United States Environmental Protection Agency

Final Construction Quality Assurance Plan

Spickler Landfill Site
Spencer, Wisconsin

November 17, 1993

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FINAL CONSTRUCTION QUALITY ASSURANCE PLAN

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CONSTRUCTION QUALITY ASSURANCE PLAN

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FIGURE

1 - Organization Chart

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

On behalf of the Respondents for the Spickler Landfill site, STS Consultants, Ltd. (STS) has prepared this Construction Quality Assurance (CQA) Plan for the Remedial Design (RD) Construction. The Spickler Landfill site is located in Marathon County, Wisconsin. This CQA Plan was prepared to satisfy the requirements of the Record of Decision (ROD), Agreement on Consent (AOC) and Scope of Work (SOW); and to be in accordance with the RD Work Plan.

The purpose of this Plan is to specify the methods, procedures, and frequency of observation and testing activities to be implemented to document that Remedial Action (RA) Construction activities are in accordance with the Project Drawings and Specifications. Construction activities shall include covering the New and Old Fill areas and the brine pit, and installation of an active gas collection and surface water management systems.

1.2 PLAN FORMAT

This section (Section 1.0) comprises the Introduction. Section 2.0 defines the organizations involved in the RD Construction with their respective responsibilities and authorities. Section 3.0 outlines the personnel qualifications and training required. Section 4.0 outlines the required construction inspections and tests. Section 5.0 provides sampling strategies for the tests. Required documentation of the inspections and tests as well as for the corrective actions is provided in Section 6.0.

2.0 ORGANIZATION, RESPONSIBILITY AND AUTHORITY

2.1 GENERAL

The principal organizations involved in permitting and constructing this RD include the Permitting Agencies; Respondents; Design Engineer; Certifying Engineer; CQA Personnel; Construction Contractor; Geomembrane Manufacturer, Fabricator, and Installer; Geotextile Manufacturer, Fabricator and Installer; and CQA Laboratory. The principal parties may not necessarily be independent of each other except for the Permitting Agencies. The CQA Personnel may be employees of the Respondents, Design Engineer, Certifying Engineer, or an independent firm. The organization structure and lines of communication for this Project are presented in Figure 1.

2.2 PERMITTING AGENCIES

The Permitting Agencies, United States Environmental Protection Agency (USEPA) and the Wisconsin Department of Natural Resources (WDNR), are authorized by law and regulation to issue a permit (approval) for the construction of the RD. It is the responsibility of the Permitting Agencies to review the Respondents' closure plans for compliance with the Agencies' requirements (regulations) and to approve or deny the application based on this review. The Agencies have the responsibility and authority to review and accept/reject any design revisions or requests for variance that are submitted by the Respondents after the approval is given. The Agencies also have the responsibility and authority to review this CQA Plan and construction records to confirm, with a reasonable degree of certainty, that the RD was constructed to meet or exceed the design criteria objectives.

2.3 RESPONDENTS

The Respondents are responsible for the RD Construction and operation and maintenance as approved by the Permitting Agencies. This responsibility includes complying with the requirements of the Permitting Agencies and assuring the Agencies, by the submission of the CQA documentation, that the RD was constructed, with a reasonable degree of certainty, to meet the design criteria, Project Drawings and

Specifications. The Respondents shall have the authority to accept or reject organizations charged with design, CQA, and/or construction activities; Project Drawings and Specifications; CQA Plan; reports and recommendations of the CQA Officer; the materials and workmanship of the Construction Contractor; and Geotextile and Geomembrane Manufacturers, Fabricators, and Installers.

2.4 DESIGN ENGINEER

The Design Engineer's primary responsibility shall be to design the RD in accordance with the AOC, ROD, and RD Work Plan. The Design Engineer may be requested by the Certifying Engineer to change some component of the design if unexpected site conditions are encountered or changes in construction methodology occur which could adversely affect the Remedial Action Construction. In addition, the Design Engineer shall be responsible for documenting these changes. The Design Engineer shall report to the Respondents.

2.5 CERTIFYING ENGINEER

The Certifying Engineer shall be ultimately responsible for preparing the Final Construction Documentation Report (discussed in detail in Section 6.5); making minor field adjustment decisions; and addressing design discrepancies. The Certifying Engineer shall report to the Respondents.

2.6 CQA PERSONNEL

The overall responsibility of the CQA Personnel shall be to perform those activities specified in this Plan (e.g., inspection, sampling, documentation). CQA Personnel shall include a CQA Officer and the necessary supporting CQA Inspection Personnel. Their respective responsibilities and authority are discussed in the following paragraphs.

2.6.1 CQA Officer

The CQA Officer shall be responsible for administering this Plan and confirming compliance to the elements of this Plan by performing quality audits. Additional

responsibilities and authority shall include formulating and implementing this CQA Plan, periodic review of CQA documentation, modifying construction site activity, and specifying specific corrective measures in cases where deviation from the specified design or failure to meet design criteria and Project Drawings and Specifications is detected by CQA Personnel. Specific responsibilities of the CQA Officer shall include:

- Reviewing design criteria, Project Drawings and Specifications for clarity and completeness so that this Plan can be implemented.
- Educating CQA Inspection Personnel on CQA requirements and procedures.
- Scheduling and coordinating CQA inspection activities.
- Directing and supporting the CQA Inspection Personnel in performing observations and tests by:
  - Submitting blind samples (knowns, duplicates, and blanks) for analyses by the CQA Inspection Personnel and one or more independent laboratories.
  - Confirming that regular calibration of testing equipment is properly conducted and recorded.
  - Confirming that the testing equipment, personnel, and procedures do not change over time or making sure that any changes do not adversely impact the inspection process.
  - Confirming that the test data are accurately recorded and maintained.
  - Confirming that the raw data is properly recorded, validated, reduced, summarized, and interpreted.
- Providing to the Certifying Engineer reports on the inspection results including:
  - Review and interpretation of the data sheets and reports.
  - Identification of work that the CQA Officer believes should be accepted, rejected, or uncovered for observation, or that may require special testing, inspection, or approval.
- Rejection of defective work and verification that corrective measures are implemented.
- Reporting to the Construction Contractor results of the observations and tests as the work progresses and interacting with the Construction Contractor to provide assistance in modifying the materials and work to comply with the specified design.

The CQA Officer shall report directly to the Certifying Engineer.

2.6.2 CQA Inspection Personnel

For the CQA Inspection Personnel, specific responsibilities shall include:

- Performing independent on-site inspection of the work in progress to assess compliance with the closure design criteria, Project Drawings and Specifications.
- Confirming that the equipment used in testing meets the test requirements and that the tests are conducted according to the standardized procedures defined by this Plan.
- Reporting to the CQA Officer results of the inspections including work that is not of acceptable quality or that fails to meet the specified design.

The CQA Inspection Personnel shall report directly to the CQA Officer.

