IFB No.: DRR21001
ATTACHMENT B
EXHIBIT A-2

Construction Quality Assurance Plan
WMU II-IV Final Closure Construction
Bonzi Sanitation Landfill
Stanislaus County, California

Prepared for

CalRecycle
Department of Resources Recycling and Recovery
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Sacramento, California 95814

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Project #AU20.1181.00

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Definitions

Wherever the terms listed below are used in this CQA, their intent and meaning shall be interpreted as defined in this section.

ASTM - ASTM International (formerly American Society for Testing and Materials), 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, 19428-2959; also, the numerical designation of a standard specification, test method, or practice established by ASTM International.

Caltrans - Caltrans (aka California Department of Transportation), 1120 N Street, P.O. Box 942873, Sacramento, California 94273-0001; also, the numerical designation of a standard specification, test method, or practice established by Caltrans.

Contract Documents - The official document set issued for the project, including bidding requirements, contract forms, contract conditions, Construction Drawings, Construction Specifications, addendums and contract modifications.

Contractor - A person or persons, firm, partnership, corporation, or combination, whether private, municipal, or public, who, as an independent contractor, has entered into a contract with Owner to perform the construction activities for the project. This includes but is not limited to the earthwork contractor(s), geosynthetic installer(s), or their subcontractor(s).

Construction Completion Report - Report to be prepared at the completion of construction by the CQA Engineer/Officer that documents the as-built conditions and record drawings.

Construction Drawings - The official plans, profiles, cross-sections, elevations, notes, and details, as well as their amendments and supplemental drawings, showing the locations, character, dimensions, and details of cover construction and grading.

Construction Manager - The designated representative of the CalRecycle on the site, responsible for construction contract administration.

Construction Quality Assurance - A planned series of observations and tests to verify and document that quality control functions have been performed adequately and to assess compliance with contract drawings.

Construction Quality Assurance Consultant (CQA Consultant) - The party, independent from Owner or Contractor, that is responsible for observing and documenting activities related to the quality of material manufacturing, material installation, and other construction activities related

to the project. Also responsible for issuing a CQA report sealed by a Professional Engineer registered in the State of California.

Construction Quality Assurance (CQA) Laboratory - A laboratory capable of conducting materials testing required by this CQA Plan.

Construction Specifications - The official quality requirements for products, materials, and workmanship upon which the design and construction of the project are based. The Construction Specifications are on the plans and in the Technical Specifications document.

CQA Engineer/Officer - A civil engineer, registered in the State of California as required by 27 CCR 20324(b)(2), who is responsible for observing, verifying, and documenting the construction and for preparing, signing, and sealing the Construction Completion Report.

CQA Monitor - A designated site representative of the CQA Engineer responsible for observing and documenting field conditions and tests.

Owner – Department of Resources Recycling and Recovery "CalRecycle"

Daily Report - A record of construction progress prepared by the CQA monitor which documents construction on a daily basis as outlined in this CQA Plan.

Earthwork - Work performed by the Contractor using soil or soil-like materials, including (but not limited to) excavation, hauling, stockpiling, general fill and compacted earth fill.

Engineer/Design Engineer - The individual(s) or firm(s) responsible for designing the final closure and preparing the Construction Drawings and Construction Specifications, either by or under the direct supervision of a civil engineer registered in the State of California. The Design Engineer for this project is Geo-Logic Associates, Inc., 143E Spring Hill Drive, Grass Valley, California 95945.

Excavation - The removal of soil, soil-like material, and rock from in-place masses within areas identified on the Construction Drawings for excavation. Excavation may include the exclusion of unsuitable materials and preparation of the foundation layer.

Fabricator – Company or manufacturer responsible for joining or prefabricating in a factory or warehouse individual manufactured components together.

Linear Low Density (LLDPE) Geomembrane - A polymeric sheet material that is impervious to liquid, also referred to as flexible membrane liner, membrane, or liner.

Geotextile - Woven or nonwoven sheet synthetic fabric manufactured for use as a cushion, separator, or reinforcement in geotechnical applications.

Geocomposite – Two or more geosynthetics materials bonded together. Typically, two geotextile fabrics bonded to a geonet core for drainage purposes.

GSI - Geosynthetic Institute.

Installer – The Installer is responsible for proper installation of the geosynthetic components in accordance with the Construction Drawings and specifications. The Installer may be affiliated with the Manufacturer.

Manufacturer - The Manufacturer(s) is responsible for production of the geosynthetic components outlined in this plan. The Manufacturer may be affiliated with the Installer. Each Manufacturer must pre-qualify that they are able to produce material that meets the requirements of the Project Specifications.

Nonconformance - A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate, including (but not limited to) physical defects, test failures, failure to conform to the requirements of the Construction Drawings or Construction Specifications, or inadequate documentation.

Procedure - A document that specifies or describes how an activity is to be performed.

Project Document - Any document, either required or incidental, prepared to further the construction of the cover, including (but not limited to) Contractor submittals, Construction Drawings, Construction Specifications, Technical Specification, Record Drawings, shop drawings, construction quality control and quality assurance plans, safety plans, and project schedules.

Quality Assurance - A planned and systematic program of procedures and documents to show that items of work or service meet the requirements of the Construction Drawings and Construction Specifications. Quality assurance does not include quality control, and will be performed by the CQA Engineer, acting through the CQA Monitor when appropriate.

Quality Control - Actions that provide a means of measuring and regulating the characteristics of items of work or service so that they comply with the requirements of the Construction Drawings and Construction Specifications. Quality control shall be performed by the Contractor, Subcontractors, manufacturers, and suppliers, as appropriate.

Record Drawings - Drawings recording the dimensions, details, coordinates, and characteristics of the project as they were actually constructed; informally referred to as "as-builts".

RWQCB – California Regional Water Quality Control Board, Central Valley Region.

Surveyor - The individual(s) or firm(s) responsible for locating project features, staking grades to establish required elevations, and measuring construction quantities as needed to carry out; and produce the data on which the record drawings are based and payment quantities are estimated. All such work being performed by or under the continuous supervision of a licensed land surveyor registered in the State of California.

Testing - Verification that an item meets specified requirements by subjecting that item to a set of physical, chemical, environmental, or operating conditions and recording the associated physical state or response of the item.

USCS - Unified Soil Classification System, as defined in ASTM D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) (if laboratory data are available) or ASTM D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (if laboratory data are unavailable).

1. Construction Quality Assurance

1.1 Introduction and Scope

This Construction Quality Assurance (CQA) Plan describes the CQA requirements for WMU II-IV Final Closure at the Bonzi Sanitation Landfill being closed under the authority of the Department of Resources Recycling and Recovery "CalRecyle" (Owner). CQA refers to the duties of a third party CQA Consultant hired by the Owner to monitor, inspect, and evaluate materials and workmanship during construction. The CQA activities document the compliance of the Contractor with the Construction Drawings (Drawings) and Construction Specifications (Specifications) for the construction which has been approved by the California Regional Water Quality Control Board (RWQCB).

