTHETIC LINER SYTEM PACKAGE**
**SCOPE OF WORK**

## 1.0 SUMMARY OF THE OVERALL PROJECT

The synthetics installation construction project includes installation of a 3-layer geosynthetic liner system approximate 6-acre lined disposal cell of Phase 2 South Cell (hereinafter referred to as Phase 2). Each task is described in this Scope of Work narrative and each task should be included in your bid.

The overall project consists of excavating and backfilling as necessary to design subgrade and finish grades for an approximate 6-acre lined area called Phase 2, including tie-in of the subgrade with the subgrade of Phase 1, not including and construction of haul/access roads for Contractor use (incidental to the work). The liner and leachate collection system will be a composite liner consisting of (from the base of the system upwards) a Geosynthetic Clay Liner (GCL) and a High-Density Polyethylene (HDPE) membrane, overlain by a geocomposite leachate collection system on the floor of Phase 2. Suitable soils excavated from the Phase 2 area may be used in any portion of the construction area that requires fill. The GCL and HDPE liner terminates on the excavation floor on the west side, at the permanent anchor trench just outside of the excavation crest on the north and east sides of Phase 2, and will be tied into the Phase 1 liner system on the south side of Phase 2. The Geocomposite drainage layer terminates at the excavation toe on the north and east sides of Phase 2, at the termination of the GCL and HDPE liner system on the west side of Phase 2, and will be tied into the Phase 1 geocomposite leachate collection system on the south side of Phase 2.

The termination of the liner and drainage system on the west side is covered with plywood as shown on the drawings. The earthworks contractor is responsible for stormwater runoff control prior to, during, and following the installation of the synthetic components to protect them and the work area from damage, as well as exposing the Phase 1 tie-in zone.

## 2.0 CONTRACTOR'S SCOPE OF WORK

All work must be carried out and maintained per the Drawings, Bid Forms and Scope of Work, Construction Quality Assurance ("CQA") Plan, and Addendums (collectively the Contract Documents) subject to the approval of the CQA Personnel. Any materials that are found to be outside the tolerances identified in the Drawings, and CQA Plan must be reworked or removed and replaced to the approval of the CQA Personnel and at no additional costs to the OWNER. If there are any conflicts between this document and the CQA Plan, the CQA Plan will generally take precedence. Contractor shall notify CQA personnel of any conflicts or discrepancies as soon as possible after discovery and the CQA Engineer will determine a direction going forward. Contractor will be responsible for any damage its operations cause to any portion of the Work, regardless of the circumstances, and will repair this damage to the approval of the CQA Personnel and at no additional cost to the OWNER.

The quantities shown on Bid Form A are pre-established pay quantities and if Contractor disagrees with any pay quantity, he shall demonstrate to the satisfaction of the CQA Engineer that a different pay quantity is appropriate. The OWNER will provide survey to locate and mark the limits of liner to be installed. The Contractor may, at Contractor's discretion, verify these limits as staked or surveyed by OWNER's surveyor and will bring any discrepancies that affect the contract documents to the attention of the OWNER immediately upon discovery of that discrepancy.

## 3.0 BID ITEM DEFINITIONS

The Contractor's unit prices and lump sum prices included in Form A (Schedule of Bid Prices) will serve as the sole basis for compensating the Contractor to complete the project in accordance with the Contract Documents. All costs that are within the scope of work of the project but are not specifically identified as a bid item shall be factored into the unit and lump sum prices included in the Bid Forms. Examples of such costs include, but are not limited to, overhead, profit, insurance, and project management.

The bid item definitions are intended to provide the Contractor with a general overview of the project. The Contractor is referred to the Scope of Work, Construction Plans, and CQA Plan for detailed information on the project scope and construction requirements.

## 4.0 DESCRIPTION OF PAY ITEMS

The Contractor shall be responsible for the 2022 South Cell Phase 2 Liner Construction work consisting of and limited to: 1) supply and installation of geosynthetic clay liner (GCL), supply and installation of dual-side-textured 60-mil HDPE geomembrane, supply and installation of a geocomposite drainage layer, and termination of the GCL and geomembrane in anchor trenches to be excavated and backfilled by others. Payment for all work will be made under one of the pay items listed below. Payment of all geosynthetic work items will be based upon listed Bid Quantities and Bidder shall include sufficient material to include lap, scrap, and waste and account for all quantities required to comply with the design and specifications in the Bid Unit Rate.

A ten percent (10%) retainer will be applied to each invoice. The retainer will be paid in full upon completion of the project and once the final invoice is received by Owner and the Final Payment, General Release, and Indemnity is executed. Any work which the Contractor believes not to be covered by one of these pay items shall be addressed in the bid submitted to the Owner.

The Contractor shall take all necessary actions needed to meet the proposed schedule, considering weather conditions that may be expected for the project area and season.

## BASE BID PAY ITEMS

### 100: Payment Bond

A Performance Bond is required and shall be no less than the contract amount in accordance with the Instruction to Bidders, Bid Form A and the Contract Documents. A Letter from the surety must be provided with the bid as evidence of ability to be bonded. Payment for this item shall be on the bid lump sum price.

### 200: Mobilization and Demobilization

Mobilization and demobilization shall be a lump sum item. Payment for 100% of this item shall be made upon mobilization of equipment necessary to initiate installation of the liner system. The Contractor is expected to have satisfactory completion of all work items for this project, demobilization of equipment and any unused materials, and leaving allocated work areas, including borrow sources, haul roads and stockpiles, in a satisfactory condition. Assume one mobilization for the project. Payment for this item is on the bid lump sum price.

### 300: Supply and Install Geosynthetic Clay Liner (GCL)

The Contractor shall be responsible for suppling sufficient quantities to complete the job, including purchase, transport, and installation of a geosynthetic clay liner as the bottom layer of a three-layer synthetic liner system that also includes the dual-side-textured, 60-mil HDPE geomembrane and a 200-mil geocomposite drainage layer. The GCL is to be installed over an area shown on the design drawings, and in compliance with the approved Construction Quality Assurance Plan (CQAP) and material specifications. A copy of the Product Data Sheet for the proposed material shall be included with the Bid. The Contractor will be responsible for assembling the required panel layout drawings and confirming material take-offs prior to the award of contract. The installation of the GCL must be performed concurrently with the installation of the geomembrane liner (Bid Item 400) in such manner that ensures complete coverage of any exposed GCL by the geomembrane at the end of each working day of installation in accordance with the CQAP and geosynthetics installation specifications. Contractor shall conduct all field testing of the GCL in compliance with the CQAP if any is required. The CQA Monitor will be responsible for providing oversight during GCL and Geomembrane installation as well as certification testing and as-built survey documentation to verify proper installation procedures and required testing is completed during and after all geosynthetics placement.

This item also includes preparing the entire northern termination of the Phase 1 GCL liner as required and joining it to the Phase 2 GCL liner. The western termination of the Phase 1 GCL shall be installed to or cut in a straight neat line to the limits shown on the drawing. The GCL of Phase 2 shall overlap the GCL in Phase 1.

Payment for this item is the Bid Quantity shown on Form A at the Bid Unit Rate. Contractor shall account for scrap, lap, and waste not included in the Bid Quantity in the Bid Unit Rate.

## 400: Supply and Install Geomembrane Liner

The Contractor shall be responsible for suppling sufficient quantities to complete the job, including purchase, transport, and installation of a dual-side-textured, 60-mil HDPE geomembrane that completely covers the installed GCL (Bid Item 300). The geomembrane is to be installed over an area shown on the design drawings, and in compliance with the design drawings and in compliance with the approved Construction Quality Assurance Plan (CQAP) and material specifications. A copy of the Product Data Sheet for the proposed material shall be included with the Bid. The Contractor will be responsible for assembling the required panel layout drawings and confirming material take-offs prior to the award of contract. The installation of the geomembrane must be performed concurrently with the installation of the GCL (Bid Item 300) in such manner that ensures complete coverage of any exposed GCL by the geomembrane at the end of each working day of installation in accordance with the CQAP and geosynthetics installation specifications. The Contractor shall be responsible for conducting all field testing required by, and in compliance with, the CQAP. The CQA Monitor will be responsible for providing oversight during GCL and Geomembrane installation as well as third-party testing and as-built survey documentation to verify proper installation procedures and required testing is completed during and after all geosynthetics placement.

This item also includes preparing the entire northern termination of the Phase 1 HDPE liner as required and joining it to the Phase 2 HDPE liner. The work shall be done as directed by the CQA Personnel, and all materials and work done in accordance with the specifications, drawings and CQA Plan. The western termination of the Phase 1 HDPE shall be installed to or cut in a straight neat line to the limits shown on the drawing. The HDPE of Phase 2 shall overlap the HDPE in Phase 1.

Payment for this item is the Bid Quantity shown on Form A at the Bid Unit Rate. Contractor shall account for scrap, lap, and waste not included in the Bid Quantity in the Bid Unit Rate.

## 500: Supply and Install Geocomposite Drainage Layer

The Contractor shall be responsible for suppling sufficient quantities to complete the job, purchase, transport and installation of geocomposite drainage layer above the installed GCL/Geomembrane Liner system over an area shown on the Design Drawings (floor only) and in compliance with the CQAP. The geocomposite installation will be competed in compliance with the approved Construction Quality Assurance Plan (CQAP). The Contractor will be responsible for assembling the required panel layout drawings and confirming material take-offs prior to the award of contract. A copy of the Product Data Sheet for the proposed material shall be included with the Bid. The Contractor shall conduct all field testing required by, and in compliance with, the CQAP. The CQA Monitor will be responsible for providing oversight during geocomposite installation as well as any third-party testing and as-built documentation to verify proper installation procedures and required testing is completed during and after all geosynthetics placement.

This item also includes preparing the entire northern termination of the Phase 1 geocomposite as required and joining it to the Phase 2 geocomposite. The work shall be done as directed by the

CQA Personnel, and all materials and work done in accordance with the specifications, drawings and CQA Plan. The western termination of the Phase 1 geocomposite shall be installed to or cut in a straight neat line to the limits shown on the drawing.

Payment for this item is the Bid Quantity shown on Form A at the Bid Unit Rate. Contractor shall account for scrap, lap, and waste not included in the Bid Quantity in the Bid Unit Rate.

## 6.0 QUALITY ASSURANCE

Quality Assurance (QA) requirements are defined in the CQA Plan. CQA observations and testing will be conducted by AEC to verify compliance with the contract documents. At the completion of each significant work item, acceptance of the work by the CQA Personnel will be required before the Contractor can proceed with related Work Items.

## 7.0 SERVICES AND MATERIALS TO BE FURNISHED BY MORGAN COUNTY

1. Adequate storage and equipment parking area in the vicinity of the actual construction area.
2. On-site representative to interface with contractors at the site.
3. Design services
4. Construction Management
5. Approval of the Work

## 8.0 SERVICES AND MATERIALS TO BE FURNISHED BY CONTRACTOR OR OTHERS

1. CQA Services – American Environmental Consulting, LLC
2. Certification Surveys (under the CQA services)
3. GCL/HDPE liner/Geocomposite construction – (Contractor)
4. Water, storage, and distribution as needed (Others)
5. Sanitary Facilities (Others)

## 9.0 COORDINATION BETWEEN CONTRACTORS

Before any work is installed, Contractor shall carefully check all plans and specifications for each trade and job condition. Any conflict or lack of coordination between his work, other Contractors and the project plans or specifications or job conditions shall be immediately reported to the OWNER representative in writing. If Contractor fails to call such conflict or lack of coordination between other Contractors, plans, specifications, or job conditions to the attention of OWNER before any work is done, it will be assumed that no conflict or lack of coordination exists, and that all specified work scopes contained in the approved baseline schedule will be met.

Notwithstanding the above, Contractor and OWNER will make every attempt to ensure well-coordinated operations including the use of planning and progress meetings.

**ATTACHMENT NO. 4 TO THE BID FORM**
**REQUEST FOR WAIVER FROM C.R.S § 8-17-101**
**REQUIREMENT FOR COLORADO LABOR**

Colorado Revised Statutes (C.R.S.) § 8-17-101 of Colorado law requires in general that government contractors must have a minimum of 80% of their personnel on a particular project reside in Colorado. There is a provision that governments can waive this requirement under certain conditions. If Bidder feels that he may not be able to meet this requirement, Bidder shall submit a request to Morgan County to waive this requirement with their Bid.

# CONSTRUCTION QUALITY ASSURANCE PLAN AND SPECIFICATIONS

## MORGAN COUNTY LANDFILL

Morgan County, Colorado

**Prepared for:**
Morgan County Landfill

**Prepared by:**
American Environmental Consulting, LLC
8191 Southpark Lane #107
Littleton, Colorado 80120

May 2019
Revised November 2020
Revised March 2021

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## TABLES

## 1.0 INTRODUCTION

These are the construction quality assurance (CQA) procedures for site development of the Morgan County Landfill (MCLF) located in Morgan County, Colorado. The goals of these procedures are to provide mechanisms for:

1. assuring that proper construction techniques and procedures are used,
2. assuring that the intent of the design is met, and
3. resolving problems that may arise during construction.

The landfill is designed to incorporate a combination of materials during the development of the landfill. The liner and leachate collection system include:

1. A Geosynthetic Clay Liner installed atop the prepared subgrade.
2. A High-Density Polyethylene geomembrane in intimate contact with the Geosynthetic Clay Liner.
3. A Geocomposite drainage layer installed atop the geomembrane on the cell floor.
4. Two leachate collection sumps to be constructed over the life of the landfill. The sump will be constructed with an 18-inch perforated pipe and a riser pipe to remove leachate. The sump will be filled with an aggregate to facilitate the removal of the leachate. The sump aggregate will be covered with a geocomposite filter fabric.
5. A one-foot-thick protective layer will be place on the geocomposite to protect the liner and leachate collection system.

The final cover system consists of:

1. A 6-inch foundation layer of general fill soils
2. A 60-mil LLDPE geomembrane moisture barrier layer
3. An 18-inch layer of protective soils overlaying the geomembrane
4. A 6-inch vegetation soil layer, seeded with the NRCS recommended mix

## 2.0 DEFINITIONS

The CQAP is a site-specific document which addresses the following: (i) CQA personnel responsibilities, authorities, and qualifications; (ii) inspection, monitoring, and testing activities necessary to ensure that the facility is constructed to meet or exceed design criteria, plans, and specifications; and (iii) CQA documentation requirements.

**ASTM** – American Society for Testing and Materials.

**Construction Quality Assurance** (CQA) – A planned and systematic pattern of the means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

In the context of this document Quality Assurance Plan (QAP) refers to means and actions employed by the CQA Engineer to assure conformity of liner system preparation, production, and installation with this CQA Plan, the Specifications, and the Construction Drawings. CQA is provided by a party independent from the product Manufacturer and Contractor.

**CQA Engineer** – The individual or firm responsible for oversight of all CQA activities required by the design drawings, specifications, and this CQA Plan and may or may not be the same as the Design Engineer. The duties and responsibilities of the CQA Engineer are separate and distinct from those of the Design Engineer and include certification of the construction as described in this CQA Plan. The CQA Engineer shall be a Professional Engineer (P.E.) registered in the State of Colorado and may be represented by other personnel variously referred to as the CQA Monitor, CQA Resident Engineer, or Project Manager, etc., who shall work under the direction and supervision of the CQA Engineer. The CQA Engineer may not approve any substantive changes to the approved design or specifications.

**CQA Firm** – The firm or organization responsible for implementation, verification, and documentation of the CQA program. For purposes of this plan, the terms "CQA Firm", "CQA Engineer", and "CQA Monitor" are generally interchangeable. The CQA firm must be separate and independent from any contractors.

**CQA Monitor** – Typically the field representative of the CQA Engineer. The CQA Monitor conducts oversight and field testing of the construction to verify that it is conducted in accordance with the approved design, CQA Plan, and specifications. The CQA Monitor works under the supervision and authority of the CQA Engineer but may not make any independent changes to the requirements of the approved CQA Plan, Design, or specifications.

**Construction Quality Control** (CQC) – Those actions, which provide a means to measure and control the characteristics of an item or service to meet contractual and regulatory requirements.

CQC refers to those actions taken by Manufacturers, Suppliers, Contractors, or Owners, including their designated representatives, to ensure that the materials and the workmanship meet the requirements of the Specifications, and the Construction Drawings. In the case of soils, and within this CQA Plan, CQC is typically made a part of the CQA requirements and is provided by

the CQA Engineer. In the case of geosynthetic and other non-soil components, the Manufacturers and installers of the various geosynthetics provide CQC.

**Construction Drawings** – The official plans, profiles, typical cross sections, elevations, and details, as well as their amendments and supplemental drawings, which show the locations, character, dimensions, and details of the work to be performed. Construction drawings are also referred to as the "plans."

**Construction Specifications** – The qualitative and quantitative requirements for products, materials, and workmanship upon which the construction is based. Construction specifications are also referred to as "specifications" and are included in the CQAP as applicable.

**Contract Documents** – The official set of documents issued by the Owner, which includes bidding requirements, contract forms, contract conditions, construction specifications, construction drawings, construction quality assurance plan, addenda, and contract modifications.

**Contractor** – The person or persons, firm, partnership, corporation, or any combination, private, municipal, or public, who, as an independent Contractor, has entered into a contract with the Owner. In cases where the Owner is providing actual construction services, the term "contractor" as used herein may be interpreted as the Owner where applicable.

**Design Engineer** – The individual or firm responsible for the development of the design and specifications for the construction project and may or may not be the same as the CQA Engineer. The duties and responsibilities of the Design Engineer are separate and distinct from those of the CQA Engineer. Any substantive changes to the design and specifications must be approved by the Design Engineer.

**Earthwork** – An activity involving the use of soil or rock materials for construction purposes.

**Earthwork Contractor** – The person or firm responsible for earthwork related activities.

**Excavation** – Excavation of materials from areas identified on the construction drawings. The process may require exclusion and segregation of materials unsuitable for use in construction.

**Facility Manager** – Owner's representative on site, who is responsible for contract administration.

**General Fill** – Compacted soil fill used for purposes of providing a firm base surface for construction components, backfill of trenches used to anchor synthetic materials outside of the lined cell area, surface water control structures, or other fills not specified elsewhere. In general, General fill characteristics are specific to the intended use and are installed under specific compaction and often moisture requirements.

**Geomembrane** – The synthetic lining material, also referred to as geomembrane, used in construction as a barrier to fluid migration. A geomembrane may be constructed with High-Density Polyethylene (HDPE), Linear Low-Density Polyethylene (LLDPE), etc.

**Geotextile** – A synthetic fabric used in construction, generally for filtration, protection, or limiting transmission of fluids.

**Nonconformance** – A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity non-compliant with project requirements and specifications. Examples of nonconformance's include, but are not limited to, physical defects, test failures, and inadequate documentation.

**Owner** – Morgan County owns and operates this landfill and, for purposes of this plan, is referred to as the Owner.

**Panel** – a two-dimensional unit area of the geosynthetic material that will be constructed in the field or in the fabricators plant and generally joined by some fashion to an adjacent panel. Unless cut smaller, the panel width generally corresponds to the width of a roll when geosynthetic products are supplied by the roll.

**Project Construction Drawings & Specifications** – These are all project related drawings and specification including design modifications and record drawings.

**Project Documents** – These include construction drawings, record drawings, specifications, shop drawings, construction quality control and quality assurance plans, quality assurance documentation, safety plans, and project schedules.

**Project Manager** – The official representative of the Owner responsible for construction of the project.

**Record Drawings** – Drawings recording the dimensions, details, and coordinates of the facility after construction is completed (as-built drawings).

**Quality Control** – or service to comply with the requirements of the construction documents. Quality control will be performed by the Contractor, manufacturers, suppliers, and sub-Contractors.

**Site Manager** – Owner's representative on site, who is responsible for day-to-day operations of the landfill and may be assigned authority over all or part of the project by the Project Manager.

**Surveyor** – The individual or firm responsible for grade staking to establish required elevations to construct the project in accordance with the drawings and specifications and certification surveys to document as-built conditions to demonstrate compliance with project requirements. The surveyor shall be a Professional Land Surveyor (P.L.S.) registered in the State of Colorado.

**Testing** – Verification that materials meet specified requirements by subjecting that material to a set of physical, chemical, environmental, or operating conditions.

**Testing Laboratory** – A laboratory capable of conducting the tests required by this CQAP.

**USCS** – Unified Soil Classification System

**Vegetative Layer** – The approximate upper six-inches of the AFC that will be seeded and may require amendments as recommended by a qualified vegetation expert.