2.7 CONSTRUCTION CONTRACTOR

The Construction Contractor shall be ultimately responsible for constructing the Remedial Action in strict accordance with the design criteria, Project Drawings and Specifications and for using the necessary construction procedures and techniques. Remedial Action Construction activities for the construction include: site preparation, borrow source work, erosion control measures, site clean up, rough grading, placement of the cover layers for the two landfills and the sludge lagoon, installation of the leachate seep and gas condensate collection system, and installation of the active gas extraction system. In addition, the Construction Contractor shall also be responsible for coordinating, supervising and overseeing subcontractors as needed and employed by the Construction Contractor to perform the activities.

The Construction Contractor shall report to the Respondents or their Representative.

2.8 GEOMEMBRANE MANUFACTURER, FABRICATOR AND INSTALLER

The Geomembrane Manufacturer shall be responsible for the production of the geomembrane rolls from resin which meets the requirements detailed in the Project Specifications. The resin shall be delivered to the Manufacturer from the Resin

Supplier. Qualifications of the Resin Supplier shall be specific to the Manufacturer's requirements.

The Geomembrane Fabricator shall be responsible for the fabrication of geomembrane factory panels constructed from rolls received from the Geomembrane Manufacturer.

Both the Geomembrane Manufacturer and Fabricator shall report to the Geomembrane Installer.

The Geomembrane Installer shall be responsible for field handling, storing, placing, seaming, loading (against wind), and other aspects of the geomembrane in accordance with Spec. Section 02261. The Geomembrane Installer is responsible for transportation of these materials to the site and for the anchor trenches. The Geomembrane Installer reports to the Construction Contractor.

2.9 GEOTEXTILE MANUFACTURER, FABRICATOR AND INSTALLER

The Geotextile Manufacturer shall be responsible for the production of the geotextile rolls which meets the requirements detailed in the Spec. Section 02260. The Geotextile Fabricator shall be responsible for the fabrication of geotextile factory panels constructed from rolls received from the Manufacturer. Both the Geotextile Manufacturer and Fabricator shall report to the Geotextile Installer.

The Geotextile Installer is responsible for transportation of these materials to the site, field handling, storing, placing, sewing, loading (against wind), anchor trenches, and other aspects of the installation. The Geotextile Installer shall report to the Construction Contractor.

2.10 CQA LABORATORY

The CQA Laboratory shall be a party, independent from the Construction Contractor, and shall be responsible for conducting tests on samples of geosynthetics collected for pre-qualification testing and from the site. The CQA Laboratory shall report to the Certifying Engineer.

2.11 PROJECT MEETINGS

The Certifying Engineer and/or the CQA Officer shall be responsible for conducting periodic project meetings. The Certifying Engineer shall be responsible for a Pre-Construction Meeting and the CQA Officer shall be responsible for conducting Weekly Progress Meetings. Both shall be responsible for Problem Resolution Meetings. These meetings are discussed in the following paragraphs below.

Meeting minutes shall be documented, maintained, and transmitted to the principal project participants attending such meetings and those who shall be affected by the decisions. Meeting minutes shall be prepared by a member of the CQA Personnel.

2.11.1 Pre-Construction Inspection and Meeting

A Pre-Construction Inspection and Meeting shall be held to resolve any uncertainties following the award of the construction contract. The Respondents, Design Engineer, Certifying Engineer, CQA Officer, Construction Contractor, and the Agencies shall be present. The topics of this meeting shall include, but not be limited to:

- Review methods for documenting and reporting inspection data;
- Review methods for distributing and storing documents and reports;
- Review work area security and safety protocol;
- Discuss any appropriate modifications of the construction quality assurance plan to ensure that Site-specific considerations are addressed; and
- Conduct a Site walk-around to verify that the design criteria, plans and specifications are understood and to review material and equipment storage locations.

2.11.2 Weekly Progress Meetings

A progress meeting shall be held weekly at the work site just prior to commencement or following completion of work. At a minimum, the meeting shall be attended by the Construction Contractor, CQA Officer, and the CQA Inspection Personnel. The purpose of the meeting shall be to:

- Review the previous week's activities and accomplishments.
- Review the work location and activities for the week.
- Identify the Construction Contractor's personnel and equipment assignments for the week.
- Discuss any potential construction problems and their respective corrective actions.

2.11.3 Problem Resolution Meetings

A special meeting shall be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting shall be attended by the Construction Contractor, the CQA Inspection Personnel, the CQA Officer and/or the Certifying Engineer. The purpose of the meeting is to define and resolve a problem or recurring work deficiency in the following manner:

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

If the issue could not be resolved or if the WDNR Oversight Engineer observes a problem or deficiency, the WDNR Oversight Engineer and CQA Officer (and/or Certifying Engineer) shall attempt to resolve the issue. If this is not successful or the issue requires USEPA input, the USEPA Remedial Project Manager would be contacted.

2.11.4 Pre-Final Inspection and Meeting

Upon preliminary project completion, the CQA Officer shall notify U.S. EPA for the purposes of having U.S. EPA conduct a pre-final inspection. The pre-final inspection shall consist of a walk-over through inspection of the entire project site, accompanied by U.S. EPA. The inspection is to determine whether the project is complete and consistent with the contract documents and the U.S. EPA-approved remedial action. The CQA Officer and U.S. EPA shall identify and note any outstanding construction items discovered during the inspection. Additionally, treatment equipment shall be

operationally tested by the Contractor. The Certifying Engineer shall certify and submit to U.S. EPA that the equipment has performed to meet the purpose and intent of the specifications. Retesting shall be completed by the Contractor where deficiencies are revealed. The Pre-final Inspection Report which shall outline the outstanding construction items, actions, required to resolve items, completion date for those items, and data for final inspection.

2.11.5 Final Inspection and Meeting

Upon completion of any outstanding construction items, the CQA Officer shall notify U.S. EPA for the purposes of having U.S. EPA conduct a final inspection. The final inspection shall consist of a walk-through inspection of the project site, accompanied by U.S. EPA. The pre-final inspection report will be used as a checklist with the final inspection focusing on the outstanding construction items identified in the pre-final inspection. The Certifying Engineer shall confirm that outstanding items have been resolved in the Final Inspection Report.

3.0 PERSONNEL QUALIFICATIONS AND TRAINING

3.1 GENERAL

Personnel assigned to this Project shall be qualified and trained, as necessary, to perform their specific responsibilities and functions as addressed in this Plan and referenced procedures. Qualifications and training of the Certifying Engineer, CQA Officer and Design Engineer shall be reviewed and monitored by the Agencies to document that the assigned responsibilities can be executed safely and consistently with the elements of this Plan.