The overall goal of this CQA Plan is to assure that proper construction techniques and procedures are used and that the project is built in accordance with the Construction Drawings and Specifications. The intent is to identify and define problems that may occur during construction and to observe that these problems are corrected before construction is complete. A written final report prepared by the CQA Consultant will be prepared summarizing the construction activities and observing that the installation was performed in general accordance with the Construction Drawings and Specifications.

All quality assurance activities shall be conducted in accordance with this CQA Plan, and with the Construction Drawings and Specifications. Where there is a discrepancy, the Specifications shall govern unless otherwise specified by the Owner and approved by the RWQCB. The CQA Monitor shall observe all field installation activities. The CQA Consultant shall be responsible for ensuring that the proper number of personnel are onsite and capable of observing construction activities as described in this document. The CQA Monitor shall be present during all phases of construction that require CQA observation. Documentation shall meet the requirements of this CQA Plan and the Specifications.

1.2 Duties of CQA Personnel

It is the duty and responsibility of the CQA Consultant to implement the elements of this CQA Plan in order to ensure that the construction and installation of the composite cover system at the site is performed in accordance with the approved Construction Drawings and Specifications, Title 27 of the California Code of Regulations, and 40 CFR 258 (Subtitle D). The CQA personnel shall make every effort to communicate in an efficient and effective manner to

the Contractor's representatives on issues concerning testing and observation procedures and results of materials or *in situ* tests performed.

The CQA Consultant is not in a position to direct construction activities, but is encouraged to give advice to the Contractor on items which may improve the quality or speed progress of the construction.

The CQA Consultant and its representatives shall make every effort to furnish test results to the Contractor in a prompt manner. The representatives of the CQA Consultant shall report to the Owner any nonconformance items, which cannot be resolved promptly.

The CQA monitor will be on site as required during the construction project to ensure that all aspects of construction are monitored and documented.

1.3 Personnel Qualifications

1.3.1 CQA Officer

The CQA Officer will have formal academic training in civil engineering or a closely related discipline and will be a registered civil engineer or certified engineering geologist in the State of California. The CQA Officer will have experience in earthworks construction, landfill design and construction, and final closure. The CQA Officer will have practical technical and managerial experience that will allow the CQA Plan to be properly implemented. The CQA Officer must be able to communicate effectively with the Owner and the Contractor so that there will be a clear understanding of construction activities and the CQA Plan.

1.3.2 CQA Monitor

The CQA monitors will work directly under the responsible charge of the CQA officer. The CQA Monitors will have formal training and practical experience in inspecting and testing earthworks construction, geomembrane installations, and final closure, including conducting and recording inspection activities, preparing daily reports, and performing field testing. In addition, knowledge shall be required of the specific field practices and construction techniques for landfill cover construction and all codes and regulations involving material handling, observation of testing procedures, equipment, and reporting procedures.

2. Meetings

2.1 General

Throughout the entire construction and installation of the final cover system, close communication between all parties involved with the project is essential. In order to coordinate activities between the Owner, CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting, meetings shall be held before and during construction. The type and purpose of meetings to be held for this project are described in this section.

2.2 Preconstruction Meeting

A preconstruction meeting shall be held, at the Owner's request, prior to project start-up. The parties that shall attend this meeting are the Owner, Contractor, and CQA Consultant. The purpose of this meeting is to:

- Identify key personnel
- Review the project Construction Drawings, Specifications, and CQA Plan
- Review project tasks and responsibilities
- Review project schedule
- Review lines of communication and authority
- Review reporting and documenting procedures
- Review testing equipment and test methods
- Review protocol for submittal of CQA conformance testing data sheets
- Conduct a site inspection to review work areas, lay-down areas, stockpile areas, access roads, and related project issues

The CQA Consultant shall document the preconstruction meeting and copies shall be provided to all attendees and other parties requested by the Owner. Preconstruction meeting documentation shall become part of the project documents.

2.3 Daily Progress Meetings

A progress meeting shall be held before the start of each construction shift. The daily progress meetings shall be attended by the CQA Monitor and the Contractor. The purpose of this meeting shall be to:

- Review the proposed activities scheduled by the Contractor for the day
- Discuss any problems or deficiencies that have arisen during construction
- Review the results of any test data
- Discuss the Contractor's deployment of personnel and equipment
- Review the previous day's activities including the effectiveness of procedures taken to alleviate any deficiencies

All progress meetings shall be documented by the CQA Monitor on his daily field construction inspection report.

2.4 Weekly Progress Meetings

Progress meetings will be held at the beginning or end of each week to review the previous week's activities or progress, discuss present and future work, and discuss any current or potential construction problems. At a minimum the CQA Monitor, Owner representative, the Contractor, and all active subcontractors shall attend. If necessary, the CQA Officer and/or Engineer shall also attend. All weekly progress meetings will be documented by the CQA Monitor who will transmit minutes by the end of the second working day to all parties.

2.5 Work Deficiency Meetings

As needed, meetings shall be held to discuss specific problems or deficiencies that occur during construction that cannot be easily resolved. Work deficiency meetings shall be attended by the CQA Monitor, CQA Officer, the Owner, and the Contractor and Engineer, if necessary. The purpose of these meetings is to:

- Identify the nature and extent of the problem
- Discuss the means necessary to correct the deficiency or problem
- Provide a solution to the problem and determine how the corrective action shall be implemented

All work deficiency meetings will be documented by the CQA Consultant who will transmit minutes to all attending parties. Deficiency meeting documentation shall become part of the project documents.

3. Design Changes

3.1 Minor Design Changes

Minor changes to the Construction Drawings and Specifications may be necessary to maintain or enhance quality during the project or to adjust unforeseen field conditions. Minor changes must be approved by the Engineer.

Procedures for providing minor changes include the following:

- The need for a design change may become apparent during the course of construction of the project and a request for a change may be initiated by any individual associated with the project.
- All proposed design changes must be approved by the Engineer and submitted to the CQA Officer with necessary documentation supporting the change for approval. All design changes must meet the intended quality and technical requirements of the design.
- Approved changes will be distributed to the Owner, CQA Monitor, CQA Officer, Contractor, Geosynthetics Installer, applicable subcontractor(s), and the RWQCB as required.
- Minor changes do not include changes that decrease the environmental protection of the unit such as decreasing the final cover system components, changing the synthetic liner materials, etc.

3.2 Major Design Changes

Major changes to the Construction Drawings and Specifications are unlikely to occur but may become necessary during the course of construction. Major changes may include elimination of final closure design components or changes to final cover system components and the extent of cover installation. The following procedures will be implemented for all major changes:

- A special meeting will be scheduled immediately with the RWQCB and LEA as necessary to discuss the need for the change.
- Owner and Engineer will both attend the meeting to present the basis for the change. Requested changes and supporting documentation will be provided at the meeting.
- Major changes will not be implemented without the express written approval from pertinent regulatory agencies (e.g. RWQCB and/or LEA).

- Copies of approved changes will be distributed to Owner, Engineer, CQA Monitor, CQA Officer, Contractor, Geosynthetics Installer, applicable subcontractor(s), and pertinent state and local regulatory agencies.