## 3.0 MEETINGS

To facilitate construction and to clearly define construction goals and activities, close coordination between the Engineer, Owner, CQA Monitor, and the various Contractors is essential. To meet this objective the following meetings will be held.

### 3.1 Pre-Construction Meetings

A pre-construction meeting will be held at the site within two weeks prior to the start of construction. The CQA Engineer, Project Manager, CQA Monitor, Earthwork Contractor and others designated by the Owner will attend this meeting. The purposes of this meeting are as follows:

- Provide all parties with relevant documents
- Review the project construction drawings, specifications, and CQA plan
- Review and assign responsibilities for each party
- Identify key personnel
- Define lines of communications
- Establish reporting and documenting procedures
- Establish work area security and safety protocols
- Establish testing protocols and procedures for correcting and documenting construction deficiencies
- Conduct a site inspection to discuss work areas, work plans, stockpiling, laydown areas, access roads, haul roads, and related items
- Review the project schedule
- Develop any required addends to the project documents

This meeting will be documented by the Project Manager or his designee and copies of the minutes will be distributed to all parties.

### 3.2 Progress Meetings

Progress meetings will be held weekly during the period of the work. At a minimum, the CQA Monitor, Project Manager, and the Contractors will attend these meetings and the following topics will be discussed:

- Scheduled work activities
- Problems encountered or expected
- Recent CQA test results
- Other appropriate matters

Minutes of the meetings will be kept by the CQA Monitor and distributed to all parties.

### 3.3 Problem Resolution Meetings

As required, special meetings will be held to discuss problems or deficiencies. At a minimum, the CQA Monitor and appropriate Contractor will be in attendance. If the problem requires a design modification, the Project Manager, CQA Engineer, and Design Engineer will also be present. Minutes of the meeting will be kept by the CQA Monitor and, if appropriate, the Design Engineer.

## 4.0 EARTHWORK

### 4.1 General

Construction must be conducted in accordance with the project construction drawings and specifications. To monitor compliance, a two-part quality assurance testing program will be implemented that includes material evaluation and construction testing. Material evaluation includes borrow and other pre-construction investigations. Construction testing includes those activities that occur during material placement. All quality assurance testing shall be conducted in accordance with this CQA plan and the project construction drawings and specifications. Where there is a discrepancy, the document that requires the most frequent number of tests or the more stringent test requirement will govern unless otherwise specified by the CQA Engineer. All in -situ testing and sampling will be observed by the CQA Monitor. Documentation shall meet the requirements of this CQA plan.

### 4.2 Surveying

Site survey requirements include performing periodic and record surveys to confirm that the disposal cells are constructed in accordance with approved design plans. Periodic surveys are conducted as necessary during construction to guide excavation and liner installation activities. Record surveys are considered final surveys of a specific constructed element demonstrating compliance with approved plans. Record surveys require Professional Land Surveyor certification and will be included in the CQA certification report.

Surveys will be required both within the portion of the landfill liner being constructed, and outside of the liner construction (generally for surface water drainage structures). Elevation, Northing and Easting coordinates shall be determined and recorded on a minimum 50-foot grid as well as 50-foot centers at major grade breaks at each of the following surfaces and at locations shown on the drawings:

- Top of excavated subgrade (the surface below compacted clay or GCL liner)
- Top of protective layer
- Top of final cover foundation layer
- Top of 24-inch final cover soils
- Alternatively, if not all soils comprising the 24-inch final cover soils are suitable for vegetation:
    - Top of 18-inch final cover protective soils
    - Top of 6-inch vegetation layer

Survey points for each of the various component layers noted above will be stacked to easily show liner and protective layer thicknesses.

All piping installed within the area constructed to receive refuse shall be surveyed at the end

points, all changes in direction or orientation, and at a minimum of every 50 linear feet of pipe to allow location of the pipes once they are buried.

All applicable constructed features shall comply with the tolerances shown on Table 1 unless otherwise approved by the Design Engineer.

**TABLE 1**
**SURVEY TOLERANCES**

| | |
|---|---|
| Horizontal, All Points | plus or minus 0.20 feet of design coordinates (± 0.20 feet) |
| Vertical, Subgrade | plus 0.00 to minus 0.20 feet of design (+ 0.00 to – 0.20 feet) |
| Vertical, Top of Protective Soils | plus 0.20 to minus 0.00 feet of design (+0.20 to -0.00 feet) |
| Vertical, Top of final cover foundation layer | plus 0.00 to minus 0.20 feet of design (+ 0.00 to – 0.20 feet) |
| Vertical, Top of 24-inch final cover soils | plus 0.20 to minus 0.00 feet of design (+0.20 to -0.00 feet) |

All constructed layers for which a minimum thickness is specified shall be constructed to that minimum thickness. Nothing in Table 1 shall be construed to allow a layer to be constructed at less than the minimum required thickness.

## 4.3 Soil Material Evaluation and CQA

The soils used in the landfill construction include materials for general fill components both within and outside of the lined area, sump drainage material, and protective soils. Definitions of these materials are provided herein, and material uses are shown either on the drawings or will be identified by the Owner or CQA Engineer. Prior to the start of construction, sources for each material shall be identified and samples tested to determine that they meet project specifications. Additional sources may be identified during construction and must be tested and approved by the CQA Engineer prior to their use.

### 4.3.1 Sampling

Samples shall be obtained in a manner to best ensure the sample is representative of the materials to be used in construction.

### 4.3.2 Testing

Tests to confirm required properties shall be performed on each material from each borrow source. All test results shall be thoroughly documented. Testing frequency for each material is presented in Tables 2 through 4.

**TABLE 2**
**MINIMUM FREQUENCY OF TESTING FOR CQA**
**EVALUATION OF GENERAL FILL**

| Test | Standard Test Method | Construction Frequency | Preconstruction Frequency |
|---|---|---|---|
| Standard Proctor | ASTM D 698 | As needed for material (1) | 1 per 5,000 cy |
| Grain Size | ASTM D 422 | As needed for material (1) | 1 per 5,000 cy |
| Compacted Density-nuclear methods | ASTM D6398 | 1 per 100 linear feet per 12-inch thickness (anchor trench)<br>1 per 10,000 $ft^2$ per 12-inch thickness (area fills) | |
| Compacted Moisture Content – nuclear methods | ASTM D6398 | 1 per 100 linear feet per 12-inch lift (anchor trench)<br>1 per 10,000 $ft^2$ per 12-inch lift (area fills) | |

(1) The CQA Monitor will determine if additional testing of materials is required due to a change in material characteristics based on visual observation or comparing field moisture density testing with existing Proctor information.

**TABLE 2A**
**CQA REQUIRED PROPERTIES FOR**
**CONSTRUCTION OF GENERAL FILLS**

| Property | Requirement |
|---|---|
| Grain Size | Specific to use and must be approved by CQA Monitor. For most uses, must exhibit some cohesion sufficient for stability |
| Compacted Density | Equal or greater than 95% of Maximum Standard Proctor Density within lined area out to perimeter ditch. For some general fills, over synthetic materials, the Design Engineer may specify alternative density to avoid damage to synthetics |
| Compacted Moisture Content | $\pm$ 5% of Optimum Moisture defined by Standard Proctor Test for synthetic anchor trenches and fills within the lined area intended for waste disposal. Outside of lined area intended for waste, only moisture content necessary to achieve compaction specification |

**TABLE 3**
**MINIMUM FREQUENCY OF TESTING FOR CQA**
**EVALUATION OF PROTECTIVE SOIL LAYER**

| Test | Standard Test Method | Construction Frequency | Preconstruction Frequency |
|---|---|---|---|
| Grain Size | ASTM D422 | 1 per 5,000 cy | 1 per 10,000 cy |

**TABLE 3A**
**CQA REQUIRED PROPERTIES FOR**
**CONSTRUCTION OF PROTECTIVE SOIL LAYER**

| Property | Requirement |
|---|---|
| Grain Size | Max nominal size 3-inches.<br>Occasional up to 2 inches with CQA approval<br>Not angular based on visual inspection |

**TABLE 4**
**MINIMUM FREQUENCY OF TESTING FOR CQA**
**EVALUATION OF SUMP DRAINAGE MATERIAL**

| Test | Standard Test Method | Construction Frequency | Preconstruction Frequency |
|---|---|---|---|
| Grain Size | ASTM D422 | 1 per sump; min 1 per source | 1 per sump; min 1 per source |
| Permeability | ASTM D 2434 | 1 per sump; min 1 per source | 1 per sump; min 1 per source |
| USCS Class. | ASTM D 2487 | | 1 per sump; min 1 per source |

**TABLE 4A**
**CQA REQUIRED PROPERTIES FOR**
**CONSTRUCTION OF SUMP DRAINAGE MATERIAL**

| Property | Requirement |
|---|---|
| Grain Size | $\geq$ 95% greater than sump pipe perforations<br>< 5% passing #200 U.S. Sieve<br>Maximum particle size 3 inches |
| Permeability | $\geq 1 \times 10^{-1}$ cm/sec |
| USCS Class. | GW or GP |

Note: The Design Engineer may waive minor deviations from the Grain Size specification if the permeability is met.

4.3.3 Inspection

Inspection of soil placement shall at a minimum include:

- The surface on which soils are to be placed
- Determining that the construction activities are not adversely impacting other items such as piping and geosynthetics
- Monitoring lift thickness
- Observing the effect of compaction equipment on the material placed (e.g., penetration, pumping, and cracking)

- Observing placement for material segregation and uniformity of the moisture content
- Observing the compacted base for desiccation cracking on low permeability barrier layers
- Observing that the materials are placed to the lines and grades shown on the drawings

#### 4.3.3.1 General Fill

General Fill soils are used in a variety of applications both inside and outside of the lined construction area, including backfilling of over-excavated materials to design subgrade prior to constructing liner systems, and non-structural components such as surface-water control berms. General Fill soils are also used for construction of features outside of the lined area such as access roads, berms, surface water drainage structures, etc. The requirements for construction of General Fills are specific to the intended uses and described herein for components within the lined construction area.

General Fill shall be tested and meet the requirements as specified in Tables 2 and 2A above and approved by the CQA Monitor based on the specific use. General Fill shall be constructed in lifts not to exceed nine inches in loose thickness.

Areas within the lined portion of the construction that are backfilled with General Fill shall be scarified prior to filling, and proof rolled if to be overlain by synthetics, and shall not exhibit more than 2-inches of deflection. All surfaces within the lined area and temporary surface water control structures where General Fill are to be used shall be approved by the CQA Monitor prior to placing the General Fill.

Compaction of General Fill may be conducted with heavy construction equipment only as directed by the CQA Monitor and shall be uniformly conducted to provide consistency throughout the component. General Fill used for backfilling over-excavated materials within the lined area to form a subgrade for overlying liner components shall be placed and compacted in individual loose lifts no more than nine inches thick. General Fill used for backfilling internal temporary surface control berms on top of the liner system shall be placed and compacted in individual lifts of approximately 12 inches thick to prevent damage to underlying geotextiles. General Fills used in temporary surface water berms and other soils such as protective layer soils (as discussed below) constructed on top of liner and leachate collection drainage layers shall only be compacted with Low-Ground Pressure (LGP) track equipment and only to the extent to form a firm stable structure.

#### 4.3.3.2 Protective Soil Layer

A minimum 12-inch-thick protective layer of soils meeting specific criteria shall be placed above the leachate collection system on the floor to protect the underlying liner and leachate collection system components. The protective layer must be placed within a reasonable amount of time following construction of the underlying liner system to help protect the liner from the potential effects of freeze/thaw cycles.

Protective layer soils must be tested and meet the requirements shown on Tables 3 and 3A and the survey tolerances shown in Table 5 below. The protective layer soils shall be placed and

spread using only low ground-pressure track equipment approved by the CQA Engineer and the equipment shall not travel over the geotextile materials unless a minimum of 12-inches of protective soils separates the equipment from the geotextile materials.

Protective layer soils shall not be placed from the top of slopes downward but shall be placed from the bottom of slopes working upward. To be able to maintain the appropriate thickness of soils on slopes of 4H:1V or greater, the soils may be placed and verified ahead of refuse filling operations rather than in one single construction episode prior to refuse filling.

Compaction of the protective layer soils shall be avoided to prevent damage the underlying geotextile components. Incidental compaction from the equipment used to place and spread the soils is sufficient to firm and stabilize the soils until they can be covered with refuse.

#### 4.3.3.3 Sump Drainage Materials

The sump is filled with specified aggregate material meeting the test requirements of Tables 4 and 4A. Sump drainage materials shall be carefully placed into the sump to the limits shown on the drawings without damage to the underlying HDPE membrane or geocomposite drainage material. In no cases, shall sump drainage material be allowed to fall into place from a height of more than two feet.

The CQA Monitor shall constantly observe and monitor the placement of the sump drainage material and shall immediately halt placement of the sump drainage material if damage is suspected.

The CQA Monitor shall inspect the sump drainage material prior to, and during its placement to ensure is remains clean and continues to meet the requirements for fine material shown in Table 4A. No equipment shall be allowed directly on the sump drainage material once placed in the sump. Any grading or adjusting of the sump drainage material shall be done by hand or by bucket or hoe stationed outside of the sump limits.

## 4.4 Stormwater Controls

The stormwater controls at the MCLF consist primarily of “Vee” type and trapezoidal type ditches on the landfill interior and perimeter. The ditches will be constructed as per the reaches outlined in the EDOP Plate 8. The CQA controls include survey point sets obtained at 50-foot intervals and at vertical and horizontal breaks in grade. The point set will include a survey of each constructed ditch crest and the base of the ditch. The survey tolerances are as follows:

**TABLE 5**
**STORMWATER CONTROLS AND PROTECTIVE LAYER SOILS SURVEY TOLERANCES**

| | |
|---|---|
| Horizontal, All Points | plus or minus 0.20 feet of design coordinates (± 0.20 feet) |
| Vertical, Top of Protective Soils | plus 0.20 to minus 0.00 feet of design (+0.20 to -0.00 feet) |
| Vertical, Stormwater Controls | Plus 0.10 to minus 0.10 feet of design (+0.10 to -0.10 feet) |

## 4.5 Deficiencies

When deficiencies (items that do not meet specified values) are discovered, the CQA Monitor shall immediately determine the nature and extent of the problem and notify the Earthwork Contractor. In all cases, the CQA Monitor will attempt to notify the Earthwork Contractor within 1/2 hour of discovering the deficiency. If the deficiency will cause construction delays of more than one hour or will necessitate substantial rework, the CQA Monitor shall notify both the Earthwork Contractor and the Project Manager. The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Monitor. If the Earthwork Contractor is unable to correct the problem, the CQA Engineer will develop and present to the Project Manager suggested solutions for approval. If the solution involves a design revision, the Design Engineer shall also be contacted. The corrected deficiency shall be retested before additional work is performed by the Earthwork Contractor. All retests and steps taken to correct the problem shall be documented by the CQA Monitor.

# 5.0 GEOSYNTHETICS

## 5.1 General

Placement of geomembranes in construction of the landfill liner and final cover systems must be completed in accordance with the project construction drawings and specifications. To monitor compliance, a quality assurance program will be implemented that includes: (1) a review of the Geosynthetics Contractor's quality control submittals, (2) material conformance testing, (3) construction testing, and (4) construction observation. Conformance testing refers to activities that take place prior to material installation. Construction testing includes those activities that occur during geomembrane installation. All quality assurance testing shall be conducted in accordance with this CQA plan and with the project construction drawings and specifications. All field testing will be observed by the CQA Monitor. Documentation shall meet the requirements of the CQA plan.

## 5.2 High Density Polyethylene (HDPE)

### 5.2.1 Material

The HDPE materials used to line the facility shall have texturing on both sides of the material. Prior to ordering the material and delivery to the site, the Contractor shall provide the CQA Engineer with manufacturer's documentation that the resin and membrane meet the requirements and specifications shown in Tables 6 and 7.

**TABLE 6**
**HDPE RESIN AND EXTRUDATE REQUIREMENTS**

| Property | Test Method | Requirement |
|---|---|---|
| Resin | | |
| Density (gm/cm3) | ASTM D 1505 | $\geq$ 0.932 |
| Melt Flow Index (g/10 min) | ASTM D 1238 (190/2.16) | $\leq$1.0 |
| OIT (minutes) | ASTM D 3895 (1 ATM @ 200˚ C) | $\geq$ 100 |
| Extrudate | | |
| Carbon Black Content (%) | ASTM D 1603, modified | $\geq$ 2% |

**TABLE 7**
**HDPE GEOMEMBRANE MATERIAL SPECIFICATIONS (1)**

| Property | Units | Test Frequency | Test Method | 60-mil HDPE Two-Sided Textured |
|---|---|---|---|---|
| Thickness | Mils | Every Roll | ASTM D 5994 | 54 min; 57 min ave. |
| Formulated Density | $g/cm^3$ | 200,000 lb. | ASTM D 1505 /D 792 | 0.940 min. ave. |
| Carbon Black Content | % | 20,000 lb. | ASTM D 1603/D 4218 | 2.0 – 3.0 |
| Tensile Strength at Yield | ppi | 20,000 lb. | ASTM D 6693 | 126 min ave. |
| Tensile Strength at Break | ppi | 20,000 lb. | Same as above | 90 min ave. |
| Elongation at Yield | % | 20,000 lb. | Same as above | 12 min ave. |
| Elongation at Break | % | 20,000 lb. | Same as above | 100 min ave. |
| Tear Resistance | lbs. | 45,000 lb. | ASTM D 1004 | 42 min. ave. |
| Asperity Height | Mils | Every 2nd roll | ASTM D 7466 | 16 min. ave. |
| Oxidative Induction Time (2) | Minutes | 200,000 lb. | ASTM D 3895 (Stnd OIT) **OR** D 5885 (HP OIT) 200°C; $O_2$, 1 atm | 100 min. ave. Stnd **OR** 400 min. ave. HP |
| Puncture Resistance | lbs. | 45,000 lb. | ASTM D 4833 | 90 min. ave. |
| Carbon Black Dispersion | Category | 45,000 lb. | ASTM D 5596 | 9 of 10 in Cat 1, 2 Max 1 in Cat 3 |
| Oven Aging @ 85°C | % retained | 1 per formulation | ASTM D5721/D 3895 (Stnd OIT) **OR** D 5885 (HP OIT) | 55 min. ave. Stnd **OR** 80 min. ave. HP |
| UV Resistance | % retained | 1 per formulation | ASTM D 5885 (HP OIT) | 50 min. ave. HP |
| Stress Crack Resistance | Hrs. | 1 per every 2 resin lots | ASTM D 5397 (app) | 500 min. ave. |

(1) All testing shall be conducted in accordance with GRI GM 13 protocols
(2) OIT not standard MQC test, so may be approved as a reference property on Data Sheet

### 5.2.2 Delivery

The CQA Monitor shall verify the following on delivery of the material.

- Equipment used to unload the rolls will not damage the membrane.
- Care is used to unload the rolls.
- All documentation required by the specifications has been received.
- The roll numbers delivered to the site match the roll numbers that were tested in the

manufacturer's quality control test data submitted to confirm compliance with Tables 6 and 7. CQA Monitor will record the roll numbers delivered to the site for future reference.

At the discretion of the CQA Monitor, damaged rolls may be rejected and shall be removed from the site or stored at a location designated by the Owner that is separate from the accepted rolls. All rolls that do not have proper manufacturer's documentation will be rejected.

The CQA Engineer will not allow installation of the material to begin until reviewing and approving of the results of the conformance testing described below.

### 5.2.3 Conformance Testing

Conformance testing of samples collected from the rolls to be used at the facility shall be conducted at the rate of one test for every 100,000 square feet installed during any one construction event, or one sample per lot, whichever results in the greater number of conformance tests. The sample may be collected prior to shipment to the site, and in this case, the roll number from which the samples will be collected shall be included with all test reports and compared with the roll numbers delivered to the site. The sample shall be forwarded to the Third-Party Laboratory for the following tests:

- Density (ASTM D 792 Method A or ASTM D 1505)
- Carbon black content (ASTM D 1603 or D 4218)
- Thickness (ASTM D5994)
- Tensile characteristics (ASTM D 638 or D 6693/GRI GM13)
- Puncture Resistance (ASTM D 4833)
- Asperity Height (ASTM D 7466)

The CQA Monitor will review all test results and shall report any nonconformance with the requirements in Table 7 to the Project Manager and to the Geosynthetics Contractor.