3.2 PERSONNEL QUALIFICATIONS

3.2.1 Certifying Engineer

The Certifying Engineer shall possess adequate formal academic training in engineering, engineering geology, or closely associated disciplines and shall have sufficient practical, technical, and managerial experience to successfully oversee and implement CQA activities. In addition, the Certifying Engineer shall be a Professional Engineer registered in the State of Wisconsin.

3.2.2 CQA Officer

The CQA Officer shall have adequate formal training and sufficient practical technical and administrative experience to execute and record inspection activities successfully. This shall include demonstrated knowledge of specific field practices relating to construction techniques used for the RD Construction, the codes and regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures, and site safety.

3.2.3 Design Engineer

The Design Engineer is a Professional Engineer registered in the State of Wisconsin having a civil or geotechnical engineering background.

4.0 CONSTRUCTION, INSPECTION AND TESTING

4.1 GENERAL

This Section includes inspections, confirmations, audits, and evaluations of material and workmanship necessary to determine and document the quality of the RD Construction. This shall provide assurance that the construction was performed as specified in the Project Drawings and Specifications.

4.2 ACCESS ROADS

The Construction Contractor shall be responsible for maintaining the access roads and repairing off-site damaged roads. The gravel material used in repairing or final regrading of the access roads shall be locally available road bed material.

The CQA Personnel shall observe and document (photograph) the preconstruction condition of the haul roads to be used by the Construction Contractor. This shall be performed with the county/local highway department to document the preconstruction condition of the roads.

4.3 PROGRESS CLEANING

The Construction Contractor shall be responsible for maintaining the site in a clean and orderly condition according to Spec. Section 01500, Part 1.12 and a final cleaning according to Spec. Section 01700, Part 1.04.

The CQA Inspection Personnel shall observe the site cleanliness. Any infractions shall be reported to the Construction Contractor for clean up. In addition, the CQA Officer shall perform and document a final inspection.

4.4 REPAIR OF BASE GRADES

The Construction Contractor shall be responsible for repairing the base grades to receive the low hydraulic conductivity layer material on the New and Old Fill Areas according to

Spec. Section 02240. This shall involve regarding, repairing, and/or restoring grades to the required slopes under the direction of the CQA officer.

The CQA Inspection Personnel shall perform the following:

- Prohibit tracked equipment to operate on or drive over the existing gas pipeline.
- Observe and record that temporary erosion control measures are re-established and maintained.
- Observe and document that the moisture content of uncovered base grade soils are maintained to prevent desiccation.
- Observe and record that landfill grade changes are gradual and positive drainage away from the site is maintained.

The CQA Officer shall perform the following after rough grading is finished:

- Review and document the topographic maps (2 foot contour intervals) submitted by the Construction Contractor (in accordance with Spec. Section 00211) which shall contain the base grade repairs. Areas which do not maintain positive drainage or do not have smooth grade changes shall be regraded, resurveyed, and resubmitted for approval at the Construction Contractor expense.
- Observe and document the base grades prior to placement of the low hydraulic conductivity layer material.

4.5 FILL AREA COVERS

The Construction Contractor shall be responsible for constructing the New and Old Fill Area. The covers shall consist of, in ascending order: a variable depth grading layer, a 2-foot low hydraulic conductivity layer; a 2.5 foot frost protection/vegetative support layer; and a 6 inch topsoil layer.

The following sections outline the responsibilities and quality assurance of the above layers.

4.5.1 Grading Layer

The Construction Contractor shall be responsible for placing the grading layer material according to Spec. Section 02240. This material shall be random fill material stockpiled

on the Mid-State Landfill site located on Big Rapids Road, Marathon County, Wisconsin as indicated on the Project Drawings and as specified in Spec. Section 02205.

The CQA Inspection Personnel shall perform the following activities during construction:

- Document the subgrade condition immediately prior to the low hydraulic conductivity layer placement. If soft spots are identified by the CQA Inspection Personnel, the Construction Contractor shall rework the material or undercut the area, replace with grading layer material, and regrade to the satisfaction of the CQA Inspection Personnel at the expense of the Construction Contractor. Regrading of identified soft spots shall be documented. The Construction Contractor shall notify the CQA Officer at least 24 hours in advance that the base grades are completed and are ready for placement of the low hydraulic conductivity layer material. The moisture content of the base grades shall be maintained to prevent desiccation. Standing water shall not be allowed.

- Document the compaction methods and type of compaction equipment.

- Observe and document the final stability of the grading layer by proofrolling.

Once the layer is placed, the CQA Personnel shall perform the following:

- The CQA Officer shall review the survey notes and topographic map submitted by the Construction Contractor to determine if the lines and grades are in accordance with the Project drawings. Areas which do not meet grade (± 0.1 feet) shall be regraded, resurveyed, and resubmitted for approval by the CQA Officer. This process shall be repeated until approval is given as provided in Spec. Section 02240, Part 3.07(A).

- The CQA Inspection Personnel shall confirm the as-built grades at the discretion of the CQA Officer.

4.5.2 Low Hydraulic Conductivity Layer

The Construction Contractor shall be responsible for placing the low hydraulic conductivity layer material according to Spec. Section 02240. This material shall be obtained from the stockpiles located at the Mid-State site.

The CQA Inspection Personnel shall perform the following activities prior to the construction of the low hydraulic conductivity layer:

- Observe and document that construction materials are as specified in the Project Specifications.

- Establish a table of proposed testing and sampling locations to meet the individual sampling frequency and location requirements included herein. This

table shall be utilized in performing frequency-specific or location-specific quality assurance documentation. The sample grid shall be off-set on each subsequent layer of tests.

- Establish identification numbering system for proposed test and sample locations.

The CQA Personnel shall perform the following activities during construction:

- The CQA Officer shall observe and document the foundation immediately prior to the placement of the low hydraulic conductivity material. The moisture content shall be maintained to prevent desiccation. Standing water shall not be allowed.

- Document the compaction methods and type of compaction equipment. The CQA Inspection Personnel shall perform the testing activities listed below and document actual sampling locations as they are performed. Actual sampling frequencies shall meet or exceed the frequencies required herein. Sample holes created during testing from the placed layer shall be backfilled in accordance with Section 4.5.5. A verbal report of soil laboratory tests shall be made to the CQA Officer as soon as possible after the results have been tabulated. If the low hydraulic conductivity material does not meet Spec. Section 02240. Part 2 as determined by the CQA Officer, a retest shall be performed at the Construction Contractor's expense. If the retest does not meet the Project Specifications, the low hydraulic conductivity material in that area shall be unacceptable, as determined by the CQA Officer.

- Test on a one hundred foot grid pattern (for a minimum of 5 tests per acre) for every one-foot thickness of in-place low hydraulic conductivity material. This grid shall be offset for each subsequent layer of tests. The material shall be tested for In-situ Density and Moisture Content (ASTM D2922 and ASTM D2216).