4. Earthwork

4.1 General

This section outlines the requirements for earthwork operations for the construction of the landfill cover system. The Contractor shall excavate soils and prepare the cover subgrade as necessary to achieve the grades set forth within the Construction Drawings and Specifications. Earthwork includes but is not limited to:

- Excavation
- Engineered fill
- Geomembrane subgrade preparation
- Foundation layer
- Vegetative/Protective Cover
- Culvert pipe installation
- Rock slope protection
- Geocell armor

Specifically excluded from this section is the geomembrane, geotextile, and geocomposite installation which is addressed within later section of this CQA Plan.

The CQA Monitor or outside testing agency will perform testing on the soils and granular materials at the site in general conformance with the ASTM Standard methods described in Table 4.1.

The CQA Monitor shall observe that the Contractor has conducted all surveying and as-built drawing preparation as required by the Specifications. Where called for in this CQA plan or in the Specifications, the following test methods may apply:

Table 4.1 – List of ASTM Standard Tests for Soil and Granular Materials

STANDARD	TITLE AND TEST DESCRIPTION
ASTM D1556	Density and unit weight of soil in place by the sand-cone method
ASTM D698	Laboratory compaction characteristics of soils using Standard Effort ("Standard Proctor" method)
ASTM D1557	Laboratory compaction characteristics of soils using Modified Effort ("Modified Proctor" method)
ASTM D2216	Laboratory determination of water (moisture) content of soil by the microwave oven method
ASTM D4643	Determination of water (moisture) content of soil by the microwave oven method
ASTM D2434	Permeability of granular soils (constant head)
ASTM D5084	Measurement of hydraulic conductivity of saturated porous materials using a flexible wall permeameter
ASTM D4318	Liquid limits, plastic limit, and plasticity index of soils (Atterberg limits)
ASTM C136	Sieve analysis of fine and coarse aggregate
ASTM D2487	Standard classification of soils for engineering properties
ASTM D2488	Standard practice for description and identification of soils
ASTM D4220	Standard practices for preserving and transporting soil samples
ASTM D6836	Determination of the Soil Water Characteristic Curve for Desorption using a Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, and/or Centrifuge
ASTM D6938	In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods
ASTM D854	Specific Gravity of Soils
ASTM D6913	Particle Size Distribution (Gradation) of Soil using Sieve Analysis
ASTM D2937	Standard Test Method for Density of Soil in Place by the drive Cylinder Method

4.2 Soil Sampling

4.2.1 Sample Processing

The CQA Monitor is responsible for the timely processing and testing of soil samples. The CQA Officer must determine which samples will be tested on-site and which will be tested off-site. This determination will be made based on available manpower, available equipment, complexity of test, and time available to determine results. For expediency, samples tested off-site must be shipped the same day as they are obtained.

As test data is obtained from the on-site and off-site laboratories it must be summarized in the form it will appear in the CQA report.

4.2.2 Sample Numbering and Logging

The CQA Monitor must maintain a sample numbering system for all soil samples obtained for the project. These samples include those obtained prior to construction for conformance or slope stability testing, and samples obtained during construction such as samples obtained for moisture-density relationship testing.

Documentation of soil sampling must be summarized in the form it will appear in the CQA report, and be maintained throughout the project. The log must include soil sample numbers beginning with (0001) and proceeding sequentially. No sample number can be repeated, and re-tests of a sample that does not meet specified requirements must be given the original number with a letter suffix (i.e., re-tests for a sample 0021 not meeting specified requirements would be 0021A, 0021B, etc.). Information contained in the master soil sample log must include:

- Sample number
- Test(s) being performed
- Date the sample was obtained
- Name of CQA Monitor that obtained the sample
- Location that the sample was obtained, such as a stockpile, a fill, a borrow area, etc.
- Location testing will take place (on-site vs. off-site)
- Date sample sent off-site
- Date test results were completed on-site or received from off-site
- Name of CQA Monitor that performed the on-site testing
- Comments about the test results, such as pass / fail information

4.2.3 Sample Tagging

The CQA Monitor must maintain the identification of all samples obtained throughout the project from the time the sample is obtained to the time testing is completed. The monitor must place an identifying tag on the sample or mark the sample container with the sample number immediately upon sampling. The tag or identifying container must remain with the sample throughout processing, testing and storage. The tag or container must have the following information:

- Sample number
- Soil material type
- Project name and project number
- Name of CQA Monitor that obtained the sample
- The date the sample was obtained

4.3 Conformance and Construction Phase Testing

Table 4.2 establishes test frequencies for earthwork CQA testing. It includes classification and conformance tests that must be performed prior to soil installation to assure soil materials meet quality standards established in the technical specifications. In addition, Table 4.2 outlines post-construction testing to assure installed materials meet specified requirements.

The test frequencies listed establish the minimum number and intervals of required tests. Additional testing must be conducted whenever work or materials are suspect, marginal, or of poor quality. Extra testing may also be performed to provide additional data for engineering evaluation. Any re-tests performed as a result of a failing test cannot contribute to the total number of tests performed in satisfying the minimum test frequency.

Table 4.2 – Earthwork Conformance and Construction Testing

Required Test	ASTM Designation	Test Frequency
Engineered Fill Conformance Testing		
Identification and Classification of Soil Type	D2488/D2487	1 / 5,000 cy
Gradation	D6913	1 / 5,000 cy
Moisture / Density Relationship	D1557	1 / 10,000 cy
Engineered Fill Construction Testing		
Identification and Classification of Soil Type	D2488/D2487	1 / 5,000 cy
Gradation	D6913	1 / 10,000 cy
Density, Nuclear Method	D6938	1 / 2,500 cy
Moisture Content, Nuclear Method	D6938	1 / 2,500 cy
In Place Density Verification (Sand Cone Method or Drive Cylinder Method)	D1556/D2937	1 / 20 nuclear tests
Moisture Content Verification	D2216	1 / 20 nuclear tests
Geomembrane Subgrade Construction Testing		
Moisture / Density Relationship	D1557	1 / material type
Density, Nuclear Method	D6938	1 / 50,000 sf
Moisture Content, Nuclear Method	D6938	1/ 50,000 sf
Observe compacted subgrade for yielding under equipment load	N/A	Continuous
Foundation Layer Conformance Testing		
Identification and Classification of Soil Type	D2488/D2487	1 / 5,000 cy
Sieve Analysis	D6913	1 / 5,000 cy
Moisture / Density Relationship	D1557	1 / 10,000 cy
Foundation Layer Construction Testing		
Density, Nuclear Method	D6938	1 / 2,500 cy
Moisture Content, Nuclear Method	D6938	1 / 2,500 cy
In Place Density Verification (Sand Cone Method or Drive Cylinder Method)	D1556/D2937	1 / 20 nuclear tests
Moisture Content Verification	D2216	1 / 20 nuclear tests
Vegetative/Protective Cover Conformance Testing		
Gradation	D6913	1 / material type
Identification and Classification of Soil Type	D2487,D2488	1 / material type

Required Test	ASTM Designation	Test Frequency
Moisture / Density Relationship	D1557	1 / material type
Vegetative/Protective Cover Construction Testing		
Gradation	D6913	1 / 10,000 cy
Density, Nuclear Method	D6938	1 / 2,500 cy
Moisture Content, Nuclear Method	D6938	1/ 2,500 sf
Pipe Bedding and Pipe Zone Backfill Construction Testing		
Density, Nuclear Method	D6938	1 / 100 cy
Identification and Classification of Soil Type	D2487,D2488	1/100 cy placed

4.4 Excavation/Stockpiling

The excavated soil materials shall be stockpiled in the identified stockpiles as directed by the CQA Monitor or Owner. The CQA Monitor will visually monitor the excavation to identify soil types and confirm the soil types by sampling and visual classification. The Monitor shall observe that the stockpiles conform to the requirements of the Specifications.