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The CQA Monitor or sampler shall mark the machine direction, the manufacturer's roll identification number, and the date the sample was obtained on the sample.

### 5.2.4 Geomembrane Installation

#### 5.2.4.1 Surface Preparation

Prior to liner installation, the CQA Monitor shall verify that the following conditions exist:

- All lines and grades on the subgrade have been verified by a qualified surveyor.
- The subgrade has been prepared in accordance with the project requirements.
- The surface has been proof-rolled and compacted to be free of surface irregularities, loose

soil, and protrusions.

- There is no desiccation cracking of the subgrade surface.
- The supporting surface does not contain stones or other material that could damage the liner.
- There are no excessively soft areas that could result in liner damage.
- The clay liner testing, if used, is complete and meets specified values and approval to proceed with the geomembrane installation has been given by CQA Personnel.
- The GCL, if used, has been installed according to these plans and approval to proceed with the geomembrane installation has been given by CQA Personnel.
- All construction stakes and hubs have been removed.
- The Geosynthetics Contractor has certified in writing that the surface on which the geomembrane will be installed is acceptable.

5.2.4.2 Panel Placement

The Geosynthetics Contractor shall give each panel an identification number which shall be agreed to and used by the CQA Monitor, Project Manager, and the Geosynthetics Contractor. The CQA Monitor shall establish a chart showing correspondence between roll numbers, certification reports, and panel numbers. The CQA monitor shall record the panel number on the Panel Placement Log and Geomembrane Placement Record.

During panel placement, the CQA Monitor shall:

- Observe the sheet surface as it is deployed and record all panel defects and disposition of the defects (e.g., panel rejected or patch installed). All repairs are to be made in accordance with the specifications.
- Verify that equipment used does not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.
- Verify that the surface beneath the geomembrane has not deteriorated since previous acceptance.
- Verify there are no stones, construction debris, or other items beneath the geomembrane that could cause damage.
- Observe that the geomembrane is not dragged across an unprotected surface. If the geomembrane is dragged across an unprotected surface, the geomembrane shall be inspected for scratches and repaired or rejected, if necessary.
- Record weather conditions including temperature, wind, and humidity. The membrane shall not be deployed in the presence of excess moisture (e.g., rain, fog, dew, or mist).
- Verify that people working on the membrane do not smoke, wear shoes that could damage the membrane, or engage in activities that could damage the membrane.

- Verify that the method used to deploy the sheet minimizes wrinkles and that the sheets are anchored to prevent movement by wind. The CQA monitor will not specify anchorage methods (the Geosynthetics Contractor is responsible for any damage resulting to or from windblown membranes).

The CQA monitor shall inform both the Geosynthetics Contractor and the Project Manager if the above conditions are not met.

5.2.4.3 Trial Seams

Prior to seaming, each welder and seaming apparatus shall be tested in accordance with these requirements to determine if the equipment is functioning properly and conditions are amenable to seaming. Trial seams shall be conducted for each piece of equipment to be employed shall be conducted at the beginning of each seaming period, at least once every five hours, and if the ambient temperature changes more than 20 degrees F within any seaming period.

Samples for trial seams shall be at least five feet long and 12 inches wide with the seam centered lengthwise. Overlaps shall be at least four inches for fusion seams and three inches for extrusion seams. A minimum of five, one-inch-wide coupons at locations selected by the CQA Monitor shall be removed from each sample. Two coupons shall be tested in the peel mode and three coupons shall be tested in shear mode with a field tensiometer. For a seaming apparatus and seamer to be considered acceptable, the weld must meet the same requirements for peel and shear as the field seams and shown on Table 8 of Section 5.2.5.4. If a sample fails the trial weld, the reason for the failure must be determined, corrected, and another trial weld conducted. No seaming apparatus that does not have a passing trial weld shall be allowed to conduct seaming operations. Trial welds must be completed under conditions similar to those under which the panels will be seamed. If at any time during seaming the CQA Monitor believes that an operator or seaming apparatus is not functioning properly, additional trial welds shall be performed. If there are large changes in temperature (20 degrees F within a seaming period), humidity, or wind speed, the weld test shall be repeated.

5.2.4.4 Field Seaming

The Geosynthetics Contractor shall provide the Project Manager and CQA Monitor with a seam and panel layout drawing and is responsible for updating this drawing daily as the job proceeds. No panels shall be seamed until the panel layout drawing has been approved by the CQA Engineer. A seam numbering system shall be agreed to by the CQA Monitor, Project Manager, and Geosynthetics Contractor prior to the start of seaming operations. One procedure is to identify the seam by adjacent panels. For example, the seam located between Panel 120 and 302 would be Seam No. 120/302.

Acceptable seaming methods include double-fusion and extrusion. Double-fusion methods shall be the primary method and extrusion welding methods will only be used in cross-seams, patches, small repairs, or other awkward areas where an extrusion weld would result in a better weld than a double-fusion weld.

During seaming operations, the CQA Monitor shall verify the following:

- That the seaming apparatus to be used has successfully completed the trial weld procedures.
- The Geosynthetics Contractor has the number of seamers and spare parts agreed to in the pre-construction meeting.
- Equipment used for seaming does not damage the membrane.
- The extruder is purged prior to beginning a seam until all heat-degraded material is removed (extrusion welding only).
- Seam grinding has been completed less than one hour before seam welding (extrusion welding only).
- Seam edges are beveled and grind marks are perpendicular to the seam (extrusion welding only).
- Grind marks do not extend more than 1/4 inch from edge of weld.
- The ambient temperature measured within six inches of the membrane surface is between 32 and 150 degrees Fahrenheit, unless otherwise approved in writing by the CQA Engineer. Seaming conducted below 32 degrees Fahrenheit shall be conducted in accordance with GRI Test Method GM 9, "Cold Weather Seaming of Geomembrane".
- The end of old welds, more than 5 minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The weld is free of dust, dirt, moisture, or other contaminants.
- For cross seams, the seam is ground to a smooth incline prior to welding (fusion welding only).
- The seams are overlapped a minimum of 3 inches for extrusion welding and 4 inches for fusion welding.
- No solvents or adhesives are present in the seam area unless written approval has been received from the CQA Engineer.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being seamed in accordance with the plans and specifications.

The CQA Monitor shall prepare a Seaming Record and Seaming/Panel Placement Log to document seaming CQA activities.

### 5.2.5 Construction Testing

#### 5.2.5.1 Non-Destructive Seam Testing

One hundred percent of accessible seams shall be non-destructively tested for continuity by air

pressure (ASTM D 5820) of double fusion welds and vacuum box testing (ASTM D 5641) of extrusion welds. Occasionally seams must be constructed that cannot be tested by air pressure or vacuum box methods, and in these cases the CQA Monitor shall very thoroughly inspect the quality and continuity of the seam. Air pressure and vacuum box testing shall be conducted using the following procedures:

Air Pressure Testing

Air pressure testing is applicable to double fusion welding which produces a double seam with an enclosed space.

a. The equipment for air pressure testing shall consist of the following:
    i. An air pump (manual or motor driven) equipped with pressure gauge and capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the geomembrane.
    ii. A rubber hose with fittings and connections.
    iii. A sharp hollow needle or other pressure feed device approved by CQA Engineer.
b. The following procedures shall be followed:
    i. Seal both ends of the seam to be tested.
    ii. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
    iii. Insert a protective cushion between the air pump and the geomembrane.
    iv. Pressurize the air channel to a pressure of approximately 30 psi. Close valve, allow two minutes for pressure to stabilize, and sustain pressure for at least five minutes.
    v. If loss of pressure of 3 psi or more in the 5-minute test period is measured or does not stabilize, locate faulty area and repair in accordance with Section 5.2.5 and 5.2.6.
    vi. Cut opposite end of tested seam area once testing is completed to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area. Seam the cut end of the air channel.
    vii. Remove needle or other approved pressure feed device and seal the hole in the geomembrane.

Vacuum Testing

Vacuum testing is applicable to extrusion welding and to non-seam areas of the liner.

a. The equipment shall consist of the following:

i. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.

ii. A pump assembly equipped with a pressure controller and pipe connections.

iii. A rubber pressure/vacuum hose with fittings and connections.

iv. A soapy solution. (CQA Monitor shall ensure solution makes bubbles when air is passed through. Windshield washer fluid shall be used as anti-freeze in cold weather.)

v. A bucket and wide paintbrush, or other means of applying the soapy solution.

b. The following procedures shall be followed:

i. Wet a strip of geomembrane approximately 12 inches by 48 inches with the soapy solution.

ii. Place the box over the wetted area.

iii. Close the bleed valve and open the vacuum valve.

iv. Ensure that a leak-tight seal is created.

v. Energize the vacuum/venturi pump and reduce the applied pressure to approximately five psi (10 in of Hg) gauge.

vi. For a minimum of ten seconds, apply vacuum with the box placed and maintaining a seal, examine the geomembrane through the viewing window for the presence of soap bubbles.

vii. If no bubble appears after ten seconds, close the vacuum valve, open the bleed valve, move the box over the next adjoining area with a minimum three inches overlap, and repeat the process.

viii. All areas where soap bubbles appear shall be marked and repaired in accordance with Section 5.2.5.

During non-destructive testing operations, the CQA Monitor shall:

- Record and observe all continuity testing.
- Record the location, date, test number, technician name, and results of all testing. These results shall be recorded on the Panel Placement/Seaming Log.
- Mark the location of any defects requiring repairs.
- Mark the failed areas with a waterproof marker compatible with the liner (spray paint shall not be used) and inform the Geosynthetics Contractor and the Project Manager of any required repairs.
- Verify that all testing is completed in accordance with the project specifications.
- Verify that all repairs are completed and tested in accordance with the project

specifications.

5.2.5.2 Destructive Seam Testing

Destructive seam tests will be performed at one location per 500 feet of constructed seams. The test location shall be selected at the discretion of the CQA Monitor considering such factors as:

- Wrinkling in seam area
- Suspect seaming equipment
- Adverse weather conditions (wind, temperature, moisture)
- Possibility of dirt in the seam
- Failing tests

Destructive tests from a sump area shall be avoided unless the CQA Monitor identifies specific concerns with sump seams. Additional tests may be performed, if the CQA Monitor suspects the seam may not meet specification requirements or additional questionable areas are identified.

Destructive tests are performed to evaluate seam strength and to estimate long-term performance. Destructive testing shall be performed concurrently (within 2 working days of the time the seam is completed) with seaming operations, not at the completion of the installation.

Destructive testing consists of testing the strength of the seam in both the peel and shear modes. The CQA Monitor shall select locations where seam samples will be cut for laboratory testing. These locations shall be established as follows:

- A test location shall be determined on a sidewall section of seam at the discretion of the CQA Monitor. Test locations shall not be identified prior to welding. Locations selected may be prompted by liner distortion due to overheating, weld contamination, or any potential cause of poor welds as listed above. The Geosynthetics Contractor shall not be informed in advance of the destructive sample location(s).

- Additional destructive tests may be conducted at the discretion of the CQA Monitor based on the questionable quality of the seam or localized areas.

- Unless extenuating circumstances dictate, removing samples for destructive testing from the sump area shall be avoided.

Samples shall be removed by the Geosynthetics Contractor at locations identified by the CQA Monitor. The CQA Monitor shall:

- Observe sample cutting.
- Ensure each sample is marked sample with an identifying number that contains the seam

number and sample number.

- Ensure each sample location is recorded on the panel layout drawing and Seaming/Panel Layout Log.

Two types of samples shall be taken at each location. First, two seam samples (coupons), 1 inch wide by 12 inches long with the seam centered across the length, shall be taken 40-42 inches apart. These samples shall be tested in the field by the contractor using a tensiometer capable of quantitatively measuring shear and peel strengths. If one or both samples fails, the Geosynthetics Contractor can, at his discretion,

1. Reconstruct the seam between passed test locations, or
2. Take another test sample 10 feet from the point of the field test in each direction and repeat this procedure. If the second test passes, the Geosynthetics Contractor can either reconstruct or cap strip the seam between the two passed test locations. If subsequent tests fail, the procedure is repeated until the length of the poor-quality seam is established. Repeated failures indicate a problem with the seaming equipment or operator error (or both) and appropriate action shall be taken.

Once the field tests have passed, a sample shall be recovered from between passing field sample locations for Third party Laboratory testing. The sample shall be a minimum of 38 inches long by 12 inches wide, with the seam centered along the length. The recovered sample shall be divided into three parts: one 12-inch by 12-inch section shall be given to the Geosynthetics Contractor, one 12-inch by 12-inch sample shall be sent to the Third Party Laboratory for testing, and one 12-inch by 12-inch sample shall be given to the Owner for archiving. The results of the laboratory testing shall be recorded.

If the laboratory test fails in either peel or shear, the Geosynthetics Contractor may either reconstruct all the seams constructed with that particular seaming apparatus or additional samples may be recovered. If additional samples are to be recovered, samples must be taken on either side of the failed sample from seam constructed with the same seaming apparatus for third party testing. These samples must be taken at least 10 feet from the location of the failed sample and may require a sample from a different seam if necessary to bound the failing sample location by two passing samples constructed with the same seaming apparatus. Sample size and disposition shall be as described in the preceding paragraph. This process shall be repeated until passed tests bracket the failed seam section. All seams shall be bounded by locations from which passing Third Party Laboratory tests have been taken. In cases involving more than 50 feet of reconstructed or cap stripped seam, the reconstructed or cap stripped seam must also be tested. Third party Laboratory testing governs seam acceptance. In no case shall field testing of installed seams be used for final acceptance.

#### 5.2.5.3 Third Party Laboratory Testing

Destructive samples shall be shipped by the CQA Monitor to the Third Party Laboratory on the same day the sample is obtained. Testing shall include seam strength and peel (ASTM D 6392).

At least five (5) specimens shall be tested in peel and 5 specimens in shear. At least 4 of the 5 specimens tested by each method must meet the minimum test values presented below with the failing test a minimum of 80% of the specified value, except for Maximum Seam Separation in Peel which must be met for all five specimens. The Third Party Laboratory shall provide test results within 24 hours in writing or via telephone conversation with the CQA Monitor. Final written test results are to be provided within 5 days. The CQA Monitor shall immediately notify the Geosynthetics Contractor in the event of a failed test. No areas, except as necessary to provide wind protection or to prevent the penetration of water beneath the geomembrane, are to be covered prior to receiving Third party Laboratory test results and approval from the CQA Monitor.

5.2.5.4 Passing Criteria for Welds

Passing criteria for trial weld and destructive seam tests are shown in Table 8 below. Failure to meet the criteria for trial welds in Table 8 shall render the equipment that was used in the failed trial weld unacceptable until the reason for the failure has been identified and rectified and until approval for its use is given by the CQA Monitor. Failure to meet the criteria in Table 8 for constructed seams shall trigger an investigation of the cause of the failure. The problem shall be rectified to the satisfaction of the CQA Monitor and additional confirmatory destructive tests shall be conducted.

**TABLE 8**
**HDPE GEOMEMBRANE MINIMUM STRENGTHS**
**PER ASTM D 6392 OR EQUIVALENT**

| Type of Weld | Shear Strength | Peel Strength | Maximum Seam Separation in Peel | Minimum Strain at Break in Shear |
|---|---|---|---|---|
| Fusion Weld | 120 ppi | 91 ppi | 25% of seam | 50% |
| Extrusion Weld | 120 ppi | 78 ppi | 25% of seam | 50% |

Notes: Only peel and shear strength tests are required in field. Seam separation and strain are laboratory only tests.
Values are valid for 60-mil HDPE, double-side textured.

5.2.6 Repairs

Any portion of the geomembrane with a flaw or that fails a non-destructive or destructive test shall be repaired in accordance with these requirements. The CQA Monitor shall locate and describe all repairs on the appropriate CQA form, as follows:

- Patching – used to repair large holes, tears, large panel defects, and destructive sample locations.
- Extrusion – used to repair small defects in the panels and seams. In general, this procedure shall be used for defects less than 3/8 inch in the largest dimension.
- Capping – used to repair failed welds or to cover longer lengths of seams.

- Removal – used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembrane.

#### 5.2.7 Wrinkles, Bridging & Folding

Placing soil cover or drain materials over the geomembrane, temperature changes, or creep may cause wrinkles to develop in the geomembrane. Any wrinkles that can fold over shall be repaired either by cutting out excess material, or, if possible, allowing the liner to contract due to temperature reduction. Wrinkles greater than 12 inches in height that cannot be reduced or mitigated by other means shall be cut out, removed, and repaired. The CQA Monitor shall closely monitor equipment travel over the geomembrane and placement of overlying components to prevent any wrinkle from folding over. In no case shall material be placed over the geomembrane that could result in geomembrane folding.

Unless approved by the CQA Engineer, bridging must be removed.

All folded geomembrane shall be removed and repaired in accordance with the requirements for installation of the original membrane.

#### 5.2.8 Geomembrane Acceptance

The Geosynthetics Contractor shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner. In the event the Geosynthetics Contractor is responsible for placing materials over the geomembrane, the Geosynthetics Contractor shall retain ownership and responsibility for the geomembrane until the cover is placed. The geomembrane shall be accepted by the CQA Engineer when:

- The installation is finished.
- All defects have been repaired, tested, and approved.
- All seams have been inspected, field tested, and approved.
- All required laboratory tests have been completed and approved.
- All required Geosynthetics Contractor supplied documentation has been received and approved.
- All record drawings have been completed and approved.

### 5.3 Linear Low-Density Polyethylene (LLDPE)

#### 5.3.1 Material

Prior to ordering the material and delivery to the site, the Contractor shall provide the CQA Engineer with manufacturer's documentation that the resin and membrane meet the requirements and specifications shown in Tables 9 and 10.

**TABLE 9**
**LLDPE RESIN REQUIREMENTS**

| Property | Test Method | Requirement |
|---|---|---|
| Density (gm/cm3) | ASTM D 1505 | $\geq$ 0.915 |
| Melt Flow Index (g/10 min) | ASTM D 1238 (190/2.16) | $\leq$1.0 |
| OIT (minutes) | ASTM D 3895 (1 ATM @ 200˚ C) | $\geq$ 100 |

**TABLE 10**
**LLDPE GEOMEMBRANE MATERIAL SPECIFICATIONS (1)**

| Property | Units | Test Frequency | Test Method | 60-mil LLDPE Two-Sided Textured |
|---|---|---|---|---|
| Thickness | Mils | Every Roll | ASTM D 5994 | 51 min; 57 min ave. |
| Formulated Density | g/cm$^3$ | 200,000 lb. | ASTM D 1505 / D 792 | 0.939 max |
| Carbon Black Content | % | 45,000 lb. | ASTM D 1603/D 4218 | 2.0 – 3.0 |
| Tensile Strength at Break | ppi | 20,000 lb. | ASTM D 6693 | 90 min ave. |
| Elongation at Break | % | 20,000 lb. | ASTM D 6693 | 250 min ave. |
| Tear Resistance | lbs. | 45,000 lb. | ASTM D 1004 | 33 min ave. |
| Asperity Height | Mils | Every 2nd roll | ASTM D 7466 | 16 min ave. |
| Oxidative Induction Time (2) | Minutes | 200,000 lb. | ASTM D 3895 (Stnd OIT) **OR** D 5885 (HP OIT) | 100 min ave. (Stnd) **OR** 400 min. ave. (HP) |
| Puncture Resistance | lbs. | 45,000 lb. | ASTM D 4833 | 66 min ave. |
| Carbon Black Dispersion | Category | 45,000 lb. | ASTM D 5596 | 9 of 10 in Cat 1, 2 Max 1 in Cat 3 |
| Oven Aging @ 85°C | % Retained | 1 per formulation | ASTM D 5721/3895 (Stnd OIT) **OR** D 5885 (HP OIT) | 35 min. ave. (Stnd) **OR** 60 min. ave. (HP) |
| UV Resistance | % Retained | 1 per formulation | ASTM D 5885 (HP) | 35 min. ave. |

(1) All testing shall be conducted in accordance with GRI GM17 protocols.
(2) OIT not standard MQC test, so may be approved as a reference property on Data Sheet

The CQA Engineer will not allow installation of the material to begin until reviewing and approving of the results of the conformance testing described below.

The CQA Monitor will review all test results and shall report any nonconformance with the requirements in Table 10 to the Project Manager and to the Geosynthetics Contractor.

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless

otherwise specified, samples shall be 3 feet long by the roll width. The CQA Monitor or sampler shall mark the machine direction, the manufacturer's roll identification number, and the date the sample was obtained on the sample.