- Two In-Situ Density and Moisture Content (ASTM D2922 and ASTM D2216) tests shall be performed for each one-foot thickness of low hydraulic conductivity material placed in confined areas where equipment movement is anchored or hand compaction is necessary.

- Test one sample for each 5,000 cubic yards or less, and for each major soil type change, of material placed for the following:

  - Grain Size Distribution Test (ASTM D422), including material passing the 0.002 mm particle size.

  - 5-Point Standard Proctor Test (ASTM D698)

  - Atterberg Limits (ASTM D4318)

- If apparent changes in soil quality are observed, perform one 1-Point Standard Proctor Test (ASTM D698).

- One undisturbed sample for each acre or less for every one-foot thickness of in-place low hydraulic conductivity material shall be tested for the following:
  - Atterberg Limits Test (ASTM D4318)
  - Grain Size Distribution Test including the material passing the 0.002 mm particle size (ASTM D422)
  - Dry Density (STS procedure adopted from Tien Hsing Wu, 1966; Soil Mechanics, Second Edition)
  - Moisture Content
  - Hydraulic Conductivity on every third undisturbed sample (Army Corps of Engineers EM 1110-2-1906)

Once the layer is placed, the CQA Personnel shall perform the following:

- The CQA Officer shall review the survey notes and topographic map submitted by the Construction Contractor to determine if the lines and grades are in accordance with the Project Drawings. Areas which do not meet grade (± 0.1 feet) shall be regraded, resurveyed, and resubmitted for approval at the expense of the Construction Contractor. This process shall be repeated until approval is given.
- The CQA Inspection Personnel shall confirm the as-built grades at the discretion of the CQA Officer.

4.5.3 Frost Protection/Vegetative Support Layer

The Construction Contractor shall be responsible for placing the frost protection/vegetative support layer according to Spec. Section 02240. This material shall be random fill material stockpiled from the Mid-State Landfill site as indicated on the Project Drawings and as specified in Spec. Section 02240.

The CQA Inspection Personnel shall observe and document construction materials are as specified in Spec. Section 02240 prior to construction of the frost protection/vegetative support layer. The CQA Inspection Personnel shall perform the following during construction of the frost protection/vegetative support layer:

- Observe and document the foundation immediately prior to frost protection/vegetative support layer placement. The moisture content shall be maintained to prevent desiccation. Standing water shall not be allowed.
- Document the compaction methods and type of compaction equipment.

Once the layer is placed, the CQA Personnel shall perform the following:

- The CQA Officer shall review the survey notes and topographic map submitted by the Construction Contractor to determine if the lines and grades are in accordance with the Project drawings. Areas which do not meet grade (± 0.1 feet) shall be regraded, resurveyed, and resubmitted for approval by the CQA Officer. This process shall be repeated until approval is given as provided in Spec. Section 02240, Part 3.05.

- The CQA Inspection Personnel shall confirm the as-built grades at the discretion of the CQA Officer.

4.5.4 Topsoil

The Construction Contractor shall be responsible for constructing the topsoil layer according to Spec. Section 02240. The topsoil shall be imported material meeting the requirements of Spec. Section 02911.

The CQA Personnel shall perform the following activities prior to the construction of the topsoil layer:

- Observe and document construction materials are as specified in the Project Specifications.

- Establish a table of proposed testing and sampling locations to meet the individual sampling frequency and location requirements included herein. This table shall be utilized in performing frequency-specific or location-specific quality assurance documentation. Document actual sampling locations as they are performed. Actual sampling frequencies shall meet or exceed the frequencies required herein.

- Establish an identification numbering system for proposed test and sample locations.

- The Certifying Engineer shall review and approve, in writing, submitted test reports and samples according to Spec. Section 02911.

The CQA Officer shall review and approve, in writing, the test results submitted by the Construction Contractor for chemical analysis and physical properties as well as the recommended fertilization and soil neutralization measures as required in Spec. Section 02911 on borrow material, if utilized.

The CQA Inspection Personnel shall perform the following during construction:

- Obtain two (2) samples for each acre to be tested for the following at an independent laboratory:

  - pH
  - Nitrogen
  - Phosphorus
  - Potassium
  - Classification (USDA soil classification system)

- Observe and document that the topsoil is free of boulders. cobbles, and large roots.

- Document type of topsoil additives necessary based on the topsoil testing as defined in Spec. Section 02911.

- Document the dates of fertilization, seeding, mulching and method and rates of application.

Once the layer is placed, the CQA Personnel shall perform the following:

- The CQA Officer shall review the survey notes submitted by the Construction Contractor to determine if the lines and grades are in accordance with the Project Drawings. Areas which do not meet grade (± 0.1 feet) shall be regraded. resurveyed. and resubmitted for approval by the CQA Officer. This process shall be repeated until approval is given as defined in Spec. Section 02240, Part 3.05.

- The CQA Inspection Personnel shall confirm the as-built grades at the discretion of the CQA Officer.

4.5.5 Sample Hole Abandonment

The CQA Inspection Personnel shall abandon the holes created during sample collection by filling the holes with bentonite chips, pellets or granular bentonite and hydrating in-place.

4.6 BRINE PIT

The Construction Contractor shall be responsible for constructing the brine pit cover in accordance with Spec. Section 02241. The cover shall consist of, in ascending order: a geotextile over the existing cover; a 1-foot thick gas collection layer; a geotextile; a variable thickness fill layer; a 2-foot low hydraulic conductivity layer: a flexible membrane liner (FML); and a 1-foot drainage layer; a geotextile; a 4-foot cover layer; and a 6-inch topsoil layer.

The following sections outline the responsibilities and quality assurance of the above layers.

4.6.1 Geotextile

The Geotextile Installer shall be responsible for the installation of the geotextiles according to the Spec. Section 02260. In addition, the Geotextile Installer shall retain ownership and responsibility for each geotextile layer until written acceptance by the Certifying Engineer. The geotextile shall be a non-woven material which meets the minimum roll value specified in Spec. Section 02260, Part 2.

Prior to the installation of any geotextile material, the Geotextile Installer shall submit to the Certifying Engineer the information listed below. Within two weeks of receipt, the Certifying Engineer shall review and document that the geotextile is in conformance with Spec. Section 02260. Any discrepancies shall be reported to the Geotextile Installer for correction. Final acceptance shall be the responsibility of, and to be documented by, the Certifying Engineer.

- A properties sheet including a list of guaranteed minimum physical properties in accordance with ASTM Test methods as outlined in the Project Specifications for the type of geotextile to be delivered.
- The sampling procedures and results of the testing performed by the Geotextile Manufacturer.
- A copy of the Geotextile Manufacturer's Standard Warranty.
- A written statement shall be provided that states the following regarding factory seaming:
  - All seams were continuously seamed.
  - Polymeric thread was used with chemical properties equal to or exceeding those of the geotextile.