4.5 Engineered Fill Placement

The CQA Monitor shall observe that the engineered fills are placed to the lines and grades shown on the Construction Drawings.

Prior to fill placement, the CQA Monitor shall verify that all demolition, clearing, grubbing, and stripping has been performed by the Contractor in accordance with the appropriate sections of the project Specifications, this includes verifying that existing slopes over 5 feet tall with inclinations greater than 5:1 (H:V) have been properly benched and fill keys have been prepared. The CQA Monitor shall observe fill placement and perform the necessary field and laboratory testing to ensure that materials are compacted at the specified moisture content and to the minimum density specified. The CQA Monitor shall observe the placement of engineered fill material in loose lifts not exceeding the thickness stated in the Specifications. The CQA Monitor shall observe that each lift of engineered fill receives an adequate number of passes by compaction equipment. Tests to be performed and their frequency are provided in Table 4.2.

4.6 Geomembrane Subgrade Preparation

Prior to geomembrane subgrade preparation, the CQA Monitor shall verify removal of large or sharp materials and verify that surface is suitable for liner subgrade. Geomembrane subgrade proof-rolling, smooth-drum compaction, and other preparation activities shall be observed by

the CQA Monitor as required by the Specifications and this Plan. The CQA Monitor shall observe the subgrade compaction and perform the necessary field and laboratory testing to ensure that materials are compacted at the specified moisture content and to the minimum density specified and that this condition is maintained. The completed liner subgrade for the synthetic liner shall be inspected and tested by the CQA Monitor, Contractor, and/or Geosynthetics Installer (Installer) to ensure that it will provide a firm and relatively smooth base for construction of the lining system in accordance with the Construction Drawings and Specifications. Any areas observed to be excessively soft or having excessive moisture during proof-rolling shall be excavated and reworked or removed and suitable materials placed by the Contractor in accordance with the project Specifications. At the conclusion of the liner subgrade preparation, the CQA Monitor shall record on an appropriate form that the subgrade is acceptable to the Installer for placement of the overlying geosynthetic materials.

4.7 Foundation Layer

CQA Monitors shall perform the following tasks during preparation of the foundation layer:

- Observe that construction staking is performed before work and that survey bench marks with elevations are secured outside the work area.
- Perform visual and manual soil classifications (ASTM D2487/D2488) to verify that material source is suitable for foundation layer.
- Observe that the material is free of organic and oversized materials.
- Perform classifications and the foundation layer material is delivered to the site.
- Perform moisture-density relationship testing (ASTM D1557) to determine the maximum dry density and optimum moisture content of fill materials. Perform tests at testing frequencies specified in Table 4.2.
- Observe that fill materials are placed and compacted in accordance with the project Specifications. If a sheepsfoot compactor is not used, verify that the top of each compacted lift is scarified before placing the subsequent lift.
- Perform nuclear density-moisture tests (ASTM D6938) to verify that each lift is compacted as required by the Specifications. Perform tests at the testing frequencies specified in Table 4.2.
- Observe that soil materials that are too wet for proper compaction per the Specifications are properly aerated and processed to bring the moisture content of the material into the acceptable range of the optimum moisture content.

- Observe that fill soils that are too dry for proper compaction per the Specifications are properly moisture conditioned and processed to bring the moisture content into the acceptable range of the optimum moisture content.
- Observe that desiccated fills are properly repaired or removed before placing subsequent lifts.
- Observe that angular or sharp rocks and other debris that could damage the geosynthetics are removed from the surface of the subgrade. Observe that the subgrade is free of irregularities and has been prepared in accordance with the Specifications prior to geosynthetic placement. Unless otherwise noted in the Specifications, the surface should be free of stones greater than 2 inches in diameter or protrusions greater than 0.5 in.
- Coordinate with the Contractor to perform verification surveys at the completion of fill operations. Observe corrective action measures as determined by verification surveys.

4.8 Vegetative/Protective Cover

No vegetative/protective cover material shall be placed until the synthetic liner has been installed and approved by the CQA Monitor and CQA Officer. The CQA Monitor shall obtain samples and perform conformance testing on the vegetative/protective cover materials in accordance with the Specifications prior to installation.

The CQA Monitor and CQA Officer shall review the Contractor's list of proposed equipment and his description of the construction methods to excavate and place the vegetative/protective cover over the geosynthetic materials in accordance with the Specifications.

The CQA Monitor and CQA Officer shall review the Contractor's list of proposed equipment and his description of the construction methods to blend organic material with the vegetative/protective cover material for the top 6 inches of the vegetative/protective layer in accordance with the Specifications.

The CQA Monitor shall continuously observe placement of the vegetative/protective cover so that no materials are placed over wrinkles in the underlying geosynthetics. The thickness of the vegetative/protective cover shall also be observed to ensure compliance with the Specifications.

The Contractor shall schedule placement of the vegetative/protective cover layer material during cooler parts of the day in the event of warm weather to avoid placement of materials when the liner is wrinkled. All observed damages shall be recorded by the CQA Monitor and their location clearly marked for scheduled repair. The CQA Monitor shall observe the placement of the

vegetative/protective cover material to ensure that the Contractor follows the procedures described in the Specifications.

The CQA Monitor shall test the vegetative/protective cover materials during placement in accordance with Table 4.2.

4.9 Rock Slope Protection, Geocell Armor, and Stormwater Features

The CQA Monitor shall observe and verify that construction of stormwater channels and basin are in accordance with the Construction Drawings and Specifications. The CQA Monitor shall observe that ditches and basin are constructed to the alignments, slopes, flow line elevations, and dimensional cross-sections shown on the Construction Drawings. Any fills necessary for the construction of the stormwater channels shall be observed and tested in accordance with the frequencies and requirements as specified in Table 4.2 and in the Construction Drawings and Specifications.

The CQA Monitor shall review product submittals and provide visual observation and documentation that the rock slope protection products are in accordance with the thickness and gradation requirements outlined in the Construction Drawings and Specifications. Where specified, the CQA Monitor shall observe that the separator geotextile is installed on the graded subgrade in accordance with the Construction Drawings and Specifications. Once the geotextile has been installed, the CQA Monitor shall verify that the rock slope protection materials are placed to the approximate lines and grades shown on the Construction Drawings.

The CQA Monitor shall review product submittals and provide visual observation and documentation that the geocell armor is supplied and installed in accordance with the requirements outlined in the Construction Drawings, Specifications, and manufacturer's recommendations.