### 5.3.2 Delivery

The CQA Monitor shall verify the following on delivery of the material.

- Equipment used to unload the rolls will not damage the membrane.
- Care is used to unload the rolls.
- All documentation required by the specifications has been received.
- The roll numbers delivered to the site match the roll numbers that were tested in the manufacturer's quality control test data submitted to confirm compliance with Tables 9 and 10. CQA Monitor will record the roll numbers delivered to the site for future reference.

At the discretion of the CQA Monitor, damaged rolls may be rejected and shall be removed from the site or stored at a location designated by the Owner that is separate from the accepted rolls. All rolls that do not have proper manufacturer's documentation will be rejected.

### 5.3.3 Conformance Testing

Conformance testing of samples collected from the rolls to be used at the facility shall be conducted at the rate of one test for every 100,000 square feet installed during any one construction event, or one sample per lot, whichever results in the greater number of conformance tests. The sample may be collected prior to shipment to the site, and in this case, the roll number from which the samples will be collected shall be included with all test reports and compared with the roll numbers delivered to the site. The sample shall be forwarded to the Third-Party Laboratory for the following tests:

- Density (ASTM D 792 Method A or ASTM D 1505)
- Carbon black content (ASTM D 1603 or D 4218)
- Thickness (ASTM D5994)
- Tensile characteristics (ASTM D 638 or D 6693/GRI GM13)
- Puncture Resistance (ASTM D 4833)
- Asperity Height (ASTM D 7466)

### 5.3.4 Geomembrane Installation

#### 5.3.4.1 Surface Preparation

Prior to liner installation, the CQA Monitor shall verify that the following conditions exist:

- All lines and grades have been verified by a qualified surveyor.

- The subgrade has been prepared in accordance with the specifications.
- The surface has been proof-rolled and compacted to be free of surface irregularities, loose soil, and protrusions.
- There is no desiccation cracking of the soil liner surface.
- The supporting surface does not contain stones or other material that could damage the liner.
- There are no excessively soft areas that could result in liner damage.
- The soil liner testing is complete and meets specified values.
- All construction stakes and hubs have been removed.
- The Geosynthetics Contractor has certified in writing that the surface on which the geomembrane will be installed is acceptable.

5.3.4.2 Panel Placement

The Geosynthetics Contractor shall give each panel an identification number which shall be agreed to and used by the CQA Monitor, Project Manager, and the Geosynthetics Contractor. The CQA Monitor shall establish a chart showing correspondence between roll numbers, certification reports, and panel numbers. The CQA monitor shall record the panel number on the Panel Placement Log and Geomembrane Placement Record.

During panel placement, the CQA Monitor shall:

- Observe the sheet surface as it is deployed and record all panel defects and disposition of the defects (e.g., panel rejected or patch installed). All repairs are to be made in accordance with the specifications.
- Verify that equipment used does not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.
- Verify that the surface beneath the geomembrane has not deteriorated since previous acceptance.
- Verify there are no stones, construction debris, or other items beneath the geomembrane that could cause damage.
- Observe that the geomembrane is not dragged across an unprotected surface. If the geomembrane is dragged across an unprotected surface, the geomembrane shall be inspected for scratches and repaired or rejected, if necessary.
- Record weather conditions including temperature, wind, and humidity. The membrane shall not be deployed in the presence of excess moisture (e.g., rain, fog, dew, or mist).
- Verify that people working on the membrane do not smoke, wear shoes that could damage the membrane, or engage in activities that could damage the membrane.

- Verify that the method used to deploy the sheet minimizes wrinkles and that the sheets are anchored to prevent movement by wind. The CQA monitor will not specify anchorage methods (the Geosynthetics Contractor is responsible for any damage resulting to or from windblown membranes).

The CQA monitor shall inform both the Geosynthetics Contractor and the Project Manager if the above conditions are not met.

#### 5.3.4.3 Trial Seams

Prior to seaming, each welder and seaming apparatus shall be tested in accordance with these requirements to determine if the equipment is functioning properly and conditions are amenable to seaming. Trial seams shall be conducted for each piece of equipment to be employed shall be conducted at the beginning of each seaming period, at least once every five hours, and if the ambient temperature changes more than 20 degrees F within any seaming period.

Samples for trial seams shall be at least five feet long and 12 inches wide with the seam centered lengthwise. Overlaps shall be at least four inches for fusion seams and three inches for extrusion seams. A minimum of five, one-inch-wide coupons at locations selected by the CQA Monitor shall be removed from each sample. Two coupons shall be tested in the peel mode and three coupons shall be tested in shear mode with a field tensiometer. For a seaming apparatus and seamer to be considered acceptable, the weld must meet the same requirements for peel and shear as the field seams and shown on Table 11 in Section 5.3.5.4. If a sample fails the trial weld, the reason for the failure must be determined, corrected, and another trial weld conducted. No seaming apparatus that does not have a passing trial weld shall be allowed to conduct seaming operations. Trial welds must be completed under conditions similar to those under which the panels will be seamed. If at any time during seaming the CQA Monitor believes that an operator or seaming apparatus is not functioning properly, additional trial welds shall be performed. If there are large changes in temperature (20 degrees F within a seaming period), humidity, or wind speed, the weld test shall be repeated.

#### 5.3.4.4 Field Seaming

The Geosynthetics Contractor shall provide the Project Manager and CQA Monitor with a seam and panel layout drawing and is responsible for updating this drawing daily as the job proceeds. No panels shall be seamed until the panel layout drawing has been approved by the CQA Engineer. A seam numbering system shall be agreed to by the CQA Monitor, Project Manager, and Geosynthetics Contractor prior to the start of seaming operations. One procedure is to identify the seam by adjacent panels. For example, the seam located between Panel 120 and 302 would be Seam No. 120/302.

Acceptable seaming methods include double-fusion and extrusion. Double-fusion methods shall be the primary method and extrusion welding methods will only be used in cross-seams, patches, small repairs, or other awkward areas where an extrusion weld would result in a better weld than an extrusion weld.

During seaming operations, the CQA Monitor shall verify the following:

- That the seaming apparatus to be used has successfully completed the trial weld procedures.
- The Geosynthetics Contractor has the number of seamers and spare parts agreed to in the pre-construction meeting.
- Equipment used for seaming does not damage the membrane.
- The extruder is purged prior to beginning a seam until all heat-degraded material is removed (extrusion welding only).
- Seam grinding has been completed less than one hour before seam welding (extrusion welding only).
- Seam edges are beveled and grind marks are perpendicular to the seam (extrusion welding only).
- Grind marks do not extend more than 1/4 inch from edge of weld.
- The ambient temperature measured within six inches of the membrane surface is between 32 and 150 degrees Fahrenheit, unless otherwise approved in writing by the CQA Engineer. Seaming conducted below 32 degrees Fahrenheit shall be conducted in accordance with GRI Test Method GM 9, "Cold Weather Seaming of Geomembrane".
- The end of old welds, more than 5 minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The weld is free of dust, dirt, moisture, or other contaminants.
- For cross seams, the seam is ground to a smooth incline prior to welding (fusion welding only).
- The seams are overlapped a minimum of 3 inches for extrusion welding and 4 inches for fusion welding.
- No solvents or adhesives are present in the seam area unless written approval has been received from the CQA Engineer.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being seamed in accordance with the plans and specifications.

The CQA Monitor shall prepare a Seaming Record and Seaming/Panel Placement Log to document seaming CQA activities.

### 5.3.5 Construction Testing

#### 5.3.5.1 Non-Destructive Seam Testing

One hundred percent of accessible seams shall be non-destructively tested for continuity by air pressure (ASTM D 5820) of double fusion welds and vacuum box testing (ASTM D 5641) of

extrusion welds. Occasionally seams must be constructed that cannot be tested by air pressure or vacuum box methods, and in these cases the CQA Monitor shall very thoroughly inspect the quality and continuity of the seam. Air pressure and vacuum box testing shall be conducted using the following procedures:

Air Pressure Testing

Air pressure testing is applicable to double fusion welding which produces a double seam with an enclosed space.

a. The equipment for air pressure testing shall consist of the following:
    i. An air pump (manual or motor driven) equipped with pressure gauge and capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the geomembrane.
    ii. A rubber hose with fittings and connections.
    iii. A sharp hollow needle or other pressure feed device approved by CQA Engineer.
b. The following procedures shall be followed:
    i. Seal both ends of the seam to be tested.
    ii. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
    iii. Insert a protective cushion between the air pump and the geomembrane.
    iv. Pressurize the air channel to a pressure of approximately 30 psi. Close valve, allow two minutes for pressure to stabilize, and sustain pressure for at least five minutes.
    v. If loss of pressure of 3 psi or more in the 5-minute test period is measured or does not stabilize, locate faulty area and repair in accordance with Sections 5.3.5 and 5.3.6.
    vi. Cut opposite end of tested seam area once testing is completed to verify continuity of the air channel. If air does not escape, locate blockage, and retest unpressurized area. Seam the cut end of the air channel.
    vii. Remove needle or other approved pressure feed device and seal the hole in the geomembrane.

Vacuum Testing

Vacuum testing is applicable to extrusion welding and to non-seam areas of the liner.

a. The equipment shall consist of the following:
    i. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.

ii. A pump assembly equipped with a pressure controller and pipe connections.

iii. A rubber pressure/vacuum hose with fittings and connections.

iv. A soapy solution. (CQA Monitor shall ensure solution makes bubbles when air is passed through. Windshield washer fluid shall be used as anti-freeze in cold weather).

v. A bucket and wide paintbrush, or other means of applying the soapy solution.

b. The following procedures shall be followed:

i. Wet a strip of geomembrane approximately 12 inches by 48 inches with the soapy solution.

ii. Place the box over the wetted area.

iii. Close the bleed valve and open the vacuum valve.

iv. Ensure that a leak-tight seal is created.

v. Energize the vacuum/venturi pump and reduce the applied pressure to approximately five psi (10 in of Hg) gauge.

vi. For a minimum of ten seconds, apply vacuum with the box placed and maintaining a seal, examine the geomembrane through the viewing window for the presence of soap bubbles.

vii. If no bubble appears after ten seconds, close the vacuum valve, open the bleed valve, move the box over the next adjoining area with a minimum three inches overlap, and repeat the process.

viii. All areas where soap bubbles appear shall be marked and repaired in accordance with Section 5.3.5.

During non-destructive testing operations, the CQA Monitor shall:

- Record and observe all continuity testing.
- Record the location, date, test number, technician name, and results of all testing.

  These results shall be recorded on the Panel Placement/Seaming Log.
- Mark the location of any defects requiring repairs.
- Mark the failed areas with a waterproof marker compatible with the liner (spray paint shall not be used), and inform the Geosynthetics Contractor and the Project

  Manager of any required repairs.
- Verify that all testing is completed in accordance with the project specifications.
- Verify that all repairs are completed and tested in accordance with the project specifications.

5.3.5.2 Destructive Seam Testing

Destructive seam tests will be performed at one location per 500-feet of constructed seams. The test location shall be selected at the discretion of the CQA Monitor considering such factors as:

- Wrinkling in seam area
- Suspect seaming equipment
- Adverse weather conditions (wind, temperature, moisture)
- Possibility of dirt in the seam
- Failing tests

Additional tests may be performed, if the CQA Monitor suspects the seam may not meet specification requirements or additional questionable areas are identified.

Destructive tests are performed to evaluate seam strength and to estimate long-term performance. Destructive testing shall be performed concurrently (within 2 working days of the time the seam is completed) with seaming operations, not at the completion of the installation.

Destructive testing consists of testing the strength of the seam in both the peel and shear modes. The CQA Monitor shall select locations where seam samples will be cut for laboratory testing. These locations shall be established as follows:

- A test location shall be determined on a sidewall section of seam at the discretion of the CQA Monitor. Test locations shall not be identified prior to welding. Locations selected may be prompted by liner distortion due to overheating, weld contamination, or any potential cause of poor welds as listed above. The Geosynthetics Contractor shall not be informed in advance of the destructive sample location(s).
- Additional destructive tests may be conducted at the discretion of the CQA Monitor based on the questionable quality of the seam or localized areas.

Samples shall be removed by the Geosynthetics Contractor at locations identified by the CQA Monitor. The CQA Monitor shall:

- Observe sample cutting.
- Ensure each sample is marked sample with an identifying number that contains the seam number and sample number.
- Ensure each sample location is recorded on the panel layout drawing and Seaming/Panel Layout Log.

Two types of samples shall be taken at each location. First, two seam samples (coupons), 1 inch wide by 12 inches long with the seam centered across the length, shall be taken 40-42 inches

apart. These samples shall be tested in the field by the contractor using a tensiometer capable of quantitatively measuring shear and peel strengths. If one or both samples fails, the Geosynthetics Contractor can, at his discretion,

1. Reconstruct the seam between passed test locations, or
2. Take another test sample 10 feet from the point of the field test in each direction and repeat this procedure. If the second test passes, the Geosynthetics Contractor can either reconstruct or cap strip the seam between the two passed test locations. If subsequent tests fail, the procedure is repeated until the length of the poor-quality seam is established. Repeated failures indicate a problem with the seaming equipment or operator error (or both) and appropriate action shall be taken.

Once the field tests have passed, a sample shall be recovered from between passing field sample locations for Third party Laboratory testing. The sample shall be a minimum of 38 inches long by 12 inches wide, with the seam centered along the length. The recovered sample shall be divided into three parts: one 12-inch by 12-inch section shall be given to the Geosynthetics Contractor, one 12-inch by 12-inch sample shall be sent to the Third Party Laboratory for testing, and one 12-inch by 12-inch sample shall be given to the Owner for archiving. The results of the laboratory testing shall be recorded.

If the laboratory test fails in either peel or shear, the Geosynthetics Contractor may either reconstruct all the seams constructed with that particular seaming apparatus or additional samples may be recovered. If additional samples are to be recovered, samples must be taken on either side of the failed sample from seam constructed with the same seaming apparatus for third party testing. These samples must be taken at least 10 feet from the location of the failed sample and may require a sample from a different seam if necessary to bound the failing sample location by two passing samples constructed with the same seaming apparatus. Sample size and disposition shall be as described in the preceding paragraph. This process shall be repeated until passed tests bracket the failed seam section. All seams shall be bounded by locations from which passing Third Party Laboratory tests have been taken. In cases involving more than 50 feet of reconstructed or cap stripped seam, the reconstructed or cap stripped seam must also be tested. Third party Laboratory testing governs seam acceptance. In no case shall field testing of installed seams be used for final acceptance.

5.3.5.3 Third Party Laboratory Testing

Destructive samples shall be shipped by the CQA Monitor to the Third-Party Laboratory on the same day the sample is obtained. Testing shall include seam strength and peel (ASTM. D. 6392). At least five (5) specimens shall be tested in peel and 5 specimens in shear. At least 4 of the 5 specimens tested by each method must meet the minimum test values presented below and the failing specimen must exhibit strength of at least 80% of the specified value, except for Maximum Seam Separation in Peel which must be met for all five specimens. The Third-Party Laboratory shall provide test results within 24 hours in writing or via telephone conversation with the CQA Monitor. Final written test results are to be provided within 5 days. The CQA Monitor shall immediately notify the Geosynthetics Contractor in the event of a failed test. No

areas, except as necessary to provide wind protection or to prevent the penetration of water beneath the geomembrane, are to be covered prior to receiving Third party Laboratory test results and approval from the CQA Monitor.

5.3.5.4 Passing Criteria for Welds

Passing criteria for trial weld and destructive seam tests are shown in Table 11 below. Failure to meet the criteria for trial welds in Table 11 shall render the equipment that was used in the failed trial weld unacceptable until the reason for the failure has been identified and rectified and until approval for its use is given by the CQA Monitor. Failure to meet the criteria in Table 11 for constructed seams shall trigger an investigation of the cause of the failure. The problem shall be rectified to the satisfaction of the CQA Monitor and additional confirmatory destructive tests shall be conducted.

**TABLE 11**
**LLDPE GEOMEMBRANE MINIMUM STRENGTHS**
**PER ASTM D 6392 OR EQUIVALENT**

| Type of Weld | Shear Strength | Peel Strength | Maximum Seam Separation in Peel | Minimum Strain at Break in Shear |
|---|---|---|---|---|
| Fusion Weld | 90 ppi | 75 ppi | 25% of seam | 50% |
| Extrusion Weld | 90 ppi | 66 ppi | 25% of seam | 50% |

Note: Only peel and shear strength tests are required in field. Seam separation and strain are laboratory only tests.

5.3.6 Repairs

Any portion of the geomembrane with a flaw or that fails a non-destructive or destructive test shall be repaired in accordance with these requirements. The CQA Monitor shall locate and describe all repairs on the appropriate CQA form, as follows:

- Patching – used to repair large holes, tears, large panel defects, and destructive sample locations.
- Extrusion – used to repair small defects in the panels and seams. In general, this procedure shall be used for defects less than 3/8 inch in the largest dimension.
- Capping – used to repair failed welds or to cover longer lengths of seams.
- Removal – used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembrane.

5.3.7 Wrinkles, Bridging & Folding

Placing soil cover or drain materials over the geomembrane, temperature changes, or creep may cause wrinkles to develop in the geomembrane. Any wrinkles that can fold over shall be repaired either by cutting out excess material, or, if possible, allowing the liner to contract due to temperature reduction. Wrinkles greater than 12 inches in height that cannot be reduced or

mitigated by other means shall be cut out, removed, and repaired. The CQA Monitor shall closely monitor equipment travel over the geomembrane and placement of overlying components to prevent any wrinkle from folding over. In no case shall material be placed over the geomembrane that could result in geomembrane folding.

Unless approved by the CQA Engineer, bridging must be removed.

All folded geomembrane shall be removed and repaired in accordance with the requirements for installation of the original membrane.

#### 5.3.8 Geomembrane Acceptance

The Geosynthetics Contractor shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner. In the event the Geosynthetics Contractor is responsible for placing materials over the geomembrane, the Geosynthetics Contractor shall retain ownership and responsibility for the geomembrane until the cover is placed. The geomembrane shall be accepted by the CQA Engineer when:

- The installation is finished.
- All defects have been repaired, tested, and approved.
- All seams have been inspected, field tested, and approved.
- All required laboratory tests have been completed and approved.
- All required Geosynthetics Contractor supplied documentation has been received and approved.
- All record drawings have been completed and approved.

### 5.4 Geocomposite

A synthetic geocomposite drainage material is designed on the base of the disposal cells to transmit leachate to the sump for removal. The geocomposite consists of a polyethylene geonet with a minimum eight-ounce per square yard non-woven geotextile bonded to each side.

#### 5.4.1 Material

The geocomposite must meet or exceed the properties shown in Table 12. Prior to ordering the material and delivery to the site, the Contractor shall provide the CQA Engineer with manufacturer’s documentation that the Geocomposite meets the requirements and specifications shown in Table 12.

**TABLE 12**
**MINIMUM GEOCOMPOSITE MATERIAL REQUIREMENTS (1)**

| Property | Units | Test Method | Manufacturer's QC Test Frequency (2) | Specified Value |
|---|---|---|---|---|
| **Geocomposite** | | | | |
| Transmissivity (3) | gpm/ft | ASTM D 4716 | 1/200,000 lbs. | 0.54 min. ave. |
| Ply Adhesion | lb./in | ASTM D 7005 | 1/100,000 lbs. | 1.0 min. ave. |
| **Geonet Core** | | | | |
| Thickness | (mil) | ASTM D 5199 | 1/50,000 lbs. | 200 min. ave. |
| Density | $g/cm^3$ | ASTM D 1505/D 792 | 1/50,000 lbs. | 0.95 |
| Compressive Strength | $lb./in^2$ | ASTM D 6364 | 1/100,000 lbs. | 120 min. ave. |
| Carbon Black Content | % | ASTM D 1603/D 4218 | 1/100,000 $ft^2$ | 1.5-3.0 range |
| **Geotextile (prior to lamination)** | | | | |
| Mass per unit area | $oz/yd^2$ | ASTM D 5261 | 1/100,000 $ft^2$ | 8.0 MARV |
| Grab Tensile | (lbs.) | ASTM D 4632 | 1/100,000 $ft^2$ | 200 MARV |
| Puncture strength | (lbs.) | ASTM D 6241 | 1/100,000 $ft^2$ | 430 MARV |
| Tear Strength | (lbs.) | ASTM D 4533 | 1/100,000 $ft^2$ | 80 MARV |
| AOS-max opening size | U.S. Sieve | ASTM D 4751 | 1/100,000 $ft^2$ | 80 US sieve |
| Permittivity | ($sec^{-1}$) | ASTM D 4491 | 1/100,000 $ft^2$ | 1.2 $sec^{-1}$ |
| UV Resistance | (% retained) | ASTM D 4355 (500 hrs.) | Once per formulation | 50 retained |

(1) All tests shall be conducted in accordance with GRI GN4 protocols, except for geocomposite Transmissivity as noted in (3).
(2) Minimum one test per lot or specified frequency, whichever results in the higher number of tests.
(3) Tested between two steel plates at 0.1 gradient, confined at 10,000 psf, after 15 minutes.