Prior to the placement of the geotextiles, the CQA Officer shall establish a table of proposed testing and sampling locations to meet the individual sampling frequency and location requirements included herein. This table shall be utilized in performing frequency-specific or location-specific quality assurance documentation.

Upon delivery of the geotextiles at the site, the CQA Personnel shall perform the following, as appropriate:

- With the Geotextile Installer and Construction Contractor, conduct a visual surface review of rolls for defects and/or damage. This review shall be conducted without unrolling (unfolding) rolls unless defects or damages are found on the surface or suspected.

- Confirm that rolls are tagged with the proper identification, including roll numbers and applicable testing methods.

- Obtain the tags from the Construction Contractor.

- Confirm that the geotextiles are stored in such a way as to protect from mud, dirt, dust, debris, exposure to ultraviolet light, and heat.

- Document rolls, or portions thereof, which have been rejected and removed from the site because they have severe flaws.

- Document rolls which have repairable minor flaws, according to the Project Specifications, and the subsequent date and description of the repair work.

- Obtain one sample from each roll for AOS and fabric weight laboratory testing (ASTM D4751 and D3776-84) to document that the geotextile material received on-site satisfies the minimum criteria defined in Spec. Section 02260. If a test fails, two samples shall be collected with one sample sent to the Geotextile Manufacturer's laboratory and the other shall be sent to the CQA Laboratory for retest at the Geotextile Installer's expense. If retest by either laboratory does not meet the Project Specifications, as determined by the CQA Officer, the material shall be unacceptable.

Immediately prior to the installation of the geotextiles, the CQA Inspection Personnel shall perform the following:

- Observe and document the foundation immediately prior to placement of the geotextile being placed over the existing cover.

- Observe and document that the surface is free of objects or foreign materials which may damage the integrity of the geotextile.

- Obtain a written notification from the Construction Contractor that the surface is acceptable.

Prior to installation of the geotextile in the anchor trench, the CQA Inspection Personnel shall document the following:

- The trench has been constructed according to Spec. Section 02260 and the Project Drawings.

- The trench is free of ponded water, sharp rocks, sticks, frozen chunks of brine, vegetation, obstructions, depressions, and debris.

- A uniform surface with no abrupt grade changes.

The CQA Inspection Personnel shall observe the backfilling of the anchor trenches for conformance with Spec. Section 02260, Part 3. Any discrepancies shall be reported to the Geotextile Installer for correction.

During geotextile panel installation, the CQA Inspection Personnel shall perform the following, as appropriate:

- Document weather conditions during installation.
- Confirm that the exposure of the geotextiles to the elements between panel installation and the covering of the geotextile is a maximum of 14 days to minimize damage potential.
- Document potential for damage due to negligent activities of personnel working on the geotextile, such as smoking or wearing damaging shoes. Problems shall be brought to the attention of the Construction Contractor.
- Document protection of the geotextile during installation.
- Observe and document the panel after placement for damage. The CQA Officer shall determine the acceptability of the geotextile. Damage which has been rejected shall be marked and removed from the work area recorded by the CQA Inspection Personnel. Repairs shall be made by the Geotextile Installer according to procedures described in Spec. Section 02260.

Prior to geotextile seaming, the CQA Inspection Personnel shall document the following:

- Observations of the seam area for cleanliness and absence of moisture, dust, dirt, debris of any kind, and foreign material.
- Conformance of seam overlap with Spec. Section 02260, Part 3.02.
- Seams are aligned by the Geotextile Installer to prevent wrinkles and "fishmouths".

During seaming, the CQA Inspection Personnel shall document the following:

- The equipment used.
- The geotextile is protected from damage due to traffic during seaming.
- Visual verification that the overlap is in conformance with Spec. Section 02260, Part 3.02.
- Obtain a test seam sample from the Geotextile Installer every 100 lineal feet of seam for both the machine and cross-direction seam strength testing (ASTM

D4884). Seams not meeting the minimum strength specifications shall be resewn and retested at the Construction Contractor's expense.

All seam and non-seam areas of the geotextile shall be evaluated by the CQA Inspection Personnel for identification of defects, holes, and tears, and any sign of contamination by foreign matter. Each suspect location, both in seam and non-seam areas. shall be marked and documented by the CQA Inspection Personnel. In addition, the CQA Inspection Personnel shall advise the Geotextile Installer to repair the geotextile in accordance with Spec. Section 02260.

All repairs shall be documented by the CQA Inspection Personnel and each patch shall be numbered and logged. In addition, the date, name of patcher and repair outcome shall be documented.

After construction of a geotextile, the Certifying Engineer shall issue a letter to the Construction Contractor indicating that the geotextile installation has been completed in conformance with the Project Specifications. This shall be performed when the following apply, at a minimum:

- The installation is completed.
- All documentation of installation is complete. including the final report of the CQA Officer.
- Documentation of the adequacy of panels, field seams and repairs. including associated testing, is completed.

4.6.2 Gas Collection Layer

The Construction Contractor shall be responsible for placing the gas collection layer material according to Spec. Section 02241. This material shall be sand as specified in Spec. Section 02240.

The CQA Personnel shall perform the following activities prior to the construction of the gas collection layer:

- Observe and document construction materials are as specified in the Spec. Section 02240.

- Observe and document the foundation (i.e. geotextile) prior to sand layer placement. The geotextile shall be accepted, in writing, to the Certifying Engineer, prior to gas collection layer placement.

The CQA Inspection Personnel shall perform the following activities during construction:

- Observe and document placement methods and type of equipment used.
- Document layer thickness.
- Obtain two samples and test for the following:
  - Hydraulic Conductivity (Corps of Engineers EM 1110-02-1906).
  - Grain Size Distribution Test (ASTM D422)

The CQA Personnel shall perform the following activities after construction:

- The CQA Officer shall review the survey notes and topographic map submitted by the Construction Contractor to determine if the lines and grades are in general accordance with the Project Drawings. Areas which do not meet grade (± 0.1 feet) shall be regraded, resurveyed, and resubmitted for approval to the CQA Officer at the expense of the Construction Contractor. This process shall be repeated until approval is given as outlined in Spec. Section 01050. Part 3.05.
- The CQA Inspection Personnel shall confirm the as-built grades at the direction of the CQA Officer.

4.6.3 Grading Layer

The Construction Contractor shall be responsible for placing the grading layer material according to Spec. Section 02240. This material is the same material as described in Section 4.5.1 for the Grading Layer for the Fill Areas. The CQA Personnel shall perform the same tasks as outlined in Section 4.5.2.

4.6.4 Leachate Removal and Gas Extraction System

The Construction Contractor shall construct the leachate removal and gas extraction system as specified in Spec. Section 02732. This system shall consist of the following:

- Collection and header piping shall consist of 6-inch perforated and non-perforated corrugated polyethylene pipe and couplings; and 6-inch PVC pipe.
- Bedding as specified in Spec. Section 02732

The CQA Inspection Personnel shall perform the following prior to construction of the leachate collection system:

- Observe and document construction materials are as specified.
- Establish an identification system for subsurface drainage piping components.