4.10 Surveys and As-Builts

The CQA Officer shall review as-built survey information to confirm that minimum design thicknesses and grades are achieved prior to placement of any additional material over the prepared foundation layer. Confirm that the specified as-built survey grid is used to confirm minimum thicknesses and lines and grades of the foundation layer and top of vegetative/protective cover. Confirm that additional survey points are obtained at grade breaks. As-built surveys and submittals shall be in accordance with requirements of the Specifications.

5. Linear Low Density Polyethylene (LLDPE) Geomembrane Quality Assurance

5.1 General

This section sets forth the CQA testing and observation requirements for installing the geomembrane materials detailed on the Construction Drawings and Specifications. This work includes the manufacturer's QC testing, conformance testing, shipping and handling, deployment, seaming, repairs, and non-destructive and destructive testing of the geomembrane liner. The Contractor shall furnish submittals in compliance with this Plan and conditions of warranty prior to construction for review by the CQA Officer and CQA Monitor.

5.2 Shipping and Handling

The Contractor shall provide a copy of the QC certificates for production of all of the geomembrane manufactured for this project prior to construction for review by the CQA Monitor and CQA Officer. The certificate of compliance for the geomembrane must be received prior to installation as required by the Specifications. Materials shall be delivered to the site only after the CQA Consultant receives and approves the required submittals.

The Contractor is responsible for the transportation, off-loading and storage of the geomembrane. The materials shall be packaged and shipped by appropriate means so that no damage is caused and shall be delivered to the site only after the CQA Monitor receives and approves the required submittals and conformance testing results. Off-loading shall be performed in the presence of the CQA Monitor and any damage during off-loading shall be documented. The CQA Monitor shall keep an inventory log of all geomembrane delivered to the site on the appropriate form for review by the CQA Officer.

Damaged materials shall be separated from undamaged materials until the CQA Monitor and CQA Officer determine proper disposition of the material. Final authority on the determination of damage shall be the CQA Monitor. The Contractor shall replace damaged or unacceptable material at no cost to the Owner.

5.3 Geomembrane Conformance Testing

After production, the geomembrane shall be sampled for conformance testing by a third party geosynthetics laboratory. Sampling shall be performed at the manufacturing plant or upon arrival at the site by the CQA Monitor or the third party geosynthetics laboratory. One geomembrane sample shall be obtained for every 100,000 square feet produced per lot. The

CQA Monitor shall identify the roll numbers of the geomembrane that are tested for conformance on the inventory log of geomembrane received. The samples shall be delivered to the geosynthetics laboratory to conduct specified tests to assess whether the geomembrane properties conform to the requirements given in the Specifications. The CQA Officer shall review all test results and report any non-conformance test results to the Contractor and the CQA Monitor. Third party geosynthetics testing shall be performed by a GSI accredited laboratory.

Conformance samples shall be collected across the entire width of the roll, but shall not include the first three feet of the roll. The conformance samples shall be three feet wide by the roll width in length. Each sample shall be marked with the project name, Manufacturer's name and product identification, lot number, roll number, and type (HDPE, LLDPE, 60-mil, double-textured, single-textured, etc.). In event that sampling is necessary at the site, the Contractor shall provide the personnel and equipment to obtain the sample in the presence of the CQA Monitor. No material shall be deployed until passing conformance values are obtained by the CQA Monitor.

The conformance testing shall include the following parameters:

- Thickness (ASTM D5994)
- Sheet Density (ASTM D792 or ASTM D1505)
- Tensile Properties (ASTM D6693)
- Carbon Black (ASTM D1603)
- Carbon Dispersion (ASTM D5596)
- Asperity Height (ASTM D7466)
- Interface Shear (ASTM D5321/D6243)

Required interface shear testing is described in Section 02778 of the Specifications. The Specifications describe the requirements for sampling, sample labeling, test configurations, normal loading, and all other testing specifics. Interface shear testing is performed per ASTM D5321 or D6243 requirements.

5.4 Geomembrane Installation

Prior to installing the geomembrane panels, the Contractor and CQA Monitor shall observe that the foundation layer and subgrade preparation is properly installed, finished, and accepted. The Contractor's QC Technician shall assign and mark each panel with a unique identification number that shall be used by all parties. The CQA Monitor shall record the placement of each

panel on a geomembrane panel deployment log form to be reviewed by the CQA Officer. The CQA Monitor shall observe that the Contractor has provided sufficient slack in the geomembrane to allow for contraction due to cold temperatures. The CQA Monitor shall record the ambient temperatures during seaming operations. As the geomembrane panels are deployed in the field, the CQA Monitor shall observe and observe and document the following:

- That the Installer completes the Subgrade Acceptance form.
- That there are no significant defects present in the sheet. Small defects shall be marked, along with the type of repair required (extrudate, patch, etc.) and tracked in the repair log.
- That the sheet is not deployed under adverse weather conditions such as fog, rain, high winds, or extreme temperatures.
- That the equipment and deployment methods do not cause excessive wrinkling of the geomembrane and that the sheet is not dragged along a rough surface. If the liner is dragged, the CQA Monitor shall inspect the underside of the material for damage. Geomembrane that is scored beyond reasonable repair effort shall be rejected.
- That personnel do not engage in activities that could damage the geomembrane.
- That the Contractor's QC personnel properly record identification information including roll number, panel number, seam number, date, etc.
- That the Contractors QC personnel prepare an as-built panel layout drawing.

The CQA Monitor shall record all of the above information in daily reports and log sheets and shall inform all parties of any deviations.

5.5 Geomembrane Test Welds

The Contractor shall conduct field test welds on pieces of scrap liner prior to production welding as described in the Specifications. The CQA Monitor shall observe that the Contractor conducts test welds in accordance with the Specifications.

The CQA Monitor shall record the shear and peel test results for the test weld coupons on a geomembrane start-up trial weld log form. The Contractor shall not begin welding of field seams unless the CQA Monitor has verified that the trial welds are acceptable. Once a welding technician has been approved on a specific welding apparatus, he may not change machines without first passing a test weld on the new equipment.

5.6 Seaming of Geomembrane

The CQA Monitor shall observe that the geomembrane is seamed between the minimum and maximum ambient temperatures described within the Specifications. The CQA Monitor shall measure and record the temperature in accordance with the Specifications.

The CQA Monitor shall observe that the geomembrane is not being deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.

The Contractor's QC Technician and the CQA Monitor shall observe that geomembrane seams are oriented parallel to the maximum slope direction and that a seam numbering system compatible with the panel numbering system is used. The CQA Monitor shall observe that the Contractor has taken the following steps prior to seaming the geomembrane:

- That the liner surface has been cleaned of all foreign material including dirt, dust, debris, moisture, or oil.
- That grinding has been performed to remove the oxidation (extrusion welds only).
- That all areas where the sheet thickness has been thinned below the specified value from grinding are patched by the Contractor.
- That any bead grooves are covered with single extrudate.
- That wrinkles and fishmouths are cut out, the edges overlapped properly, and patched.
- That all seaming takes place over a firm, dry surface.
- That when the ambient temperature is below the prescribed temperature, a hot air device is used for preheating in front of the welder.
- That the approved type and quantity of welding devices are used on the job.
- That extrusion welders are purged of heat degraded material prior to use.
- That for cross or tee seams, the edge of the seam is ground to a smooth incline.
- That the seam numbering system and welding procedures agreed upon at the pre-construction meeting are strictly followed.