The contractor must submit documentation of the proposed material to the CQA Engineer for review for compliance with the above specifications prior to delivery of the material to the site and the CQA Engineer must confirm that the material characteristics meets or exceeds the minimum requirements in Table 12. The CQA Engineer will not allow installation of the material to begin until reviewing and approving of the results of the conformance testing described below.

### 5.4.2 Conformance Testing

Conformance testing of samples collected from the finished geocomposite rolls to be used at the facility shall be conducted at the rate of one test for every 100,000 square feet installed during any one construction event, or one sample per lot, whichever results in the greater number of conformance tests. The sample may be collected prior to shipment to the site, and in this case, the roll number from which the samples will be collected shall be included with all test reports and compared with the roll numbers delivered to the site. The sample shall be forwarded to the Third-Party Laboratory for the following tests:

- Transmissivity (ASTM D 4716)
- Ply Adhesion (ASTM D 7005)

The CQA Monitor will review all test results and shall report any nonconformance with the

requirements in Table 12 to the Project Manager and to the Geosynthetics Contractor.

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The CQA Monitor or sampler shall mark the machine direction, the manufacturer's roll identification number, and the date the sample was obtained on the sample.

Upon delivery to the site the CQA Monitor shall verify the following:

- Equipment used to unload the rolls will not damage the geotextile
- Care is used to unload the rolls
- All documentation required by this plan have been received
- Each roll has the name of the manufacturer, product identification, lot number, roll number, and roll dimensions.
- The geocomposite is stored off the ground and shall be protected from puncture, cutting, excessive heat and cold, moisture, mud, dirt, or other deleterious conditions. The CQA Monitor can reject any rolls that he feels have been damaged and will not meet the requirements of this plan.

Any damaged rolls shall be rejected and removed from the site. All rolls that do not have proper manufacturer's documentation shall be stored at a separate location until all documentation has been received and approved.

### 5.4.3 Installation

#### 5.4.3.1 Surface Preparation

The CQA Monitor shall ensure that all installation, inspections, and testing of the underlying geosynthetic membrane has been completed and approval to begin placement of the geocomposite has been given by the CQA Engineer.

The CQA Monitor shall inspect the underlying geomembrane immediately prior to placement of the geocomposite to ensure that conditions are suitable for the geocomposite installation. Excessive soil, dirt, rock, trash, or other deleterious materials shall be removed from the membrane. In addition, the CQA Monitor shall verify that the geomembrane complies with Section 5.2.7 of this plan regarding potential folding of wrinkles.

#### 5.4.3.2 Installation

The geocomposite shall be installed to the lines and grades shown on the drawings. Only small four-wheeler ATV type equipment may be used directly over the geomembrane to install the geocomposite and must be approved by the CQA Monitor. There shall be no vehicle travel directly on the geocomposite except as provided for in Section 5.4.3.4. The CQA Monitor shall closely monitor equipment travel over the geomembrane and ensure any damage is repaired prior

to covering with the geocomposite.

The CQA Monitor shall ensure that:

- Panel placement shall be planned such that no horizontal seams on slopes steeper than 5H:1V except in the sump, and this shall be avoided as much as possible, and only constructed with approval by the CQA Engineer.
- The geonet component of each panel shall be overlapped a minimum of 4 inches.
- The upper geotextile of adjoining panels is continuously heat lystered to prevent entry of fines into the geocomposite drainage net.
- All exposed edges of the geonet component are protected from intrusion of fine soil materials by continuous heat lystering a strip of geotextile to both the upper and lower geotextile components of the geocomposite.
- Cutting tools do not damage the underlying geomembrane.
- Nylon strings, plastic fasteners (zip ties) or polymer braid are used to join adjacent panels. No metallic fasteners shall be allowed.
- On slopes of 5H:1V or less, seams and cross-seams shall be joined using the methods allowed above at minimum 10-foot intervals. For slopes steeper than 5H:1V such as the sump slopes, panels shall be joined using the methods allowed above at minimum 5-foot intervals for seams running up and down the slope and at 2-foot intervals for cross seams perpendicular to the maximum slope angle. Panel layout shall be planned such that seams running perpendicular to the direction of maximum slope on slopes greater than 5H:1V (i.e., along the slope rather than up and down the slope) shall be avoided.
- All geotextile is covered prior to 500 hours of exposure to ultraviolet radiation (sunlight).

#### 5.4.3.3 Repairs

The CQA Monitor shall inspect the geocomposite during installation and note any holes or defects requiring repair. Repairs shall be accomplished by placing a geocomposite patch that extends a minimum of one foot beyond the damaged area and secured to the underlying geocomposite every 6 inches by one of the methods provided for in Section 5.4.3.2.

If any damaged area extends more than 50% of the width of a panel, the entire section shall be cut out and the two remaining portions of geocomposite joined with a new section of geocomposite as described in Section 5.4.3.2.

#### 5.4.3.4 Placement of overlying materials

Only low-ground pressure track equipment approved by the Design Engineer is allowed to travel over the geocomposite to place protective soils, and then only if a minimum one-foot of protective soil exists between the equipment and the geocomposite. If necessary to conduct repairs, etc., any vehicle travel directly on the geocomposite shall obtain prior approval by the

CQA Engineer, and any such vehicle travel will be thoroughly inspected by the CQA Engineer.

Sharp turns of the track equipment are prohibited, and the placement sequence should minimize any turns over the geocomposite.

The geocomposite shall not be covered with protective soils or other materials until the CQA Monitor has completed all testing and inspections and has provided approval to cover the geocomposite.

## 5.5 Geotextiles

### 5.5.1 Material

A minimum 8-ounce per square yard geotextile is used to cover the sump drainage material over the sump to protect the underlying drainage material and to restrict the entry of fine soil materials into the sump. The material shall be a continuous-filament polyester or polypropylene, non-woven, needle-punched fabric meeting the requirements shown in Table 13 below. Prior to ordering the material and delivery to the site, the Contractor shall provide the CQA Engineer with manufacturer's documentation that the Geotextile meets the requirements and specifications shown in Table 13.

**TABLE 13**
**MINIMUM GEOTEXTILE MATERIAL REQUIREMENTS**

| Property | Unit | Test Method | Manufacturers Min. Test Frequency | Min. Ave. Roll Value (1) |
|---|---|---|---|---|
| Weight | oz/sq yd | ASTM D 5261 | 100,000 sf | 8 |
| Grab Strength | lbs. | ASTM D 4632 | 100,000 sf | 200 |
| Grab Elongation | % | ASTM D 4632 | 100,000 sf | 50 |
| Trapezoidal Tear Strength | lbs. | ASTM D 4533 | 100,000 sf | 85 |
| Puncture Resistance | lbs. | ASTM D 6241 | 100,000 sf | 550 |
| Permittivity | $sec^{-1}$ | ASTM D 4491 | 600,000 sf | 1.20 |
| Water Flow | $gpm/ft^2$ | ASTM D 4491 | 600,000 sf | 95 |
| AOS | US Sieve | ASTM D 4751 | 600,000 sf | 80 (2) |
| UV Resistance | %/hrs. | ASTM D 4355 | Per formulation | 70/500 |
| (1) values shown are in the weakest principal direction<br>(2) AOS is the minimum AOS value (largest opening size) average roll value | | | | |

The CQA Monitor shall verify the following:

- Equipment used to unload the rolls will not damage the geotextile
- Care is used to unload the rolls
- All documentation required by the specification has been received

Any damaged rolls shall be rejected and removed from the site. All rolls that do not have proper manufacturer's documentation shall be stored at a separate location until all documentation has been received and approved.

### 5.5.2 Conformance Testing

Conformance testing of the rolls of geotextile designated for the site shall be conducted at the rate of one sample per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. The sample shall be forwarded to the Third-Party Laboratory for the following tests:

- Mass per unit area (ASTM D 5261)
- Puncture resistance (ASTM D 6241)
- Grab tensile strength (ASTM D 4632)
- Permittivity (if material used as a filter layer) (ASTM D 4491)
- Apparent Opening Size (if material used as a filter layer) (ASTM D 4751)

The CQA Monitor will review all test results and shall report any nonconformance to the Project Manager and to the Geosynthetics Contractor. All test results shall reference the roll number or lot number as appropriate. If samples are collected for testing prior to delivery to the site, the CQA Monitor shall confirm that the rolls sampled for conformance testing correspond to the rolls delivered to the site.

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The sampler shall mark the manufacturer's roll identification number, machine direction, and date on the sample.

### 5.5.3 Geotextile Installation

#### 5.5.3.1 Surface Preparation

Prior to geotextile installation, the CQA Monitor shall verify that:

- All lines and grades have been verified by a qualified surveyor.
- The supporting surface does not contain stones or other material that could puncture or otherwise damage the geotextile.
- All construction stakes and hubs have been removed.

#### 5.5.3.2 Panel Placement

During panel placement, the CQA Monitor shall:

- Observe the geotextile as it is deployed and record all defects and disposition of the defects (e.g., panel rejected or patch installed). All repairs are to be made in accordance

with the specifications.

- Verify that equipment used does not damage the geotextile by handling, trafficking, leakage of hydrocarbons, or by other means.
- Verify that people working on the geotextile do not smoke, wear shoes that could damage the geotextile, or engage in activities that could damage the geotextile.
- Verify that the geotextile is anchored to prevent movement by the wind (the Geosynthetics Contractor is responsible for any damage resulting to or resulting from windblown geotextiles).
- Verify that all geotextile is covered prior to 500 hours of exposure to ultraviolet radiation (sunlight).

The CQA Monitor shall inform both the Geosynthetics Contractor and the Project Manager if the above conditions are not met.

#### 5.5.3.3 Field Seaming

Seaming shall be by sewing, fusion, or other approved bonds. The overlap is dependent upon the method of seaming.

During geotextile placement, the CQA Monitor shall verify:

- The seams are overlapped a minimum of 6 inches if sewn, 12 inches if fusion (heat) bonded, or 24 inches if simply overlapped.
- Overlaps are oriented in the direction of earth filling – i.e., the direction of earth filling shall be in the direction of the seams, not perpendicular to the seams.
- No horizontal seaming shall be allowed on slopes steeper than 10H:1V.
- Thread used to sew the panels together shall be polymeric thread.
- The panels are being joined in accordance with the plans and specifications.

#### 5.5.3.4 Repairs

Allowable repair procedures include:

- Patching – used to repair holes, tears, and defects.
- Removal – used to replace areas with large defects where the preceding method is not appropriate.
- On slopes steeper than 10H:1V, a fabric patch shall be sewn into place using a double sewn lock stitch no closer than one inch to the edge of the patch with the patch extending a minimum 6 inches beyond the perimeter of the tear or damaged section. On slopes flatter than 10H:1V, the patch may be spot seamed using fusion methods with a minimum

of 36 inches overlap past the perimeter of the tear or damaged section.

### 5.5.4 Deficiencies

When deficiencies are discovered, the CQA Monitor shall immediately determine the nature and extent of the problem, notify the Geosynthetics Contractor, and complete required documentation. In all cases, the CQA Monitor will notify the Geosynthetics Contractor within 1/2 hour of discovering the deficiency. If the deficiency will cause construction delays of more than 4 hours or will necessitate substantial rework, the CQA Monitor shall also notify the Project Manager.

The Geosynthetics Contractor shall correct the deficiency to the satisfaction of the CQA Engineer. If the Geosynthetics Contractor is unable to correct the problem, the CQA Engineer will develop and present to the Project Manager suggested solutions for approval. If the solution requires a design revision, the Design Engineer shall also be contacted. The corrected deficiency shall be retested before additional work is performed, if necessary, to ensure compliance with these requirements. All retests and the steps taken to correct the problem shall be documented by the CQA Monitor.

## 6.0 GEOSYNTHETIC CLAY LINER

The following sections describe the material property requirements and CQA observation activities necessary to ensure the geosynthetic clay liner (GCL) is installed appropriately. For purposes of this Section the term "Contractor" refers to the geosynthetic installation contractor unless the referenced work is regarding earthwork.

### 6.1 General

Placement of GCL must be completed in accordance with the project construction drawings and requirements. To monitor compliance, a quality assurance program will be implemented that includes: (1) a review of the GCL Contractor's quality control submittals, (2) material conformance testing, (3) construction testing, and (4) construction observation. Conformance testing refers to activities that take place prior to material installation. Construction testing includes those activities that occur during GCL installation. All quality assurance testing shall be conducted in accordance with this CQA plan and with the project construction drawings and contract documents. All field testing will be observed by the CQA Monitor. Documentation shall meet the requirements of the CQA plan.

#### 6.1.1 Definitions

Geosynthetic Clay Liner (GCL): A manufactured hydraulic barrier consisting of clay bonded to a layer or layers of needle punched or woven geosynthetics. The GCL will be reinforced.

Geotextile: Any permeable textile used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a human-made project, structure, or system.

Minimum Average Roll Value: The minimum average value of a particular physical property of a material equal to 2 standard deviations below the average value ( 95 percent of all the material in the lot).

Overlap: Where two adjacent GCL panels contact, the distance measuring perpendicular from the overlying edge of one panel to the underlying edge of the other.

#### 6.1.2 Standards

| | |
|---|---|
| ASTM D5321 | Standard Test Method for Direct Shear of Geosynthetics |
| ASTM D5887 | Standard Test Method or Measurement of Index Flux Through Saturated GCL Specimens Using a Flexible Wall Permeameter |
| ASTM D5890 | Standard Test Method for Swell Index Measurement of the Clay Mineral Component of GCLs |
| ASTM D5891 | Standard Test Method for Measurement of Fluid Loss of Clay Mineral Component of GCLs |
| ASTM D5993 | Standard Test Method for Measuring the Mass Per Unit of GCLs |
| ASTM D6243 | Standard Test Method for Determining the Internal and Interface Shear |

| | |
|---|---|
| | Resistance of Geosynthetic Clay Liner by the Direct Shear Method |
| ASTM D6496 | Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners |
| ASTM D6768 | Standard Test Method for Tensile Strength of Geosynthetic Clay Liners |

6.1.3 Submittals

The Contractor shall furnish the following information:

- Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.
- GCL manufacturer's Quality Control Plan (MQC) for documenting compliance with the property requirements.
- A representative sample of the GCLs.
- Upon shipment, the Contractor shall furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this Plan.
- As installation proceeds, the Contractor shall submit certificates of subgrade acceptance, signed by the Contractor and Engineer for each area that is covered by the GCL.

## 6.2 Material

6.2.1 Properties

The reinforced GCL shall consist of a layer of granular sodium bentonite clay needle punched between two geotextiles and shall comply with all the criteria listed in Table 14 in this Section.

**TABLE 14**
**MINIMUM REINFORCED GCL PROPERTIES**
**AND MANUFACTURER TEST FREQUENCIES (1)**

| MATERIAL PROPERTY | UNITS | TEST METHOD | MANUFACURERS QC TEST FREQUENCY | REQUIRED VALUES |
|---|---|---|---|---|
| **BENTONITE PROPERTIES** | | | | |
| Bentonite Swell Index | (ml/2g) | ASTM D 5890 | 1/100,000 lb. | 24 min. |
| Bentonite Fluid Loss | (ml) | ASTM D 5891 | 1/100,000 lb. | 18 max. |
| **FINISHED GCL PROPERTIES** | | | | |
| Bentonite Mass/Area | (lb./ft$^2$) | ASTM D 5993 | 1/40,000 ft$^2$ | 0.75 min. |
| GCL Tensile Strength | (lb./in.) | ASTM D 6768 | 1/100,000 ft$^2$ | 30 min. |
| GCL Peel Strength | (lbs./in.) | ASTM D 6496 | 1/40,000 ft$^2$ | 3.5 min. |
| GCL Index Flux<br>**OR**<br>GCL Permeability | (m3/m2/sec)<br><br>(cm/sec) | ASTM D 5887<br><br>ASTM D 5887 | Weekly<br><br>Weekly | 1 x 10-8 max.<br><br>5x10$^{-9}$ max. |

(1) All testing shall be conducted in accordance with GRI GCL3 protocols.

A 6-inch (150 mm) overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, non-toxic ink. Alternatively, if a guideline is not present or legible, the CQA Monitor shall measure and verify a minimum six-inch overlap at frequent intervals.

### 6.2.2 Conformance Testing

Conformance testing of samples collected from the finished GCL rolls to be used at the facility shall be conducted at the rate of one test for every 100,000 square feet installed during any one construction event, or one sample per lot, whichever results in the greater number of conformance tests. The sample may be collected prior to shipment to the site, and in this case, the roll number from which the samples will be collected shall be included with all test reports and compared with the roll numbers delivered to the site. The sample shall be forwarded to the Third-Party Laboratory for the following tests:

- Moisture Content (ASTM D 5993 or D 2216)
- Bentonite Mass per Unit Area (ASTM D 5993)
- Index Flux (ASTM D 5887)

The contractor must submit documentation of the proposed material to the CQA Engineer for review for compliance with the above specifications prior to delivery of the material to the site and the CQA Engineer must confirm that the material characteristics meets or exceeds the minimum requirements in Table 12. The CQA Engineer will not allow installation of the material to begin until reviewing and approving of the results of the conformance testing described above. The CQA Monitor will review all test results and shall report any nonconformance with the requirements in Table 14 to the Project Manager and to the Geosynthetics Contractor.

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The CQA Monitor or sampler shall mark the machine direction, the manufacturer's roll identification number, and the date the sample was obtained on the sample.

### 6.2.3 Product Quality Documentation

The GCL manufacturer shall provide the Contractor or other designated party with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:

- Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the swell index and fluid loss values shown in Table 14.
- Manufacturer's test data for the finished GCL product, including the parameters of bentonite mass/area, tensile strength, and representative permeability data demonstrating compliance with the performance parameters shown in Table 14.
- GCL lot and roll numbers supplied for the project with corresponding shipping

information.

### 6.2.4 Product Labeling

Prior to shipment, the GCL manufacturer shall label each roll, identifying:

- Product identification information (Manufacturer's name and address, brand name, product code).
- Lot number and roll number.
- Roll length, width, and weight.

### 6.2.5 Packaging

The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but shall be sufficiently strong to prevent collapse during transit.

All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) light.

### 6.2.6 Shipping and Handling

The manufacturer assumes responsibility for initial loading of the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling and storage of the GCL are the responsibility of the Contractor, Installer, or other designated party.

A visual inspection of each roll shall be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging shall be marked and set aside for further inspection. The packaging shall be repaired prior to being placed in storage.

The party responsible for unloading the GCL shall contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

### 6.2.7 Storage

Storage of the GCL rolls shall be the responsibility of the installer who will work in conjunction with the Owner to identify suitable storage conditions. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well drained.

Rolls shall be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished using chock blocks. Rolls shall be stacked at a height no higher than that at which the lifting apparatus can be safely handled, but no higher than 3 rolls.

All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.

The integrity and legibility of the labels shall be preserved during storage.

### 6.3 Subgrade Preparation

Any filled earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the project requirements and drawings. Compaction of fills shall be done as per the General Fill requirements in the CQA Plan as included in Tables 2 and 2A.

The finished, compacted surface shall be smooth, firm, and unyielding, and free of:

1. Vegetation.
2. Construction Debris.
3. Sticks.
4. Sharp rocks.
5. Void spaces.
6. Ice.
7. Abrupt elevation changes.
8. Standing water.
9. Cracks larger than one-quarter inch (6 mm) in width and ½-inch deep.
10. Any other foreign matter that could contact and damage the GCL.

Immediately prior to GCL deployment, the subgrade shall be final-graded to fill in all voids or cracks and smooth-drum rolled, if requested by the CQA Monitor, to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints, or other irregularities greater than ½-inch (vertically) shall exist in the subgrade. Furthermore, all protrusions extending more than one-half inch (12 mm) from the surface shall either be removed, crushed, or pushed into the surface to create a surface in compliance with these requirements.