The CQA Inspection Personnel shall perform the following during construction of the leachate collection system:

- Test a minimum of one sample of the pipe bedding for Grain Size Distribution (ASTM D422)
- Observe and document a minimum 6 inch bedding depth every 25 feet.
- Document alignment and grade of piping as installed using horizontal coordinates and surveyed elevations of pipe invert. Obtain location and elevation data at a minimum frequency of every 25 feet, at cleanout structures, and at every outlet.
- Observe and document pipe joining procedures.
- Observe and document manhole installation is installed as specified in Spec. Section 02732.
- Confirm two (2) coatings of epoxy Tnemec #61 are applied to the inside of the manhole.
- Confirm inlet pipe invert.

The CQA Personnel shall perform the following after the installation of the leachate removal and gas extraction system:

- The CQA Officer shall review and document the survey notes submitted by the Construction Contractor to determine if the lines and grades are in accordance with the Project Drawings as outlined in Spec. Section 01050, Part 3.07(A).
- The CQA Inspection Personnel shall confirm the as-built grades at the discretion of the CQA Officer.

4.6.5 Low Hydraulic Conductivity Layer

The Construction Contractor shall be responsible for placing the low hydraulic conductivity layer material according to Spec. Section 02240. This material is the same as described in Section 4.5.2 for the low hydraulic conductivity layer material for the Fill Areas. The CQA Personnel shall perform the same tasks as outlined in Section 4.5.2.

4.6.6 Geomembrane

The Geomembrane Installer shall be responsible for installing the geomembrane according to the Spec. Section 02261. In addition, the Geomembrane Installer shall retain ownership and responsibility for the geomembrane until acceptance by the Certifying Engineer. The geomembrane shall be a 60 mil, VLDPE (very low density polyethylene) material as specified in Spec. Section 02261, Part 2.

Prior to the installation of the geomembrane, the Geomembrane Installer shall submit to the Certifying Engineer the information listed below. Within two weeks of receipt, the Certifying Engineer shall review and approve, in writing, that the geomembrane is in conformance with Spec. Section 02261. Any discrepancies shall be reported to the Construction Contractor for correction. Acceptance of the material for this Project shall be the responsibility of, and to be documented by, the Certifying Engineer.

- The origin (Resin Supplier's name, resin production plant), identification (brand name, number), and production date of the resin.
- A quality control certificate issued by the Resin Supplier.
- A properties sheet including a list of guaranteed minimum roll value properties in accordance with ASTM Test methods as outlined in the Project Specifications for the type of geomembrane to be delivered.
- The summary reports by the Geomembrane Manufacturer on the type and frequency of tests conducted by the Geomembrane Manufacturer to document the quality of each batch (lot) of the resin used to manufacture the geomembrane rolls assigned to this Project.
- A statement that no reclaimed polymer is added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done with the appropriate cleanliness and if recycled polymer does not exceed 2 percent by weight).

Prior to the installation of the geomembrane, the CQA Officer shall perform the following:

- Establish a table of proposed testing and sampling locations to meet the individual sampling frequency and location requirements included herein. This table shall be utilized in performing frequency-specific or location-specific quality assurance documentation.

- Establish an identification numbering system for proposed test and sample locations.

Upon delivery at the site, the CQA Inspection Personnel shall perform the following, as necessary to correspond to the quatity of material:

- Obtain the tags from the Construction Contractor which shall be attached to the rolls.

- Repair minor flaws according to the Project Specification, and the subsequent date and description of the repair work.

- Obtain two samples (the width of the roll by three feet in length) from the Construction Contractor. One sample shall be archived and the other shall be sent to the CQA Laboratory for the following verification testing:

  - Sheet Thickness (ASTM D1593)

  - Tensile Strength and Elongation (ASTM D638)

  - Tear Resistance (ASTM D1004 die C)

  - Puncture Resistance (FMTC, 101C Method 2065)

  A verbal report of the results shall be made to the CQA Officer within one (1) working day after testing is completed. A brief written report prepared by the CQA Laboratory, summarizing the test results shall follow the verbal report within three (3) working days. Any uncertainty of the results shall be addressed at this time by the CQA Officer.

  If the sample does not conform to Spec. Section 02261. as determined by the CQA Officer, the Geomembrane Installer shall submit an additional sample to the Geomembrane Manufacturer's laboratory and to the CQA Laboratory for retest at the Geomembrane Installer's expense. The results from both laboratories shall be submitted to the CQA Officer. If the retest does not meet the Project Specifications by either laboratory, as determined by the CQA Officer, the material shall be unacceptable.

- The Construction Contractor shall submit the information required under Spec. Section 02261, Part 1.04C with each product roll shipped to the site. The Certifying Engineer shall review each certificate within three working days of receipt for conformance with Spec. Section 02261. Any discrepancies shall be reported to the Geotextile Installer for correction.

Immediately prior to geomembrane panel installation, the following shall be performed:

- The CQA Officer shall observe and document that the foundation for this material is acceptable prior to placement of this layer. Any repairs or damage to the foundation shall be repaired at the expense of the Construction Contractor.

- The Geomembrane Installer shall certify, in writing, that the foundation for the geomembrane is acceptable.

During placement of the geomembrane, the CQA Inspection Personnel shall perform the following, as appropriate:

- Document weather conditions during installation.

- Measure and document the geomembrane thickness is in conformance with Spec. Section 02261. Thickness readings shall be taken every 50 feet along each transverse direction. Readings shall be taken across the width at any point where the panel has been cut. Any non-conformance shall be reported to the Geomembrane Installer for correction.

- Document negligent activities by personnel working on the geomembrane which could potentially damage the geomembrane. such as smoking and wearing damaging shoes. Problems shall be brought to the attention of the Construction Contractor.

After placement. the Geomembrane Installer shall field demonstrate the non-destructive test method to the CQA Personnel as outlined in the Technical Specifications.

Where seaming is required for repair or installation of pipe boots, the following procedures shall be performed prior to seaming, and whenever the operator changes welding equipment and/or welding stops for 30 minutes or more:

- Each seamer shall make at least one test seam in accordance with Spec. Section 02261, Part 3.05.

- If a test seam fails, as determined by the CQA Inspection Personnel. the entire operation shall be repeated on a new seam sample. No welder may start seaming until the test seams have been approved.

- The remainder of the successful test seam samples shall be assigned a number by the Geomembrane Installer. The CQA Inspection Personnel shall record the assigned number, log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. Each day, one (1) sample

from each seamer per machine will be sent to the CQA laboratory for destructive testing for peel and shear testing verification.