The CQA Monitor shall record the above information in his daily reports along with panel placement and seaming log forms to be reviewed by the CQA Officer.

5.7 Extrusion Welding

For extrusion welding, the CQA Monitor shall observe that the welding devices are purged of heat-degraded extrudate as described in the Specifications. All purged extrudate shall be disposed of off the liner. Each extruder shoe shall be inspected daily for wear to assure that its offset is equal to the liner thickness. All worn or damaged shoes or other parts shall be repaired. The CQA Monitor shall observe that no equipment is allowed to begin welding until the test weld, made by that equipment, passes the weld test. All test weld results shall be reviewed and recorded by the CQA Monitor.

5.8 Hot Wedge (Fusion) Welding

For hot wedge (fusion) welding, the CQA Monitor shall observe that the welding devices are automated, vehicular mounted, and equipped with gauges giving applicable speed, temperatures, and pressures. The speed, temperature, and pressure of the welding device should be determined during the test welding conducted prior to seaming of the panels.

5.9 Nondestructive Testing of Geomembrane Seams

Prior to the start of construction, the Contractor shall submit to the CQA Officer for approval, as per the specifications, a procedure for nondestructive testing of all field seams. When the seam testing begins in the field, the CQA Monitor shall maintain a log of nondestructive testing for all seams. The geomembrane QC conducted by the Contractor shall also be recorded on a geomembrane installer's field QC log form and marked on the liner.

5.10 Vacuum Box Testing

For nondestructive seam testing, all extrusion welded field seams shall be tested over their full length using vacuum box test units. The vacuum testing shall be performed by the Contractor's QC Technician under the observation of the CQA Monitor. The CQA monitor does not need to observe each vacuum box test, but shall check periodically on the methods and equipment used and record all results as marked on the liner. The CQA Monitor shall observe that the tests are conducted concurrently with the field seaming and that the vacuum box assembly consists of a rigid box with a transparent viewing window and a vacuum gauge. The CQA Monitor shall observe that the Contractor's procedure for vacuum testing is as follows:

- Clean window, gasket surfaces, and check box for leaks.
- Energize vacuum pump and set to the proper pressure as required by the Specifications.
- Place soapy solution on section of seam to be tested.

- Place box over wetted area and press down.
- Close bleed valve, open vacuum valve, and ensure that a leak tight seal is created.
- Examine the length of weld through the viewing window for bubbles for the period described in the Specifications.
- If no bubbles appear, the vacuum valve should be closed, the bleed valve opened, and the box should be moved to the next adjoining area with the specified overlap.
- Areas where soap bubbles are detected shall be marked as defects, repaired, and retested.

5.11 Air Pressure Testing

If the double hot wedge seaming system is employed, air pressure testing shall be used. The CQA Monitor shall observe that air pressure testing is conducted by the Contractor as follows:

- Seal both ends of the seam to be tested.
- Insert a hollow needle or other approved pressure feed device into the tunnel created by the double hot wedge and insert a protective cushion between the air pump and geomembrane.
- Energize the air pump to the pressure specified, close the valve, and sustain the pressure for the specified time period.
- Check the continuity of the entire seam being tested for indications that it has been fully pressurized. This shall be accomplished by opening the air channel at the opposite end of the seam and observing a loss of pressure either before or after the test.
- If a loss of pressure exceeds the specified value or does not stabilize, locate the faulty area and repair.
- Remove the approved pressure feed device and repair.

At a minimum the opening of the air channel of each seam shall be observed by the CQA Monitor. Should a loss of pressure be detected along a seam, the faulty area shall be identified, repaired, and re-tested as provided within the Specifications.

If blockage occurs along the seam, the area shall also be identified, repaired and re-tested. The Contractor shall be responsible for all costs associated with the seam repair. The results of both vacuum box and air pressure testing shall be recorded on the panel and the seam QC form by the Contractor. The CQA Monitor shall also maintain a nondestructive testing log for review by the CQA Officer.

5.12 Destructive Testing of Geomembrane Seams

The CQA Monitor shall determine the location of all destructive tests, mark the sample boundary on the geomembrane, and note the location on the seam log. The CQA Monitor shall obtain a minimum of one sample per 500 feet of seam per welding apparatus. The Contractor shall repair any suspicious looking welds before release of a seam for destructive sampling. Destructive samples shall be cut by the Contractor as the installation progresses and not at the completion of the project. The Contractor's QC Technician shall mark all destructive samples with consecutive numbers along with the seam number. The CQA Monitor shall keep a destructive testing log with the date, time, location, seaming technician, apparatus, temperature, and pass or fail criteria. The CQA Monitor shall observe that all destructive sample holes are repaired promptly by the Contractor.

The Contractor's QC Technician shall cut destructive samples at locations selected by the CQA Monitor. Samples dimensions shall be 12 inches wide by 48 inches long centered on the seam. The CQA Monitor shall:

- Mark each sample location with the sample bounds (48 inches by 12 inches), sample ID, technician ID, machine ID, date, and seam number, and the adjoining panel numbers.
- Record the sample location on the as-built geomembrane panel layout drawing and the geomembrane field seaming log form.
- Record the sample location and reason for taking the sample (random sample, poor welding, etc.) on the destructive testing log.
- Promptly ship the destructive samples to the testing laboratory for testing.
- Record the results of the testing on the destruction testing summary form.
- In the event of testing failure, track the welding performed by the welding apparatus 50 feet before and after the failed sample location, and obtain additional samples. Continue tracking until the failed sample(s) are bounded by passing tests. Log the tracking on destructive test tracking form.
- Confirm that installer caps or reconstructs the failed seam.

5.13 Repairs to Geomembrane

For final inspection, the CQA Monitor and Contractor shall check the seams and surface of the geomembrane for defects, holes, blisters, undispersed raw materials, or signs of contamination by foreign matter. If dirt inhibits inspections, the Contractor shall brush, blow, or wash the

geomembrane surface as required. The CQA Monitor shall decide if cleaning the geomembrane surface and welds is needed to facilitate inspection. Repair areas shall be distinctively marked with a description of the required type of repair and logged.

The CQA Monitor shall observe that all identified holes, tears, blisters, undispersed raw materials, and contamination by foreign matter are patched. The CQA Monitor shall observe that patches are not cut with the repair sheet in contact with the geomembrane and that the patches are extrusion welded to the geomembrane and then vacuum tested. The result of the vacuum test for the repair shall be marked by the Contractor's QC Technician with the date of the test and name of the tester on the sheet. Holes less than a quarter of an inch may be sealed with extrudate as described in the Specifications. The CQA Monitor shall record all repair areas on the repair log form.