On a continuing basis, the project CQA Monitor shall certify acceptance of the subgrade before GCL placement. Cracks exceeding the dimensions listed above that must be repaired may be filled in by very-light grading if it can be accomplished with removal of minimal materials or "chain dragging" across the area.

It shall be the installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.

At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated or an equivalent runout shall be utilized in accordance with the project plans and requirements and as approved by the CQA Monitor. When utilizing an anchor trench design, the trench shall be excavated and approved by the CQA Monitor prior to GCL placement. Loose soil at the bottom of the trench shall be minimized (generally to approximately one inch in thickness) and no sharp corners or protrusions shall exist anywhere within the trench. Observations and measurements will be made of the anchor trenches to confirm that they are constructed as specified. Additional observations will be made to ensure the following:

- The anchor trench is made with slightly rounded corners as to avoid sharp bends in the GCL and geomembrane
- The anchor trench is adequately drained to prevent ponding of water or softening of the adjacent soils while the trench is open
- The soil used to backfill the anchor trench shall be moisture conditioned and compacted in conformance with Table 2A and tested using Nuclear Density Gauge methods. Testing will be done on each 12-inch-thick lift in the trench and at every 100 linear feet of trench.

## 6.4 Installation

### 6.4.1 Placement

The areas to be lined with GCL shall be agreed upon by the Installer and the CQA Engineer or CQA Monitor prior to installation.

GCL rolls shall be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed without damaging the GCL.

Equipment which could damage the GCL shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

Care must be taken to minimize the extent to which the GCL is dragged across the subgrade to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

The GCL panels shall be placed parallel to the direction of the slope.

All GCL panels shall lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.

Only as much GCL shall be deployed as can be covered at the end of the working day with the HDPE geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The CQA Engineer, CQA Monitor, and GCL supplier shall be consulted for specific guidance if premature hydration occurs.

### 6.4.2 Seaming

The GCL seams are constructed by overlapping their adjacent edges. Care shall be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.

The minimum dimension of the longitudinal overlap shall be 6 inches (150 mm). If the GCL is

manufactured with a grooved cut in the nonwoven geotextile that allows bentonite to freely extrude into the longitudinal overlap, then no supplemental bentonite is required for this overlap. If the GCL does not have a grooved cut in the nonwoven geotextile longitudinal overlap, then bentonite-enhanced seams are required as described below.

End-of-roll overlapped seams shall be constructed with a minimum overlap of 24 inches (600 mm). Seams at the ends of the panels shall be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone. End-of-roll overlapped seams require bentonite-enhanced seams as described below.

Bentonite-enhanced seams are constructed between the overlapping adjacent panels as follows.

- The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied along a zone defined by the edge of the underlying panel and the 6-inch (150-mm) line.
- The granular bentonite shall be applied at a minimum application rate of one quarter pound per lineal foot (0.4 kg/m).
- A similar bead of granular sodium bentonite is applied at the end-of-roll overlap.

To avoid seam separation, the GCL shall not be put in excessive tension by the weight or expansion of textured geomembrane on steep slopes. The CQA Engineer shall be consulted about the potential for GCL tension to develop.

### 6.4.3 Detail Work

- The GCL shall be sealed around penetrations and embedded structures embedded in accordance with the design drawings and the GCL Manufacturer.
- Cutting the GCL shall be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

### 6.4.4 Damage Repair

If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area. The patch shall be cut to size such that a minimum overlap of 12 inches (300 mm) is achieved around all the damaged area. Granular bentonite shall be applied around the damaged area prior to placement of the patch.

### 6.4.5 HDPE and Cover Placement

The GCL shall be covered at the end of the working day with the HDPE geomembrane.

Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation

of any geosynthetic material placed over the GCL. The GCL supplier or CQA Engineer shall be contacted with specific recommendations on the appropriate procedures in this situation.

When a textured geomembrane is installed over the GCL, a temporary geosynthetic covering known as a slip sheet or rub sheet shall be used to minimize friction during placement and to allow the textured geomembrane to be more easily moved into its final position. Alternatively, the CQA Monitor shall closely observe the effects on the GCL by the textured geomembrane if no rub sheet is used.

## 6.5 GCL CQA Activities

### 6.5.1 CQA During Placement

CQA activities that will be documented during GCL placement include the following:

- Observation to ensure the GCL placement plan was followed.
- Observation of the weather conditions (e.g., temperature, humidity, precipitation, and wind) to ensure that they are acceptable for GCL placement and joining. At the beginning of each working day, the CQA Monitor shall confirm that there are no ambient site conditions which could affect the quality of the installation. Specifically, the presence at the job site of excessively high winds, rain, standing water, or snow may be construed as unsuitable weather for GCL installation. There are no temperature restrictions for installing the GCL, however.
- Prior to each day's installation activities, the CQA Engineer and/or CQA Monitor shall inspect the work area to ensure that it has been prepared in accordance with the project requirements and design drawings. Specifically, the design grades shall be verified, the slope length and steepness shall be checked, the anchor trench dimensions shall be measured, and the subgrade shall be inspected and approved. Any deviations from the requirements or design drawings shall be noted and rectified before the GCL is installed.
- The anchor trench must meet or exceed the design dimensions but must also be free of any sharp corners or protrusions which could put excessive stress on the GCL. The CQA Monitor must ensure that the anchor trench is as carefully prepared as the rest of the subgrade.
- The unrolling and placement of the GCL shall be performed in such a way that the GCL is not damaged or unduly stretched, folded, or creased. It is necessary that the GCL be deployed in a fully relaxed (but not wrinkled) state.
- Observe that equipment used to deploy the GCL does not cause rutting in the soil foundation. Also, observe that the ends of the GCL rolls are not damaged while being unrolled.
- Observe that fugitive clay, stones, sand, trash, etc. is not entrapped in or beneath the GCL which could cause damage to the overlying GCL or geomembrane.
- Observe that the panels are positioned such that their long dimension is parallel to the direction of the slope. Panels may only be placed across the slope when the slope is less

steep than 4H:1V or when the slope length is short (less than or equal to 3 m).

- Additionally, observe that the panels are "shingled" on shallow slopes (less than 4H:1V) meaning the upgradient panel overlaps the downgradient panel.
- Observations to confirm that required overlaps of adjacent membrane sheets are achieved, that proper temporary anchorage is used (e.g., sandbags or tires), and that the panel is placed in a relaxed (non-stressed) state.
- Observe that saturated GCL is replaced prior to placement of the overlying geomembrane.
- As each GCL panel is placed, it will be observed for tears, punctures, and thin spots. To accomplish this, the panels will be traversed by CQA personnel in such a way that the entire surface is inspected. Any defects shall be marked on the GCL for repair.

### 6.5.2 CQA for GCL Seaming

CQA observation activities that will be documented during seaming operations include:

- The area to be seamed is free from fugitive clay, stones, sand, trash, etc.
- Weather conditions are acceptable for seaming (i.e.: no precipitation, wind).
- The GCL is not damaged by equipment or personnel during the seaming process.
- The GCL's are overlapped to the manufacturer's match line, as well as assuring that the manufacturer's recommendation of the amount of bentonite that is to be placed between the seams, as necessary. Most GCL now comes with self-seaming materials on the long edges of the GCL. Granular bentonite will be used as per the manufacturer's recommendation for the ends of rolls.
- The hydraulic performance of GCL is maximized when the accessory bentonite is placed *continuously* within the overlap zone. Verification of continuity shall be performed visually by the CQA Monitor. The CQA Monitor shall observe the accessory bentonite as it is being placed within the overlap zone and shall give verbal approval of the seam before the overlap is flipped back into place. Many GCL products have self-seaming capabilities in their longitudinal overlaps and do not require supplemental bentonite. For these products, supplemental bentonite is required only for the end-of-panel overlapped seams and the CQA Monitor shall observe that the end seams have the proper supplemental bentonite.
- No horizontal seams are made on the side slopes, or within five (5) feet of the toe of the side slope.

### 6.5.3 CQA for GCL Anchoring

CQA observations during anchoring will include the following:

- It is important to ensure that, at the top of a slope, the GCL is properly placed in the

anchor trench. After confirming that the trench has been constructed according to the requirements, the GCL shall be placed in the trench such that it extends across the trench floor but not up the rear wall of the trench. Excess material if any, shall be cut off, *not* folded over on top of the existing material.

- If the trench is excavated in soil that is susceptible to desiccation, only that trench length that is required for 1 day's work shall be excavated.
- Good housekeeping practices are used in the trenching operation, minimizing any loose soil material in the trench or on the downhill side of the trench.
- The GCL is joined to the edges of the panels with the minimum six-inch overlap, including the length in the trench.
- Prior to backfilling, any temporary support for the GCL has been removed.
- Backfilling is not performed until approved by the CQA Monitor.
- Backfilling is performed with the materials and conditions as provided in the CQA Plans.

#### 6.5.4 Post-Construction Observation

Following GCL installation, and immediately before placement of the geomembrane, the CQA personnel will make final observations to determine that the GCL:

- Has been installed in the proper locations and according to the project plans and drawings.
- Does not show damage or distress.
- Does not show wrinkles that could prevent intimate contact with the overlying geomembrane.
- No potentially harmful objects are present, e.g., stones, cutting blades, needles, small tools, sandbags, etc.

### 6.6 Documentation

Thorough documentation of all CQA activities and tests is necessary to provide a written record that the GCL has been properly installed. The CQA documentation package for a GCL installation shall include the following items:

- Bills of lading and corresponding packing list confirming receipt of all GCL installed at the site.
- A panel layout drawing in which the GCL roll numbers are keyed to their location in the field.
- Locations where damage was encountered and repaired shall also be marked.

- The roll numbers from which samples were taken for conformance tests, along with the results of those tests.
- A daily report or diary of the activities undertaken at the site during construction.
- Certification that the requirements for the subgrade and for the cover material were achieved.
- A compilation of all CQA checklists completed during the installation.
- The MQC certification and accompanying test data.
- A description of deviations, if any, made to the original CQA plan during the installation.
- Photographs of the GCL during installation.
- The manufacturer provides the MQC certification. All other items on the above list are the responsibility of the CQA engineer.

## 7.0 POLYETHYLENE PIPE AND FITTINGS

An 18-inch, SDR-17 High Density Polyethylene pipe is designed to run along a portion of the base of the leachate collection sump and up the cell sidewall to the ground surface outside of the cell. The purpose of the pipe is to allow entry of leachate collected in the sump and provide access at the ground surface to a pump for removing leachate from the sump.

### 7.1 Material

The leachate removal pipe, also called an inclined riser pipe, shall be manufactured of HDPE and have a Standard Diameter Ratio of 17 (SDR-17). All fitting, caps, joints, couplings, etc. shall also be manufactured of HDPE and made specifically for the specified pipe and size.

The portion of the pipe laid on the base of the sump perpendicular to the blank riser pipe is perforated to allow entry of leachate. The perforations shall be sized to provide adequate water entry capacity but prohibit entry of sump drainage rock or gravel (see Table 4A). The portion of the pipe above the level of the sump and running up the cell sidewall is solid (non-perforated).

The CQA Monitor shall inspect all pipe upon delivery to the facility and record all labeling to verify that the pipe meets these requirements.

### 7.2 Installation

#### 7.2.1 Joining of Pipe Segments

Segments of the inclined riser pipe shall be joined using one of the following heat methods:

- Butt-Fusion
- Electro-Fusion

The heat method used shall follow manufacturers recommendations and be conducted in accordance with acceptable standards and practice. Upon removal of the heat source from the joint, the pipe segments shall remain pressed together under pressure until the joint has cooled to near ambient temperature before moving the pipe. The CQA Monitor shall confirm that adequate time has evolved before the pipe is moved in preparation for placement in the cell.

The CQA Monitor shall pay particular attention to the joints forming the angle between the horizontal perforated section on the base of the sump and the non-perforated section rising on the sidewall to the ground surface.

#### 7.2.2 Installation

The completed pipe section shall be placed to the lines shown on the drawings. The CQA Monitor shall observe and inspect the placement of the pipe, paying particular attention to the integrity of the pipe joints and the contact of the pipe with the underlying layer, particularly at the change in angle of the pipe between the horizontal section in the sump and the portion laying on the cell sideslope. Pipes placed within a leachate collection sump as well as sump riser pipes shall be free of internal weld beads.

The CQA Monitor shall note any bridging of the pipe that would cause stress on the pipe after backfilling and refuse placement. The CQA Monitor will bring any unacceptable bridging to the attention of the contractor, who shall rectify the situation by placing bedding materials beneath the bridged sections or another remedy acceptable to the CQA Monitor.

The entire constructed in place pipe shall be surveyed for location and elevation at each end point, change in angle or direction, and at approximately 25-foot intervals.

### 7.2.3 Acceptance

No materials shall be placed over the installed pipe until the CQA Monitor has verified that it has been placed to the lines shown on the drawings, inspected the integrity of the joints, verified that the pipe has been surveyed in conformance with Section 7.2.2, and approval is provided to do so by the CQA Monitor.

## 8.0 LANDFILL CAP AND FINAL COVER SYSTEM

The final landfill cap (final cover) will be constructed with a prepared foundation layer over the solid waste overlain by a Linear Low-Density Polyethylene (LLDPE) geomembrane. Above the geomembrane is 18-inch of protective soil layer to protect the underlying components, and the protective soil layer is overlain by a 6-inch topsoil later to provide a suitable layer for germination of vegetation.

### 8.1 Foundation Layer

To prepare the top of waste surface for placement of the geomembrane, a 6-inch foundational layer of soil shall be constructed on top of the waste in the areas to receive final cover. The foundation layer will be constructed with General Fill Soils, and the surface shall be prepared to receive LLDPE geomembrane as specified in Section 5.3. The General Fill soils shall be compacted to the specifications shown in Table 2A. Alternatively, the top of top of the 12-inch intermediate cover may substitute for the 6-inch foundation layer with the Engineer's approval.

### 8.2 LLDPE Geomembrane

The LLDPE geomembrane requirements subgrade preparation, geomembrane installation, and field testing for the final cover shall meet all the requirements from Section 5.0 of this Plan.

### 8.3 Protective Soil Layer

A minimum 18-inch-thick layer of protective soils (4.3.3.3) shall be placed above the geomembrane in the final cover system. The protective soil layer must be placed within a reasonable amount of time following construction of the underlying geomembrane layer to help protect it from the potential effects of freeze/thaw cycles and prevent wind movement of the geomembrane.

The protective soil layer shall be installed following the placement of the geomembrane. Soil used for the protective soil layer shall have some cohesion, a maximum particle size of 3 inches in the longest direction and shall be approved for use by the CQA Engineer. The soil shall be placed in a manner that will not damage the geomembrane. Care shall be taken to minimize any wrinkles of folds of the geonet and ensure that tensile stress is not induced in the materials by using only low ground-pressure equipment, placing the first lift at a minimum lift thickness of 12-inches (prior to compaction) and pushing the soil materials upslope rather than downslope.

The protective layer soils shall be placed and spread using only low ground-pressure track equipment approved by the CQA Engineer and the equipment shall not travel over the geosynthetic materials unless a minimum of 12-inches (prior to compaction) of protective soils separates the equipment from the geomembrane. Temporary thicker roadways onto the construction area may be built to allow heavier equipment to transport soils closer to the placement area where the low ground-pressure equipment can spread the material out from the roadway. The necessary thickness to avoid damage to the geomembrane for these roadways shall be dictated by the CQA Engineer based on the equipment used.

Protective layer soils shall be placed from the bottom of slopes working upward and never in a down-slope direction. The protective layer soils shall be firmly compacted using construction equipment to the satisfaction of the CQA Engineer to provide a firm, stable surface. The application of minor amounts of water may be added during construction to facilitate adequate compaction.

## 8.4 Topsoil Layer

A minimum 6-inch-thick layer of unspecified topsoil will be placed on top of the protective soils layer. If the soils used to construct the Protective Soil Layer are suitable for topsoil, the topsoil layer may be constructed as part of the protective soil layer in two, one-foot-thick lifts.

## 8.5 Revegetation

The seeding and re-vegetation instructions described below are based on recommendations supplied by the Soil Conservation Service (now known as the Natural Resources Conservation Service). The recommended grasses and their mix ratio to be planted at this site include 22 percent of sand blue stem, 25 percent of sides oats grama, 4 percent of blue grama, 14 percent of prairie sand reed, 27 percent of switch grass, and 8 percent of blue stem. The recommended seed rate for these grasses is 7.3 pounds of pure live seed (PLS) per acre. These native grasses are typical of the Fort Morgan area and shall provide good erosional protection with low maintenance. In addition to the above native grasses, it is recommended that a fast-rooting vegetation such as pearl millet be planted to provide vegetation until the native grasses become established. A recommended seeding rate for the pearl millet is 30 pounds of PLS per acre. Seed shall be planted using a drill to reduce the amount of seed used. The bulk seed rates presented are based upon using a drill for seed distribution. If broadcast seeding is used, the seed rate shall be doubled.

The Winter Wheat may be planted as a cover crop to stabilize the soil and provide protection until the grasses thrive. Once the grasses are established, the wheat may be killed to allow the grasses to take over.

Native grass mulch shall be applied to the site following seeding at the rate of 2 tons/acre. The mulch shall be spread evenly and anchored with the use of a weighted disc with straight disc blades to avoid turning the soil over. If areas are inaccessible to the seeding drill, the seed mix shall be sown by hand or broadcast at twice the specified seed rate as listed above.

**CONSTRUCTION CONTRACT**

THIS CONSTRUCTION CONTRACT (the "Contract") is made and entered into this _____ day of _____, 20__, by and between Morgan County, Colorado, a Colorado county acting by and through its Board of County Commissioners with a principal place of business at 218 West Kiowa Avenue, Fort Morgan 80701 (the "County"), and _____, an independent contractor with a principal place of business at _____, _____ _____ ("Contractor") (each individually a "Party" and collectively the "Parties").

For the consideration hereinafter set forth, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Scope of Work. Contractor shall perform the work described in Exhibits A and B (the "Work"), in accordance with this Contract and the Contract Documents, attached hereto and incorporated herein by this reference.

2. Bonds. Within ten days of the date of this Contract, Contractor shall provide the payment and performance bond and certificate of insurance required by the Contract Documents.

3. Commencement and Completion of Work. Contractor shall commence the Work within _____ days of date of the Notice to Proceed. Substantial Completion of the Work shall be accomplished by the ___ day of _____, 20__, unless the period for completion is extended otherwise in accordance with the Contract Documents. Final Completion of the Work shall be accomplished within _____ days of the date of Substantial Completion.

4. Compensation/Contract Price.

A. Subject to the terms and conditions of the Contract Documents, Contractor shall provide all materials, supplies, labor, services, transportation, tools, equipment, and parts to perform the Work for the County in a good and workmanlike manner to the satisfaction of the County for the estimated price not to exceed of $_____ ("Not to Exceed price"). If the performance of this Contract involves the services of others or the furnishing of equipment, supplies, or materials, the Contractor agrees to pay for the same in full. At the time of payment by the County, the Contractor shall certify in writing that said payments have been so made. The Not to Exceed price is in accordance with the Contractor's proposal and rates, as included in the Bid Form A and schedule, dated _____. Out of scope work agreed to by the County shall be billed at Contractors stated unit price on Form A if there is a corresponding bit items on Form A, or at the T&M rates for the applicable equipment as shown on the List of Proposed Equipment for Out of Scope that does not have a corresponding bid item under Form A. The T&M unit rates are understood to represent the fully loaded costs to include all equipment, labor, overhead, taxes, insurance, profit, and any other incidentals necessary to the specific work. All Invoices shall be subject to County review and approval before payable. The parties estimate that performance of this Contract will not exceed the Not to Exceed estimate.

B. The County is not liable for any unauthorized costs above the Not to Exceed estimate, and the Contractor is not obligated to continue performance under this Contract

(including actions under the Termination clause of this Contract) or otherwise incur costs in excess of the Not to Exceed estimate specified herein, until the County:

i. notifies the Contractor in writing that the estimated cost has been increased; and

ii. provides a revised estimated total not to exceed price of performing this Contract.

5. Governing Law and Venue. This Contract shall be governed by the laws of the State of Colorado, and any legal action concerning the provisions hereof shall be brought in Morgan County, Colorado.

6. No Waiver. Delays in enforcement or the waiver of any one or more defaults or breaches of this Contract by the County shall not constitute a waiver of any of the other terms or obligation of this Contract.