During geomembrane seaming, the CQA Inspection Personnel shall observe and document the following, as appropriate:

- The seam area for cleanliness and absence of moisture, dust, dirt, debris of any kind, and foreign material.
- Conformance of seam overlap with Spec. Section 02261.
- Seams are aligned to prevent wrinkles and "fishmouths".
- The seaming techniques for the prevailing weather conditions are being employed in conformance with Spec. Section 02261. Part 3.04. If adverse weather conditions do occur, the CQA Officer shall notify the Construction Contractor as to whether or not to seam for the day.
- Equipment used.
- The Geomembrane Installer maintains on-site at least one of each of the following operable spare apparatus: extrusion welder, wedge welder and generator.
- The extruder is purged prior to beginning a seam until the heat-degraded extrudate has been removed from the barrel.
- The geomembrane is protected from damage in heavily trafficked areas.
- The Geomembrane Installer's calibration records for welding apparatus temperature gauges.
- Apparatus temperature and ambient temperature at appropriate intervals.

The following destructive seam testing protocol shall be performed, as appropriate:

- The Geomembrane Installer shall obtain a minimum of two seam samples (38-inch long, in the direction of the seam, by 12-inch wide) at the direction of the CQA Inspection Personnel. This work shall commence as soon as possible after the field seam samples are obtained.
- The CQA Inspection Personnel shall assign a number to each sample, record the sample location on as-built drawings, and record the reason for taking the sample (i.e. routine, suspicious seam, etc.).
- The CQA Inspection Personnel shall observe and document the destructive seam tests.
- A 1-inch long specimen shall be removed from each end of the sample by the Geomembrane Installer under the observation of the CQA Inspection Personnel.

A 12-inch long section of the remaining 36-inch long sample shall be retained by the Geomembrane Installer. A second 12-inch long section shall be sent by the CQA Inspection Personnel to the laboratory for testing. The third 12-inch long section shall be sent to and retained by the Certifying Engineer.

- The laboratory shall test a minimum of 5 samples, each in shear and peel, for a total of 10 destructive tests per field seam sample. The shear and peel testing of the seams shall be conducted according to ASTM D4437.

- A minimum of three of the five tests from each of the field seam samples shall fail outside of the seamed area to be considered an acceptable seam. If one of the shear or peel tests fails, an additional specimen from the same field seam sample shall be tested in the mode by which the specimen failed. If the retest specimen passes, then the field seam sample is acceptable. If the retest specimen fails, then the field seam sample is unacceptable.

- The CQA Inspection Personnel shall verbally report the results for each field seam sample to the CQA Officer within one working day after the samples have been tested. Any uncertainty of the results shall be addressed at this time by the CQA Officer. The CQA Officer shall determine final acceptability of the seam.

- The CQA Inspection Personnel shall write a brief report to the CQA Officer within three (3) days of the verbal report. Information shall include: field sample number, date received, date tested, sample number, location of failure, strain rate, load at yield/break, elongation at yield/break, and any miscellaneous notes.

- In the event of seam failure, the Geomembrane Installer shall reconstruct the seam between the failed location and any successful test location in both directions or can retrace the welding path to an intermediate location and take a sample (8-inch by 12-inch) for additional field destructive tests. If this additional sample passes, the seam shall be reconstructed from this location to the originally failed location and for the same distance beyond. In any case, acceptable reconstructed seams must be bounded by two passed field destructive tests on both sides of the reconstructed seam. Seam samples for laboratory destructive tests must be taken from within the reconstructed area if the failed length exceeds 20 feet.

- Holes in the geomembrane resulting from the destructive seam sampling shall be immediately repaired by the Geomembrane Installer in accordance with Spec. Section 02261.

Non-destructive seam continuity testing shall be performed on the field and factory seams over their full length for continuity as described in Spec. Section 02260. This testing shall be done as the seaming work progresses for field seams. The CQA Inspection Personnel shall perform the following during this testing, as appropriate:

- Observe and document testing. Any discrepancies with the Project Specifications shall be reported to the CQA Office and the Geomembrane Installer.

- Record the seam number, date of observation, name of tester, and outcome of the test or observation.

- Document locations where the seam cannot be non-destructively tested after final placement, and non-destructive testing of the seam prior to final installation in those areas.

- Inform the Geomembrane Installer and the CQA Officer of any required repairs. The Geomembrane Installer shall complete any required repairs in accordance with Spec. Section 02261.

- If repair work is performed, observe the repair and the retesting of the repair. In addition, mark on the geomembrane that the repair has been made and document the results.

The CQA Inspection Personnel shall perform the following for the anchor trenches:

- Prior to installation of the geomembrane in the anchor trench, document that the trench is free of ponded water and that the trench has been constructed according to Spec. Section 02261-3.07 and the Project Drawings.

- Observe the backfilling of the anchor trenches for conformance with Spec. Section 02261. Any discrepancies shall be reported to the Geomembrane Installer for correction.

- Perform in-situ density testing (ASTM D2922) as applicable, on trench backfill every 100 feet of trench. If a trench is backfilled without proper testing or if a test fails, the trench shall be reworked or re-excavated by manual equipment to avoid geomembrane damage and shall be recompacted and tested at the Construction Contractor's expense.

Once the geomembrane is installed, the CQA Inspection Personnel shall observe and document the seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and signs of contamination by foreign matter. Any discrepancies shall be reported to the CQA Officer.

The geomembrane shall be clean at the time of visual observation since light reflected by the geomembrane aids in the the detection of defects. The geomembrane surface shall be broomed or washed by the Geomembrane Installer if the amount of dust or mud inhibits observation and testing. The CQA Personnel shall inform the CQA Officer if the geomembrane needs to be cleaned.

Each suspect location, both in seam and non-seam areas, shall be non-destructively tested, as appropriate. Each location which fails the non-destructive testing shall be marked by the CQA Inspection Personnel and repaired by the Geomembrane Installer.

Acceptance of the geomembrane liner shall be the responsibility of the Certifying Engineer. The geomembrane liner shall not be accepted until the following criteria are met, at a minimum:

- The installation is finished.
- All documentation of the installation is complete, including the final report of the CQA Officer.
- Documentation of the adequacy of the field seams and repairs, including associated testing, is completed.
- A letter is issued by the Certifying Engineer indicating that the liner installation has been completed in conformance with the Project Specifications.

4.6.7 Drainage Layer

The Construction Contractor shall be responsible for placing the drainage layer material according to Spec. Section 02240. This material shall be a granular material, specified in Spec. Section 02240 having a maximum 5 percent material be weight passing the U.S. No. 200 sieve, a uniformity coefficient of less than 6, and a hydraulic conductivity which is greater than or equal 1×10^{-3} cm/s.