5.14 Geomembrane Final Walk Through

The Contractor shall be responsible for maintaining the geomembrane (or portions thereof) until final acceptance by the CQA Monitor. The CQA Monitor shall recommend final acceptance when all seams have passed destructive testing, the Contractor has supplied all documentation, and all field and laboratory testing is complete and satisfactory. Prior to final acceptance, the Contractor, CQA Officer, CQA Monitor, and the Owner shall review the installation of the geomembrane (or portions thereof) for completeness. Any areas that are found to deviate from the intended design, are incomplete, or in need of repair shall be recorded by the CQA Monitor for correction by the Contractor. When all repairs have been completed, the CQA Monitor shall release the geomembrane (or portions thereof) for installation of overlying materials.

The contractor shall retain ownership of the liner throughout the installation of overlying materials as defined within his scope of work and until the project is complete.

6. Drainage Geocomposite Quality Assurance

6.1 General

This section sets forth the CQA testing and observation requirements for installing the geocomposite materials detailed on the Construction Drawings and Specifications. This work includes the examination of the Manufacturer's and Contractor's QC testing, conformance testing, shipping and handling, and deployment, seaming, and repairs of the geocomposite. The CQA Monitor and CQA Officer shall review the submittals furnished by the Contractor to ensure their compliance with this program and conditions of warranty prior to construction.

They shall also review the time schedule for installation submitted by the Contractor prior to construction.

6.2 Shipping and Handling

The Contractor shall provide a copy of the Manufacturer's QC certificates for production of each geocomposite roll manufactured for this project prior to construction for review by the CQA Monitor and CQA Officer. Materials shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. The Manufacturer's QC shall include visual inspection of the geotextile materials for foreign matter and needles. Detection of broken needles at the manufacturing plant shall be accomplished with the use of magnets and continuous metal detectors permanently installed on-line at the factory.

The Contractor is responsible for the transportation, off-loading, and storage of the geocomposite. The materials shall be packaged and shipped by appropriate means so that no damage is caused and shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. Off-loading shall be performed in the presence of the CQA Monitor to ensure that any damage during off-loading is properly documented. The CQA Monitor shall keep an inventory log of all geocomposite delivered to the site on the appropriate form for review by the CQA Officer.

The CQA Monitor shall verify that damaged materials are separated from undamaged materials until proper disposition of the material is determined by the Owner or CQA Officer. Final authority on the determination of damage shall be the CQA Monitor.

6.3 Geocomposite Conformance Testing

After production, the geocomposite shall be sampled for conformance testing by the CQA Monitor or a third party geosynthetics laboratory. Sampling shall be performed at the manufacturing plant by the third party geosynthetics laboratory or upon arrival at the site by the CQA Monitor. One geocomposite sample shall be obtained for every 100,000 square feet produced per lot. The CQA Monitor shall identify the roll numbers of the geocomposite which are tested for conformance on the log of geocomposite received form. The samples shall be delivered to the geosynthetics laboratory for testing to assess that the geocomposite properties conform to the requirements given in the Specifications. The CQA Officer shall review all test results and report any non-conformance test results to the Contractor and the CQA Monitor.

Conformance samples shall be collected across the entire width of the roll, but shall not include the first three feet of the roll. The conformance samples shall be three feet wide by the roll

width in length. Each sample shall be marked with the project name, Manufacturer's name and product identification, lot number, roll number, and type (8 oz. double-sided, single-sided, 250-mil, high flow, etc.). In event that sampling is necessary at the site, the Contractor shall provide the personnel and equipment to obtain the sample in the presence of the CQA Monitor. No material shall be deployed until passing conformance values are obtained by the CQA Monitor.

The conformance testing of the geocomposite shall include the following parameters:

- Transmissivity (ASTM D4716)
- Ply Adhesion (ASTM D7005)

The geocomposite shall also be subjected to interface testing as described in Section 5.3 of this CQA Plan and Section 02778 of the Specifications.

6.4 Geocomposite Installation

Prior to geocomposite installation, the CQA Monitor shall observe that all underlying materials have been repaired, tested, and approved in accordance with the Construction Drawings and Specifications. During geocomposite placement, the CQA Monitor shall:

- Observe the geocomposite as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed, etc.).
- Observe that equipment used does not damage the geocomposite.
- Observe that people working on the geocomposite do not engage in activities that could damage it.
- Observe that the geocomposite is anchored to prevent movement by the wind (the Contractor is responsible for any damage resulting to or from wind-blown geocomposite).
- Observe that the seams are overlapped in accordance with the project Specifications.
- Observe that the Contractor has repaired any holes or tears in the geocomposite.
- Observe that the materials and methods used to fasten the panels together meet the Specification requirements.

The CQA monitor shall record all of the above information on log sheets and in daily reports.

7. Geotextile Quality Assurance

7.1 General

This section sets forth the requirements for the CQA observation for installing the geotextile detailed on the Drawings and Specifications. The Contractor shall furnish submittals in compliance with this manual and conditions of warranty prior to delivery for review by the CQA Officer and CQA Monitor. The Contractor shall also prepare and submit a time schedule for installation prior to construction.

7.2 Shipping and Handling

The Contractor shall provide a copy of the certificate of compliance and the QC certificates for production of each geotextile roll manufactured for this project prior to construction for review by the CQA Monitor and CQA Officer. Materials shall be delivered to the site only after the CQA Consultant or the County receives, reviews, and approves the required submittals.

The CQA Monitor shall ensure that the materials were packaged and shipped by appropriate means so that no damage was caused to the materials delivered to the site. Off-loading shall be done in the presence of the CQA Monitor and any damage during off-loading shall be documented by the CQA Monitor and the Contractor. The CQA Monitor shall keep a log of all geotextile delivered to the site on a geotextile inventory log form.

Damaged materials shall be separated from undamaged materials until the CQA Monitor determines proper disposition of material. Final authority on the determination of damage shall be the CQA Monitor. The Contractor shall replace damaged or unacceptable material at no cost to the Owner.

The geotextile shall be stored on a prepared surface approved by the CQA Monitor and shall be protected from puncture, precipitation, dirt, grease, water, mechanical abrasions, excessive heat, ultraviolet light exposure or other damage. The CQA Monitor shall observe that the Contractor uses appropriate handling equipment to load, move or deploy the material to ensure that no damage is caused to the material during handling of the geotextile.

7.3 Geotextile Installation

During geotextile placement, the CQA Monitor shall:

- Observe the geotextile as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed, etc.).

- Observe that equipment used does not travel on or damage the underlying subgrade.
- Observe that people working on the geotextile do not engage in activities that could damage it.
- Verify that the geotextile is anchored to prevent movement by the wind (the Contractor is responsible for any damage resulting to or from windblown geotextile).
- Observe that the seams are overlapped and seamed in accordance with the project Specifications.
- Observe that the Contractor has repaired any holes or tears in the geotextile.
- During installation, the Contractor and CQA Monitor shall inspect the geotextile as it is deployed for the presence of foreign materials and needles.

If any needles or other materials are present within the geotextile which the CQA Monitor feels may be detrimental to the placement and/or performance of the product or if placed in direct contact with a synthetic liner, the roll shall be rejected and shipped off-site permanently and the Contractor shall replace any rejected material at no additional cost to the Owner. The CQA Monitor shall notify the Contractor of any problem areas and observe and inspect the repair. The CQA Monitor shall record all of the above information on log sheets and in daily reports.