7. Integration. This Contract and any attached exhibits constitute the entire Contract between Contractor and the County, superseding all prior oral or written communications.

8. Third Parties. There are no intended third-party beneficiaries to this Contract.

9. Notice. Any notice under this Contract shall be in writing, and shall be deemed sufficient when directly presented or sent pre-paid, first class United States Mail, addressed to:

The County: Board of County Commissioners
Morgan County
218 West Kiowa Avenue, P.O. Box 596
Fort Morgan, Colorado 80701

Contractor: _____
_____
_____
_____

10. Severability. If any provision of this Contract is found by a court of competent jurisdiction to be unlawful or unenforceable for any reason, the remaining provisions hereof shall remain in full force and effect.

11. Modification. This Contract may only be modified upon written agreement of the Parties.

12. Assignment. Neither this Contract nor any of the rights or obligations of the Parties hereto, shall be assigned by either party without the written consent of the other.

13. Governmental Immunity. The County and its officers, attorneys and employees are relying on, and do not waive or intend to waive by any provision of this Contract, the monetary limitations or any other rights, immunities, and protections provided by the Colorado Governmental

Immunity Act, C.R.S. § 24-10-101, *et seq.*, as amended, or otherwise available to the County and its officers or employees.

14. Rights and Remedies. The rights and remedies of the County under this Contract are in addition to any other rights and remedies provided by law. The expiration of this Contract shall in no way limit the County's legal or equitable remedies, or the period in which such remedies may be asserted, for work negligently or defectively performed.

15. Subject to Annual Appropriation. Consistent with Article X, § 20 of the Colorado Constitution, any financial obligation of the County not performed during the current fiscal year is subject to annual appropriation, shall extend only to monies currently appropriated, and shall not constitute a mandatory charge, requirement or liability beyond the current fiscal year.

IN WITNESS WHEREOF, this Construction Contract has been executed by the Parties as of the date first above written.

**MORGAN COUNTY, COLORADO**

_____
Jon J. Becker, Chair

_____
Gordon H. Westhoff, Commissioner

_____
Mark A. Arndt, Commissioner

ATTEST:

_____
Susan L. Bailey, County Clerk

**CONTRACTOR**

By: _____

STATE OF COLORADO )
) ss.
COUNTY OF _____ )

The foregoing instrument was subscribed, sworn to and acknowledged before me this ___ day of _____, 2022, by _____ as _____ of _____.

My commission expires: _____

(S E A L) Notary Public

## EXHIBIT A

## SCOPE OF WORK – SYNTHETICS INSTALLER

### SUMMARY

The synthetics installation construction project includes installation of a 3-layer geosynthetic liner system approximate 6-acre lined disposal cell of Phase 2 South Cell (hereinafter referred to as Phase 2). Each bit item is described in this Scope of Work narrative and each item should be included in your bid.

The overall project consists of excavating and backfilling as necessary to design subgrade and finish grades for an approximate 6-acre lined area called Phase 2, including tie-in of the subgrade with the subgrade of Phase 1, not including and construction of haul/access roads for Contractor use (incidental to the work). The liner and leachate collection system will be a composite liner consisting of (from the base of the system upwards) a Geosynthetic Clay Liner (GCL) and a High-Density Polyethylene (HDPE) membrane, overlain by a geocomposite leachate collection system on the floor of Phase 2. Suitable soils excavated from the Phase 2 area may be used in any portion of the construction area that requires fill. The GCL and HDPE liner terminates on the excavation floor on the west side, at the permanent anchor trench just outside of the excavation crest on the north and east sides of Phase 2, and will be tied into the Phase 1 liner system on the south side of Phase 2. The Geocomposite drainage layer terminates at the excavation toe on the north and east sides of Phase 2, at the termination of the GCL and HDPE liner system on the west side of Phase 2, and will be tied into the Phase 1 geocomposite leachate collection system on the south side of Phase 2.

The termination of the liner and drainage system on the west side is covered with plywood as shown on the drawings. The earthworks contractor is responsible for stormwater runoff control prior to, during, and following the installation of the synthetic components to protect them and the work area from damage, as well as exposing the Phase 1 tie-in zone.

### DESCRIPTION OF PAY ITEMS

The Contractor shall be responsible for the 2022 South Cell Phase 2 Liner Construction work consisting of and limited to: 1) supply and installation of geosynthetic clay liner (GCL), supply and installation of dual-side-textured 60-mil HDPE geomembrane, supply and installation of a geocomposite drainage layer, and termination of the GCL and geomembrane in anchor trenches to be excavated and backfilled by others. Payment for all work will be made under one of the pay items listed below. Payment of all geosynthetic work items will be based upon listed Bid Quantities and Bidder shall include sufficient material to include lap, scrap, and waste and account for all quantities required to comply with the design and specifications in the Bid Unit Rate.

A ten percent (10%) retainer will be applied to each invoice. The retainer will be paid in full upon completion of the project and once the final invoice is received by Owner and the Final Payment, General Release, and Indemnity is executed. Any work which the Contractor believes not to be covered by one of these pay items shall be addressed in the bid submitted to the Owner.

The Contractor shall take all necessary actions needed to meet the proposed schedule, considering weather conditions that may be expected for the project area and season.

## BASE BID PAY ITEMS

### 100: Payment Bond

A Performance Bond is required and shall be no less than the contract amount in accordance with the Instruction to Bidders, Bid Form A and the Contract Documents. A Letter from the surety must be provided with the bid as evidence of ability to be bonded. Payment for this item shall be on the bid lump sum price.

### 200: Mobilization and Demobilization

Mobilization and demobilization shall be a lump sum item. Payment for 100% of this item shall be made upon mobilization of equipment necessary to initiate installation of the liner system. The Contractor is expected to have satisfactory completion of all work items for this project, demobilization of equipment and any unused materials, and leaving allocated work areas, including borrow sources, haul roads and stockpiles, in a satisfactory condition. Assume one mobilization for the project. Payment for this item is on the bid lump sum price.

### 300: Supply and Install Geosynthetic Clay Liner (GCL)

The Contractor shall be responsible for suppling sufficient quantities to complete the job, including purchase, transport, and installation of a geosynthetic clay liner as the bottom layer of a three-layer synthetic liner system that also includes the dual-side-textured, 60-mil HDPE geomembrane and a 200-mil geocomposite drainage layer. The GCL is to be installed over an area shown on the design drawings, and in compliance with the approved Construction Quality Assurance Plan (CQAP) and material specifications. A copy of the Product Data Sheet for the proposed material shall be included with the Bid. The Contractor will be responsible for assembling the required panel layout drawings and confirming material take-offs prior to the award of contract. The installation of the GCL must be performed concurrently with the installation of the geomembrane liner (Bid Item 400) in such manner that ensures complete coverage of any exposed GCL by the geomembrane at the end of each working day of installation in accordance with the CQAP and geosynthetics installation specifications. Contractor shall conduct all field testing of the GCL in compliance with the CQAP if any is required. The CQA Monitor will be responsible for providing oversight during GCL and Geomembrane installation as well as certification testing and as-built survey documentation to verify proper installation procedures and required testing is completed during and after all geosynthetics placement.

This item also includes preparing the entire northern termination of the Phase 1 GCL liner as required and joining it to the Phase 2 GCL liner. The western termination of the Phase 1 GCL shall be installed to or cut in a straight neat line to the limits shown on the drawing. The GCL of Phase 2 shall overlap the GCL in Phase 1.

Payment for this item is the Bid Quantity shown on Form A at the Bid Unit Rate. Contractor shall account for scrap, lap, and waste not included in the Bid Quantity in the Bid Unit Rate.

### 400: Supply and Install Geomembrane Liner

The Contractor shall be responsible for suppling sufficient quantities to complete the job, including purchase, transport, and installation of a dual-side-textured, 60-mil HDPE geomembrane that

completely covers the installed GCL (Bid Item 300). The geomembrane is to be installed over an area shown on the design drawings, and in compliance with the design drawings and in compliance with the approved Construction Quality Assurance Plan (CQAP) and material specifications. A copy of the Product Data Sheet for the proposed material shall be included with the Bid. The Contractor will be responsible for assembling the required panel layout drawings and confirming material take-offs prior to the award of contract. The installation of the geomembrane must be performed concurrently with the installation of the GCL (Bid Item 300) in such manner that ensures complete coverage of any exposed GCL by the geomembrane at the end of each working day of installation in accordance with the CQAP and geosynthetics installation specifications. The Contractor shall be responsible for conducting all field testing required by, and in compliance with, the CQAP. The CQA Monitor will be responsible for providing oversight during GCL and Geomembrane installation as well as third-party testing and as-built survey documentation to verify proper installation procedures and required testing is completed during and after all geosynthetics placement.

This item also includes preparing the entire northern termination of the Phase 1 HDPE liner as required and joining it to the Phase 2 HDPE liner. The work shall be done as directed by the CQA Personnel, and all materials and work done in accordance with the specifications, drawings and CQA Plan. The western termination of the Phase 2 HDPE shall be installed to or cut in a straight neat line to the limits shown on the drawing. The HDPE of Phase 2 shall overlap the HDPE in Phase 1.

Payment for this item is the Bid Quantity shown on Form A at the Bid Unit Rate. Contractor shall account for scrap, lap, and waste not included in the Bid Quantity in the Bid Unit Rate.

**500: Supply and Install Geocomposite Drainage Layer**

The Contractor shall be responsible for suppling sufficient quantities to complete the job, purchase, transport and installation of geocomposite drainage layer above the installed GCL/Geomembrane Liner system over an area shown on the Design Drawings (floor only) and in compliance with the CQAP. The geocomposite installation will be competed in compliance with the approved Construction Quality Assurance Plan (CQAP). The Contractor will be responsible for assembling the required panel layout drawings and confirming material take-offs prior to the award of contract. A copy of the Product Data Sheet for the proposed material shall be included with the Bid. The Contractor shall conduct all field testing required by, and in compliance with, the CQAP. The CQA Monitor will be responsible for providing oversight during geocomposite installation as well as any third-party testing and as-built documentation to verify proper installation procedures and required testing is completed during and after all geosynthetics placement.

This item also includes preparing the entire northern termination of the Phase 1 geocomposite as required and joining it to the Phase 2 geocomposite. The work shall be done as directed by the CQA Personnel, and all materials and work done in accordance with the specifications, drawings and CQA Plan. The western termination of the Phase 2 geocomposite shall be installed to or cut in a straight neat line to the limits shown on the drawing.

Payment for this item is the Bid Quantity shown on Form A at the Bid Unit Rate. Contractor shall account for scrap, lap, and waste not included in the Bid Quantity in the Bid Unit Rate.

## EXHIBIT B

Additional Rates for Services Provided in Association with the Work in Exhibit A

**CERTIFICATE OF INSURANCE**

STATE OF _____)
) ss.
COUNTY OF _____)

I, _____, being first duly sworn, state and affirm, under penalty of law, that I am familiar with the insurance coverages maintained by the Insured, _____, and the coverage requirements set forth in the foregoing Certificate of Insurance, that I have completed or caused to be completed and subsequently reviewed the foregoing Certificate of Insurance and that the information contained therein is true and correct to the best of my knowledge. I further understand that Morgan County shall rely on the information provided.

This information is provided for Morgan County, Project: _____.

By: _____

Title: _____

Agency: _____

STATE OF COLORADO )
) ss.
COUNTY OF _____ )

The foregoing instrument was subscribed, sworn to and acknowledged before me this ___ day of _____, 20__, by _____, as _____ of _____.

My commission expires:

(S E A L)

_____
Notary Public

**NOTICE OF AWARD**
**PHASE 2 CONSTRUCTION**

| **SUPPLIER** | **OWNER** |
|---|---|
| To: _____ | From: Morgan County, Colorado |
| Address: _____ | Address: 21448 Co. Rd. 22 |
| _____ | Fort Morgan, CO. 80701 |
| _____ | Phone: 970-380-0780 |

**PROJECT:** Phase 2 Liner and Leachate Collection System Construction

**AGREEMENT FOR:** Construction of Phase 2 Liner and Leachate Collection System and Appurtenant Surface Water Drainage Structures and Roads

---

**NOTICE OF AWARD**

You are hereby notified that your (Bid) dated _____ for the above Agreement has been considered and you are the apparent successful bidder.

The Contract Price of your Agreement is: $ _____

You must comply with the following conditions precedent within 7 days of the date of the Notice of Award:

1. You must deliver to the OWNER two fully executed counterparts of the Contract Documents. This includes two sets of any applicable Drawings. Each of the Contract Documents must bear your signature.
2. Other conditions precedent as follows:
   - Site representative (Contractor Superintendent) for the project is:

     _____

     Any change in site representative must be approved by the Owner
   - _____
   - _____
   - _____

Failure to comply with these conditions within the time specified will entitle OWNER to consider your bid abandoned. Within 12 days after you comply with these conditions, OWNER will return to you one fully signed original of the Agreement with the Contract Documents attached.

**NOTICE TO PROCEED**

Date: _____

_____
Contractor Name
_____
Address
_____

_____

RE: _____

Dear _____:

This letter is your Notice to Proceed, effective as of the date cited below. This notice is in reference to the Construction Contract between you and Morgan County concerning the _____.

Please note that in accordance with the Construction Contract, Work must commence within ten days of the date of this Notice, and all Work must be substantially completed within _____ (_____) days of the date of this Notice, which shall be the ___ day of _____, 20__, and finally completed within _____ days of the date of this Notice, which shall be the ___ day of _____, 20_.

If you have any questions, please call me at _____.

Sincerely,

_____
_____, Project Manager

_____
Date

**PAYMENT AND PERFORMANCE BOND**

Bond No._____

KNOW ALL MEN BY THESE PRESENTS: that

(Firm)_____

(Address)_____
(an Individual), (a Partnership), (a Corporation), hereinafter referred to as "the Principal", and

(Firm)_____

(Address)_____

hereinafter referred to as "the Surety", are held and firmly bound unto Morgan County, Colorado, a Colorado county, hereinafter referred to as "the Owner", in the penal sum of _____ Dollars in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION are such that whereas the Principal entered into a certain Contract with the Owner, dated the ____ day of _____,20____, a copy of which is hereto attached and made a part hereof for the performance of the Work, _____.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without Notice to the Surety and during the life of the guaranty or warranty period, and shall satisfy all claims and demands incurred under such Contract, and shall fully indemnify and save harmless the Owner from all cost and damages which it may suffer by the Principal's failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, and make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such Contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, repairs on machinery, equipment and tools, consumed, rented or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor performed in such work, whether by subcontractor or otherwise, then this obligation shall be void; otherwise it shall remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this Bond; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the Work or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in five (5) counterparts, each one of which shall be deemed an original, this _____ day of _____, 20_____.

ATTEST:

By: _____

Title:_____

PRINCIPAL

By:_____

Title:_____

Address:_____

_____

(Corporate Seal)

SURETY

ATTEST:

By: _____

Attorney-in-Fact: _____

Surety:_____

By: _____

Title: _____

Address:_____

_____

(Surety Seal)

NOTE: Date of Bond must <u>not</u> be prior to date of Contract and Surety must be authorized to transact business in the State of Colorado and be acceptable to the County.

## CERTIFICATE OF FINAL PAYMENT

With reference to Contract Number _____ dated _____, 20__, between the undersigned Contractor and Morgan County (the "Owner"), for: _____ at _____, Morgan County, Colorado _____.

The undersigned hereby certifies that all costs, charges and expenses incurred by it on its behalf for work, labor, services, materials and equipment supplied to the foregoing premises, and/or used in connection with its Work under the Contract have been duly paid.

The undersigned further certifies that to its best knowledge and belief (based upon reasonable investigation) each of its subcontractors and material men have duly paid all costs, charges and expenses incurred by them or on their behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by them in connection with the Undersigned's Work under the Contract.

In consideration of _____ dollars ($_____) representing final payment under the Contract, the undersigned hereby releases and discharges the Owner and Owner's property from all claims, liens and obligations of every nature arising out of or in connection with the performance of the Work.

As additional consideration for the final payment, and to the fullest extent permitted by law, the undersigned agrees to indemnify and hold harmless Owner from and against all costs, losses, damages, claims, causes of action, judgments and expenses arising out of or in connection with claims against Owner which may be asserted by the undersigned or any suppliers, subcontractors of any tier or any of their representatives, officers, agents and employees for the costs, losses, damages, claims, causes of action, judgments and expenses and expenses that are attributable to the act, omission, error, professional error, mistake, negligence or other fault of the undersigned.

The foregoing shall not relieve the Undersigned of its obligations under the provisions of the Contract as amended, which by their nature survive completion of the Work including, without limitation, warranties, guarantees and indemnities.

Executed this _____ day of _____, 20__.

_____
Contractor

## CERTIFICATE OF FINAL ACCEPTANCE

Date: _____

TO: _____ Project No.: _____

Project Title: _____

This is to advise you that a final inspection of the referenced Work has been made and all work and material was found to be satisfactory. Therefore, the Work is considered to be complete in accordance with the approved plans, specifications and contract documents.

In accordance with the Contract, all Warranty periods shall begin as of the date of this letter.

MORGAN COUNTY

By: _____

Title:_____

# GENERAL PROVISIONS

## PART 1. DEFINITIONS

### 1.01 CONTRACT DOCUMENTS:

A. Bid Form (Including Bid Summary and all Attachments and Exhibits);
B. Bid Schedule;
C. Construction Contract;
D. Certificate of Insurance;
E. Notice of Award;
F. Notice to Proceed;
G. Payment and Performance Bond;
H. Certificate of Final Payment;
I. Final Acceptance Form;
J. General Provisions;
L. Addendum A – Construction Quality Assurance Plan and Specifications
M. Documentation submitted by Contractor prior to Notice of Award

### 1.02 CHANGE ORDER:

A written order issued by the County after execution of the Contract authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time.

### 1.03 COUNTY:

Morgan County, Colorado.

### 1.04 CONTRACT:

The entire written agreement covering the performance of the Work described in the Contract Documents including all supplemental agreements thereto and all general provisions pertaining to the Work and materials therefor.

### 1.05 CONTRACT PRICE:

The amount set forth in Paragraph 4 of the Construction Contract.

### 1.06 CONTRACT TIME:

The time for completion of the Work as set forth in Paragraph 3 of the Construction Contract.

### 1.07 DAY:

Calendar day, unless otherwise specified. When the last day for the occurrence of an event falls on a Sunday or legal holiday as recognized by the County, the time for performance shall be automatically extended to the next business day.

### 1.08 FINAL COMPLETION:

The date as certified by the Project Manager when all of the Work is completed and final payment may be made.

### 1.09 PROJECT MANAGER:

The County's duly authorized representative in connection with the Work.

**1.10 SUBCONTRACTOR:**

Any person, firm or corporation with a direct contract with Contractor who acts for or in behalf of Contractor in executing any part of the Contract, excluding one who merely furnishes material.

**1.11 SUBSTANTIAL COMPLETION:**

The date as certified by the Project Manager when the County may occupy or take possession of all or substantially all of the Work and put it to beneficial use for its intended purposes, in accordance with approval of the Work by the Colorado Department of Public Health and Environment.

**1.12 WORK:**

All the work specified, indicated, shown or contemplated in the Contract Documents, including all alterations, amendments or extensions thereto made by supplemental agreements or written orders of the Project Manager.

**1.13 OWNER:**

Morgan County, Colorado

**PART 2. TIME**

**2.01 TIME OF THE ESSENCE:**

All times stated in the Contract Documents are of the essence.

**2.02 FINAL ACCEPTANCE:**

Upon Final Completion, the Project Manager will issue final acceptance.

**2.03 CHANGES IN THE WORK:**

The County reserves the right to order changes in the Work, in the nature of additions, deletions or modifications, without invalidating the Contract, and to make corresponding adjustments in the Contract Price and the Contract Time. All changes shall be authorized by a written Change Order signed by the Project Manager. The Change Order shall include appropriate changes in the Contract Documents and the Contract Time. The Work shall be changed and the Contract Price and Contract Time modified only as set forth in the written Change Order. Any adjustment in the Contract Price resulting in a credit or a charge to the County shall be determined by mutual agreement of the parties before the work set forth in the Change Order is commenced. If a Change Order results in an increase in the Contract Price, approval of the Morgan County Board of County Commissioners shall be required, and if such approval is not obtained, the County shall have no payment obligation regardless of whether the Work pursuant to the Change Order has been performed.

**2.04 DELAYS:**

A. Contractor shall include the number of adverse weather days from the Table below in his schedule. The values in the table are based on information obtained from the National Oceanic and Atmospheric Administration and represents weather that on any calendar day varies from the average weather conditions for that day by more than 100%. If Contractor is delayed in the progress of the Work by fire, unusual delay in transportation, unanticipated adverse weather conditions over what is allowed to be incorporated into the schedule as discussed above, or other unavoidable casualties beyond Contractor's control, Contractor shall immediately notify Owner who will determine whether an extension to the Contract schedule will be allowed.

MONTHLY ANTICIPATED ADVERSE WEATHER DAYS

| JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 4 | 4 | 4 | 6 | 3 | 4 | 2 | 3 | 3 | 2 | 5 |

B. Any request for extension of the Contract Time shall be made in writing to the Project Manager not more than seven days after commencement of the delay; otherwise it shall be waived. Any such request shall contain an estimate of the probable effect of such delay on the progress of the Work.

C. Contractor shall not be entitled to any increase in the Contract Price, or to damages, or to additional compensation as a consequence of any such delays.

**2.05 NO DAMAGES FOR DELAY:**

In strict accordance with C.R.S. § 24-91-103.5, the County shall not amend the Contract Price to provide for additional compensation for any delays in performance which are not the result of acts or omissions of the County or persons acting on behalf of the County.

## PART 3. CONTRACTOR'S RESPONSIBILITIES

**3.01 COMPLETION/SUPERVISION OF WORK:**

Contractor hereby warrants that it is qualified to assume the responsibilities and render the services described herein and has all requisite corporate authority and licenses in good standing. The services performed by Contractor shall be in accordance with generally accepted professional practices and the level of competency presently maintained by others in the same or similar type of work, and in compliance with applicable laws, ordinances, rules and regulations. Contractor shall be responsible for completion of all Work in a timely and workmanlike manner in accordance with the terms and specifications of the Contract Documents, including the techniques, sequences, procedures and means. Contractor shall be responsible for the coordination of all Work. Contractor shall supervise and direct the Work and give it all attention necessary for proper supervision and direction. Contractor shall maintain a supervisor on site at all times when Contractor or any subcontractor is performing Work.

Contractor shall be responsible for all dewatering and repairs required due to rain or freezing through final acceptance of the Work. The Contractor shall be responsible for dust control and temporary stormwater drainage during construction, including during installation of the synthetic materials, to protect the work.

The County holds a stormwater discharge permit and air emissions construction permit for landfill operations, including earthmoving activities and the Contractor shall comply with all provisions of these permits as they relate to the work.

**3.02 DUTY TO INSPECT:**

Contractor shall inspect all Contract Documents, tests and reports, including soil tests and engineering tests, if applicable, and shall conduct a site or field review prior to executing the Contract. Contractor assumes the risk of all conditions which are disclosed, or which are reasonably suggested by any such tests or reports, or which would be disclosed by a field or site review. Contractor shall have the affirmative duty to advise the County of any concerns which Contractor may have regarding construction conditions prior to executing the Contract.

**3.03 FURNISHING OF LABOR AND MATERIALS:**

A. Contractor shall provide and pay for all labor, materials and equipment, including: tools; construction equipment and machinery; utilities, including water; transportation; and all other facilities and services necessary for the proper completion of the Work.

B. In all purchases of supplies, materials and provisions to be incorporated or otherwise used by Contractor in the Work, Contractor shall use supplies, materials and provisions produced, manufactured or grown in Colorado if such supplies, materials and provisions are not of inferior quality to those offered by competitors outside of Colorado.

C. While engaged in the performance of the Work, Contractor shall maintain employment practices that do not violate the provisions of the Colorado Antidiscrimination Act of 1957, C.R.S. § 24-34-301, *et seq.*, as amended.

**3.04 EMPLOYEES AND SAFETY:**

A. Contractor shall maintain at all times strict discipline of its employees, and Contractor shall not employ on the Work any person unfit or without sufficient knowledge, skill, and experience to perform properly the job for which the employee was hired.

B. Contractor shall be responsible to the County for the acts, negligence and omissions of all direct and indirect employees and subcontractors. The Contract Documents shall not be construed as creating any contractual relation between any subcontractor and the County.

C. Contractor shall provide for and oversee all safety orders and precautions necessary for the safe performance of the Work. Contractor shall take reasonable precautions for the safety of all employees and others whom the Work might affect, all work and materials incorporated into the Work, and all property and improvements on the work site and adjacent property.

D. Contractor shall have, and provide to Owner, a Health and Safety Plan in accordance with the Contract.

**3.05 CLEANUP:**

A. Contractor shall keep the work site and adjoining ways free of waste material and rubbish caused by its employees or subcontractors. Contractor shall remove all such waste material and rubbish daily during construction, together with all tools, equipment, machinery and surplus materials. Contractor shall, upon termination of its Work, conduct general cleanup operations on the work site, including the cleaning of all surfaces, paved streets and walks, and steps. Contractor shall also conduct such general cleanup operations on adjacent properties which were disturbed by the Work.

B. If Contractor fails to perform the cleanup required by this Section, after written notice, the County may cause the cleanup to be performed at Contractor's expense. Upon receipt of a statement for such cleanup, Contractor shall pay to the County the costs incurred by the County for such cleanup, or the County shall have the right to withhold said amount from any final payment due to Contractor.

**3.06 PAYMENT OF ROYALTIES AND LICENSE FEES:**

Contractor agrees to pay all royalties and license fees necessary for the Work, and to defend against all actions for infringement of copyright or patent rights, and to save and hold the County harmless from such actions.

### 3.07 TAXES, LICENSES AND PERMITS:

Contractor shall pay all taxes imposed by law in connection with the Work and shall procure all permits and licenses necessary for the prosecution of the Work.

### 3.08 SAMPLES AND SHOP DRAWINGS:

Contractor shall furnish, upon the request of the Project Manager, samples and shop drawings to the Project Manager, who shall review them for conformance with the Contract Documents. All Work shall comply with approved samples and drawings.

### 3.09 COMPLIANCE WITH LAWS AND REGULATIONS:

Contractor shall comply with all federal, state and local laws, ordinances, rules, regulations and orders in any manner relating to the Work. If any provision of the Contract Documents is at variance therewith, Contractor shall notify the Project Manager promptly.

### 3.10 SUBCONTRACTORS:

A. Contractor shall furnish to the Project Manager at the time the Construction Contract is executed, a list of names of subcontractors to whom Contractor proposes to award the portions of the Work to be subcontracted by Contractor.

B. Contractor shall not employ a subcontractor to whose employment the County reasonably objects, nor shall Contractor be required to hire a subcontractor to whose employment Contractor reasonably objects.

C. All contracts between Contractor and subcontractor shall conform to the provisions of the Contract Documents, and shall incorporate the relevant provisions of the Contract Documents.

### 3.11 CORRECTIVE WORK:

When any Work does not conform to the Contract Documents, Contractor shall make the necessary corrections so that the Work will so conform. Such corrections shall be accomplished within the time period approved by the Project Manager. Failure to complete such required corrections within the time period required shall constitute a breach of the Contract. The County's review, approval or acceptance of, or payment for any work shall not be construed as a waiver of any rights under this Contract or any cause of action arising out of the performance of this Contract and Owner shall not be charged for any costs associated with corrective work.

### 3.12 OTHER CONTRACTS:

The County reserves the right to let other contracts in connection with the Work. Contractor shall cooperate with all other contractors so that their work is not impeded by the Work, and Contractor shall give other contractors access to the work site necessary to perform their contracts.

### 3.13 COMMUNICATION:

Contractor shall direct all communications to the County regarding the Work to the attention of the Project Manager.

## PART 4. TERMINATION

### 4.01 LABOR DISPUTES:

Notwithstanding any other provision contained in this Contract, in the event of any picket or other form of labor dispute at the construction site, Contractor shall continue to perform the Work without

interruption or delay. If Contractor ceases performance of the Work because of such picket or other form of labor dispute, the County may terminate the services of Contractor after giving forty-eight (48) hours' written notice of its intent to do so.

### 4.02 DEFAULT:

The County may terminate this Contract upon seven days' written notice to Contractor if Contractor defaults in the timely performance of any provision of the Contract Documents, or otherwise fails to perform the Work, or any part thereof, in accordance with the Contract Documents. Termination of the Contract by the County shall not be the County's exclusive remedy, and the County may pursue such other remedies and actions lawfully available to the County including, but not limited to, an action at law for damages against Contractor or any bonding agency issuing a bond hereunder, or an action in equity for injunctive relief.

## PART 5. WARRANTIES:

### 5.01 WARRANTY OF FITNESS OF EQUIPMENT AND MATERIALS:

Contractor represents and warrants to the County that all equipment and materials used in the Work, and made a part of the Work, or placed permanently in the Work, shall be new unless otherwise specified in the Contract Documents. All equipment and materials used shall be of good quality, free of defects and in conformity with the Contract Documents. All equipment and materials not in conformity with the Contract Documents shall be considered defective.

### 5.02 GENERAL WARRANTY:

Contractor shall warrant and guarantee all material furnished and work performed by Contractor for a period of two years from the date of final acceptance of the Work by the Project Manager. Under this warranty, Contractor agrees to repair or replace, at its own expense and under the direction of the Project Manager, any portion of the Work which fails or is defective, unsound, unsatisfactory because of materials or workmanship, or which is not in conformity with the provisions of the Contract. Should Contractor fail to perform any such work within the warranty period after a request by the County, the County may withdraw from the Payment and Performance Bond any and all amounts necessary to complete the required work. The expiration of the warranty period shall in no way limit the County's legal or equitable remedies, or the period in which such remedies may be asserted, for work negligently or defectively performed.

## PART 6. BONDS, INSURANCE AND INDEMNIFICATION

### 6.01 INDEMNIFICATION:

A. Contractor agrees to indemnify and hold harmless the County and its officers, insurers, volunteers, representatives, agents, employees, heirs and assigns from and against all claims, liability, damages, losses, expenses and demands, including attorney fees, on account of injury, loss, or damage, including, without limitation, claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, or any other loss of any kind whatsoever, which arise out of or are in any manner connected with this Contract or the Contract Documents, to the extent that such injury, loss or damage is attributable to the act, omission, error, professional error, mistake, negligence or other fault of Contractor, any subcontractor of Contractor, or any officer, employee, representative, or agent of Contractor or of any subcontractor of Contractor, or which arise out of any worker's compensation claim of any employee of Contractor or of any employee of any subcontractor of Contractor.

B. Contractor, to the fullest extent permitted by law, shall defend, investigate, handle, respond and provide defense for and defend against any such liability, claims, damages, losses, expenses or demands at the sole expense of Contractor, or at the option of the County, Contractor agrees to pay the County or reimburse the County for defense costs incurred by the County in connection with any such liability, claims, damages, losses, expenses or demands. Contractor, to the fullest extent permitted by law, shall defend and bear all other costs and expenses related thereto, including court costs and attorney fees, whether or not such liability, claims or demands alleged are groundless, false or fraudulent.

C. This indemnification provision is intended to comply with C.R.S. § 13-21-111.5(6), as amended, and shall be read as broadly as permitted to satisfy that intent.

**6.02 NOTICE OF CLAIM:**

If Contractor receives any claim arising from the performance of the Work, Contractor shall notify the County in writing of the nature of the claim within 24 hours of receipt of the claim by Contractor. In this notice, Contractor shall provide evidence that Contractor has notified Contractor's insurer of the claim. Contractor shall keep the County apprised of the disposition of the claim, and Contractor shall take all necessary action to resolve the claim and make restitution, if required, as quickly as possible.

**6.03 INSURANCE:**

A. Contractor agrees to procure and maintain, at its own cost, a policy or policies of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by Contractor pursuant to this Contract. At a minimum, Contractor shall procure and maintain, and shall cause any subcontractor to procure and maintain, the insurance coverages listed below, with forms and insurers acceptable to the County.

1. Worker's Compensation insurance to cover obligations imposed by applicable law for any employee engaged in the performance of work under this Agreement, and Employer's Liability insurance with minimum limits of five hundred thousand dollars ($500,000) each accident, one million dollars ($1,000,000) disease – policy limit, and one million dollars ($1,000,000) disease – each employee. Evidence of qualified self-insured status may be substituted for the requirements of this Section.

2. Commercial General Liability insurance with minimum combined single limits of one million dollars ($1,000,000) each occurrence and one million dollars ($1,000,000) general aggregate. The policy shall be applicable to all premises and operations, and shall include coverage for bodily injury, broad form property damage, personal injury (including coverage for contractual and employee acts), blanket contractual, products, and completed operations. The policy shall contain a severability of interests provision, and shall include the County and the County's officers, employees, and contractors as additional insureds. No additional insured endorsement shall contain any exclusion for bodily injury or property damage arising from completed operations.

3. Business Automobile liability insurance with minimum combined single limits of at least one million ($1,000,000) each occurrence.

B. Such insurance shall be in addition to any other insurance requirements imposed by law. The coverages afforded under the policies shall not be canceled, terminated or materially

changed without at least thirty (30) days prior written notice to the County. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage. Any insurance carried by the County, its officers, its employees, or its contractors shall be excess and not contributory insurance to that provided by Contractor. Contractor shall be solely responsible for any deductible losses under any policy.

C. Contractor shall provide to the County a certificate of insurance as evidence that the required policies are in full force and effect. The certificate shall identify this Contract.

### 6.04 PERFORMANCE AND PAYMENT BOND:

Contractor shall furnish a Payment and Performance Bond in the full amount of the Contract Price, as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents, including the warranty. This bond shall remain in effect at least until two years after the date of Final Completion.

## PART 7. PAYMENT

### 7.01 PROGRESS PAYMENTS:

A. The County will make payments for services on a monthly basis for services performed during the previous month in accordance with these Contract Documents. All Invoices shall include work bid item categories, an estimate of the percentage of each Work Bid Item completed in accordance with Bid Form A, and payment requested for each Work Bid Item. No other categories or rates will be allowed or payable. All labor invoices are subject to County approval.

B. Materials will be payable on a reimbursable basis with no additional profit, fee, overhead, handling, or General and Administrative (G&A) costs. All costs for materials shall be approved by the County before the costs are incurred and payable.

C. Progress payments shall be in an amount equal to 90% of the Work actually completed until the Work, as determined by the Project Manager, is completed.

D. The County will pay the Contractor, upon submission of proper invoices, the prices stipulated in the Contract Documents for services rendered and accepted, less any deductions provided in the Contract Documents within 30 days. The County will not pay late fees or interest. Any discount payment terms offered on the invoice may be taken by the County.

E. Contractor, at his discretion, may offer a 3% discount from his bid price if Morgan County agrees to payment terms of Net 10 days.

### 7.02 FINAL PAYMENT:

Upon final acceptance of the Work, the County shall make final payment to Contractor pursuant to C.R.S. § 38-26-107.

### 7.03 LIQUIDATED DAMAGES:

A. Because time is of the essence and delayed performance constitutes a compensable inconvenience to the County and its residents, the liquidated damages in the amount of $4,000 per day may be imposed by the County. Such damages are not a penalty. For each day Final Completion is delayed after the Final Completion date stated in the Construction Contract, as

modified through approved change orders, Contractor shall be assessed the following amounts:

B. Allowing Contractor to continue and finish the Work or any part thereof after the Final Completion date shall not operate as a waiver on the part of the County of any of its rights under the Contract Documents. Any liquidated damages assessed shall not relieve Contractor from liability for any damages or costs of other contractors caused by a failure of Contractor to complete the Work in the Contract Time. Liquidated damages may be deducted from any payment due Contractor or the retainage. If the liquidated damages exceed the amount owed to Contractor, Contractor shall reimburse the County.

**7.04 ORAL AGREEMENTS PROHIBITED:**

This Contract is expressly subject to the provisions of C.R.S. § 29-1-110(1), and Contractor acknowledges that neither the County nor any employee or agent thereof is authorized to expend or contract for the expenditure of any monies in excess of those appropriated by the Morgan County Board of County Commissioners. The County acknowledges that sufficient funds have been appropriated to pay the Contract Price, but Contractor shall not rely upon the appropriation of any funds in addition to those already appropriated unless and until the same are lawfully appropriated by the Morgan County Board of County Commissioners.

**7.05 ITEMS NOT INCLUDED IN BID:**

No additional compensation shall be paid for any costs or services listed in the Contract Documents but not specifically listed in the Bid as a Bid item.

**7.06 CHANGES IN QUANTITY:**

A. Except as provided in Section 7.07, the pay quantities and unit Bid price shown in the Bid Schedule shall be used to determine the payment owed Contractor.

B. The pre-established quantities on the Bid Schedule shall be used to calculate the payment due to Contractor.

C. Except as provided in Section 7.08, Contractor shall not be entitled to compensation for any increased expense, loss of expected reimbursement or loss of anticipated profits, directly or indirectly caused by any changes in quantity.

D. If Contractor believes the pre-established pay quantities on Bid Form A are in error and that Contractor believes he is entitled to an increase or decrease in payment, Contractor shall demonstrate to the satisfaction of the Owner that the Contractors estimation of pay quantities is correct.

**7.07 BID PRICE ADJUSTMENTS:**

A. When the quantity of a major item is increased to more than 125% or decreased below 75% of the original quantity stated on the Bid Schedule and agreed to by the Owner through a demonstration by Contractor, the Bid pay quantity shall be modified by written change order. Payment for major items shall be calculated by multiplying the accepted change in quantity placed by the contract Bid price.

B. For purposes of this Section, a major item is any item having a Bid value, determined by multiplying the Bid quantity by the unit Bid price, that exceeds 10% of the original Contract Price.

### 7.08 ELIMINATED ITEMS:

Should any items contained in the Bid Schedule be found unnecessary for completion of the Work, the items shall be eliminated. The Contract Price shall be modified through written change order, and the amount of the change order shall be the eliminated quantity multiplied by the unit Bid price stated in the Bid Schedule, minus any reasonable costs incurred by Contractor for the eliminated items. Reasonable costs shall be determined by the Project Manager based on information provided by Contractor, and may include mobilization of eliminated materials and equipment mobilization costs, if the sole purpose of the equipment was to place the eliminated material. In no case shall the costs exceed the amount of the eliminated items.

### 7.09 MATERIALS STORED BUT NOT INCORPORATED:

Payments may be made to Contractor for materials stored on the work site but not incorporated into the Work as evidenced by invoices or cost analyses of material produced, if the material has been fabricated or processed and is ready for installation into the Work and conforms with the Contract Documents. Payment for stockpiled materials shall not relieve Contractor of responsibility for loss or damage to the material. Payment for living plant materials or perishable materials shall not be made until the living or perishable material is made an integral part of the finished Work.

### 7.10 COST RECORDS:

Contractor shall make cost records available to the County if the County deems it necessary to determine the validity and amount of any item claimed.

## PART 8. MISCELLANEOUS

### 8.01 PUBLICATIONS:

Any and all publications relating to the Work and authored by Contractor or any of its subcontractors shall be submitted to the County for its prior written approval of the content of the publication. If the County disapproves of the content of the publication, the author shall withdraw it from publication. The term "publication" as used herein shall include articles or letters to be published in any newspaper, magazine, trade journal or other periodical.

### 8.02 CONFIDENTIALITY:

Any and all reports, information, date, statistics, forms, designs, plans, procedures, systems, studies and any other communication form of knowledge given to or prepared or assembled by Contractor under this Contract shall, to the extent authorized and permitted by law, be kept as confidential and not be made available by Contractor to any individual, company or organization without the prior written consent of the County. Notwithstanding the foregoing, Contractor shall not be restricted from releasing information in response to a subpoena, court order, or legal process, but Contractor shall notify the County in writing before responding.

### 8.03 INDEPENDENT CONTRACTOR:

Contractor, for all purposes arising out of this Contract, is an independent contractor and not an employee of the County. It is expressly understood and agreed that Contractor shall not be entitled to any benefits to which the County’s employees are entitled, such as overtime, retirement benefits, worker's compensation, injury leave or other leave benefits.

## 8.04 CONFLICTS:

Should any conflict arise in the Contract Documents, Contractor shall bring the conflict to the attention of the Owner immediately upon discovery. The Owner, Contractor, and CQA Firm shall discuss the conflict and together determine the remedy. Contractor is made aware that the Design and Construction Quality Assurance Plan have been approved by the Colorado Department of Public Health and Environment and may not be modified unless approved the Owner and Design/CQA Personnel, or in some cases the Colorado Department of Public Health and Environment.

# ADDENDUM A

## Construction Quality Assurance Plan and Specifications