8. HDPE and PVC Pipe Quality Assurance

8.1 General

This section covers HDPE and PVC pipe material supply and installation CQA, including CQA of landfill gas pipes, landfill gas well extensions, and condensate knockouts. The Contractor shall provide a copy of the certificate of compliance for production of the piping manufactured for this project prior to delivery for review by the CQA Monitor and CQA Officer.

8.2 Shipping and Handling

The CQA monitor shall observe and verify that:

- Materials shall be delivered to the site only after the CQA Monitor receives and approves the required submittals.

- The CQA Monitor shall ensure that the materials were packaged and shipped by appropriate means so that no damage was caused to the materials delivered to the site.
- Off-loading shall be done in the presence of the CQA Monitor and any damage during off-loading shall be documented by the CQA Monitor and the Contractor.
- The CQA Monitor shall keep a log of all piping delivered to the site on an inventory log of piping received.
- Damaged materials shall be separated from undamaged materials until the CQA Monitor determines proper disposition of the material.
- All pipes shall be stored and stacked on a prepared surface as per manufacturer's recommendation and approved by the CQA Monitor and shall be protected from puncture, precipitation, dirt, grease, water, mechanical abrasions, or other damage.
- The Contractor uses appropriate handling equipment to load, move or deploy the material to ensure that no damage is caused to the materials during handling of the piping.

Final authority on the determination of damage shall be the CQA Monitor. The Contractor shall replace damaged or unacceptable material at no cost to the Owner.

8.3 Installation

The CQA Staff shall verify and observe that:

- Trenches are excavated to the lines and grades shown in the Drawings and are free of debris prior to pipe laying.
- Piping is installed to the lines and grades shown on the Drawings.
- Pipe jointing is in accordance consistent with the Manufacturer's recommendations and Specifications.
- Pipe bedding is installed per Specifications and Drawings.
- Backfilling is installed per Specifications and testing is in accordance with Table 4.2.

9. Quality Assurance for Other Improvements

This section describes CQA procedures for other improvements such as final closure landfill gas improvements. Specific requirements for the improvements are included in the Construction Drawings and Specifications.

9.1 Landfill Gas Improvements

The CQA Monitor shall observe and document the installation of the landfill gas improvements, including the extension of the existing landfill gas wells and gas probes, as necessary and shown on the Construction Drawings. Prior to improvements, the CQA Monitor shall verify that the materials (such as piping, and other appurtenances) supplied by the Contractor meet the requirements of the Specifications. The CQA Monitor shall verify that proper care is taken by the Contractor to protect the existing system during construction and especially during backfilling and placement of final cover and around the improvements.

10. Work Deficiencies

When deficiencies are discovered, the CQA Monitor shall immediately determine the nature and extent of the problem, notify the Contractor of the problem, and complete the required documentation. The CQA Monitor shall notify the Contractor within 1/2 hour of discovering any deficiency or at the earliest time possible. If the deficiency will cause significant construction delays or require substantial rework, the CQA Monitor shall notify the Owner and the CQA Officer.

The Contractor shall correct the deficiency to the satisfaction of the CQA Monitor. If the Contractor is unable to correct the problem, the CQA Monitor shall be asked to develop and recommend a solution to the CQA Officer for his approval.

The corrected deficiency shall be retested before the Contractor performs additional work. All retests and the steps taken to correct the problem shall be documented by the CQA Monitor on a field construction inspection report and on construction problem and solution data sheet forms.

11. Documentation

11.1 Daily Records

At a minimum, daily records shall consist of field notes, a summary of the daily construction activities, associated testing activities, and observation and data sheets. All project records shall be maintained in a well-organized project file at the job site and shall be available for review by the CQA Officer, Contractor, Owner, and jurisdictional agencies at all times. The CQA Officer shall review the reports and field notes prepared by the CQA Monitor. The CQA Monitor's daily summary report shall be available to the CQA Officer and the Owner for review and shall include the following information:

- Date, project name, and location
- Weather data
- A description of on-going construction
- A summary of test results identified as passing, failing, or in the event of a failed test, retests
- Off-site materials received including geosynthetics or drainage materials, plus status of certificates or off-site testing for the materials
- A summary of decisions regarding acceptance of the work and/or corrective actions taken
- The signature of the CQA Monitor

11.2 Observation and Test Data Sheets

The CQA Monitor shall prepare observation and data sheets during all phases of construction of the cover system for review by the CQA Officer. Observation and data sheets for this project may include, but may not be limited to the following:

- Field Construction Inspection Reports
- Nuclear Field Density Data Sheets
- Field Density Summary
- Soil Laboratory Test Data Sheet (Sieve, Proctor, and Moisture Content)
- Acceptance of Prepared Liner Subgrade Forms
- Inventory Log of Geomembrane Received
- Geomembrane Field Seaming and Nondestructive Test Log

- Geomembrane Panel Deployment Log
- Geomembrane Start-up Test Weld Log
- Geomembrane Defect and Repair Log
- Geomembrane Destructive Seam Strength Test Results and tracking form
- Geomembrane as-built panel layout sketches
- Photograph Log

Additional observation and data sheets may be required. All entries shall be clear and legible. All documentation should be dated and signed or initialed clearly by the CQA Monitor.

11.3 Design Change Reports

Design and specification changes may be required during construction. In such cases, procedures outlined in Section 3 shall be followed. Documentation of design changes shall be included in the final report.

11.4 Construction Difficulty Reports

In the event that the Contractor has extreme difficulty in the performance of any specified activities required, a special report shall be prepared to address the problem(s). The Owner, the Contractor, CQA Monitor, and CQA Officer and Engineer (if needed), shall meet to discuss any problems encountered and to address the solution. If changes to the construction Specifications are required, the CQA Consultant, regulatory agency (if significant, otherwise notification shall be included in the final certification report), and the Owner shall be notified. Any changes and accompanying approvals shall be in writing.

11.5 Final Report

At the completion of the project, the CQA Consultant shall prepare a final construction documentation report suitable for presentation to the RWQCB and LEA. Copies of all reports and test results prepared by the CQA Monitor shall be submitted to the CQA Officer for review. Copies of all the documents shall be maintained at the CQA Consultant's office. This report shall observe that the work has been performed in compliance with the Construction Drawings and the Specifications. At a minimum this report shall contain:

- A summary of all construction activities
- A summary of all field and laboratory test results

- All logs, forms, and reports
- As-built record drawings, survey point lists
- A description of significant construction problems and the resolution of these problems
- A list of changes (if any) from the Drawings and Specifications and the justification for these changes
- A statement signed and sealed by a professional civil engineer or certified engineering geologist registered in the State of California stating that the project was constructed in general accordance with the Construction Drawings and Specifications.

11.6 As-Built Drawings

A set of as-built, or record, drawings shall be prepared by the Contractor during the course of construction as required by the Specifications. The as-built drawings shall accurately locate all construction items including the location of piping and the extent of lining and collection system components, etc. This information shall be reviewed for completeness by the CQA Officer and included into the Final Construction Documentation Report.