The CQA Inspection Personnel shall perform the following activities prior to construction of the drainage layer:

- Observe and document construction materials are as specified.
- Establish a table of proposed testing and sampling locations to meet the individual sampling frequency and location requirements included herein. This table shall be utilized in performing frequency-specific or location-specific quality assurance documentation.
- Establish an identification numbering system for proposed test and sample locations.
- Test one sample submitted from the Construction Contractor of material to be placed for the following:

- Grain Size Distribution Test (ASTM D422)
- Hydraulic Conductivity (Corps of Engineers EM 1110-02-1906)

The CQA Inspection Personnel shall perform the following activities during construction:

- Observe and document the foundation (i.e. Geotextile A) prior to sand layer placement. Geotextile A shall be accepted, in writing, by the Certifying Engineer, prior to sand layer placement.
- Confirm sand is not stockpiled on the lagoon surface in stockpiles over 3 feet high or for longer than 30 minutes.
- Observe and document placement methods.
- Observe and document damage to the Geotextile. Damaged geotextile fabric due to fill placement operations shall be repaired in accordance with Spec. Section 02260 at the expense of the Construction Contractor.
- Observe and document material is free of large rocks, boulders, and other items which could penetrate or damage the geomembrane.
- Test a minimum of two (2) samples of placed material for Grain Size Distribution Test (ASTM D422)
- Test a minimum of two (2) samples of material placed for Hydraulic Conductivity Test (Corps of Engineers EM 1110-02-1906)
- Document actual sampling locations as they are performed. Actual sampling frequencies shall meet or exceed the frequencies required herein.

Once the layer is placed, the CQA Personnel shall perform the following:

- The CQA Officer shall review the survey notes and topographic map submitted by the Construction Contractor to determine if the lines and grades are in accordance with the Project Drawings. Areas which do not meet grade (± 0.1 feet) shall be regraded, resurveyed, and resubmitted for approval at the expense of the Construction Contractor. This process shall be repeated until approval is given as provided in Spec. Section 01050, Part 3.05(A).
- The CQA Inspection Personnel shall confirm the as-built grades at the direction of the CQA Officer.

4.6.8 Cover Layer

The Construction Contractor shall be responsible for placing the cover layer according to Spec. Section 02240. This material is the same material as described in Section 4.5.3

for frost protection/vegetative growth material layer for the New and Old Fill Areas. The CQA Inspection Personnel shall perform the same tasks as outlined in Section 4.5.3.

4.6.9 Topsoil

The Construction Contractor shall be responsible for constructing the topsoil layer according to Spec. Section 02240. This material is the same as that described in Section 4.5.4 for the New and Old Fill Area covers. The CQA Inspection Personnel shall perform the same tasks as outlined in Section 4.5.4.

4.7 EROSION AND SEDIMENTATION CONTROL

The Construction Contractor shall be responsible for maintaining erosion controls in accordance with the Project Drawings. These controls shall be inspected and re-established prior to RD Construction.

4.8 ACTIVE GAS EXTRACTION SYSTEM

The Construction Contractor shall be responsible for the installation of the active gas extraction system according to the Spec. Section 02733. The system shall consist of the following three (3) main components: extraction trenches. collection piping, and blower and flare assembly. The extraction trenches and collection pipings shall be installed as part of the LR Action construction, except in the brine pit area. The RD construction shall consist of installation of the blower and flare assembly.

Prior to the installation of the blower and flare assembly, the CQA Inspection Personnel shall observe and document that the construction materials meet the Project Specifications. The CQA Inspection Personnel shall perform the following prior to the placement of piping, as appropriate:

- Inspect pipe fittings and accessories for cracks, damage, or other defects. Damaged or defective material shall be rejected and shall be removed by the Construction Contractor from the site.
- Inspect the pipes and fittings for dirt, debris, or other foreign material. The pipes and fittings shall be clean before they are heat fused.

- Observe and document pre-installation pressure testing of stringing segments performed by the Construction Contractor prior to installation. In addition, obtain and review Construction Contractor testing documentation. If the test fails, the Construction Contractor shall determine the cause of test failure, correct the cause, log the measures taken to identify the cause, and retest.

The CQA Inspection Personnel shall perform the following during the gas collection header system installation:

- Confirm the gas collection header section is set out and staked in accordance with the Project Drawings.
- Observe and document excavation is performed in accordance with Spec. Section 02733, Part 3.05(A).
- Measure and document depth of bedding every 50 lineal feet of trench to confirm that a minimum of 6 inches of bedding is provided under piping in trenches.
- Observe and document pipe joining procedure.
- Observe and document anti-seep collars and bentonite seals are installed in accordance with Spec. Section 02733, Part 3.07.
- Observe and document compaction of backfill is performed such that no further soil densification occurs to the satisfaction of the CQA Inspection Personnel.
- Measure and document sand bedding depth over the top of the pipe every 50 feet to confirm a minimum height of 6 inches.

The CQA Inspection Personnel shall perform the following during the installation of the gas extraction trench wellhead:

- Observe and document the installation is performed by the Construction Contractor in accordance with Spec. Section 02733, Part 3.08.
- Observe and document the following:
  - Flexible hose integrity.
  - Proper operation of the monitoring ports.
  - Proper seal between quick couple body and dust cap.
  - Vacuum tight seal around trenchhead flange connections.

The CQA Inspection Personnel shall perform the following during condensate knockout and drain installation:

- Observe and document installation is performed in accordance with Spec. Section 02733, Parts 3.10 and 3.11.
- Observe and document the following:
  - Proper operation and vacuum tight seal of the sample monitoring ports.
  - Vacuum tight seal of the flange to blind flange connection.
  - Drain line is open and free flowing.

The CQA Inspection Personnel shall observe and document the pre-operation testing performed by the Construction Contractor prior to the installation of the blower and flare assembly. The CQA Inspection Personnel shall perform the following during the construction of the blower/flare system, as appropriate:

- Observe and document that the site preparation is performed in accordance with Spec. Section 11310, Part 3.01 including a minimum of 70 feet horizontal clearance from the flare stack to any overhead utility lines.
- Observe and document that the concrete pad is installed in accordance with Spec. Section 11310, Part 3.02 including verification of true piping alignment.
- Observe and document the geotextile and stone fill installation is installed in accordance with Spec. Section 11310, Part 3.06 including confirming 4 inches of stone fill is placed over the geotextile. No testing of the geotextile is required except to confirm that the specified overlap was maintained.
- Observe and document that the electrical installations, nitrogen and propane piping installation, is performed in accordance with Spec. Section 11310, Parts 3.04, 3.05, and 3.07, respectively.
- Observe and document the following items during the system start-up testing performed by the Construction Contractor who shall submit a certificate of satisfactory operational testing.
  - Piping installation is completed.
  - Drip-leg has been filled with water.
  - Well valves are closed.
  - At the well furthest from the blower, the equilibrium vacuum in the collection piping and the time required to reach equilibrium.

The Certifying Engineer shall document, in writing, that the gas extraction system installation is completed when the following, at a minimum, are completed and documented:

- The Certifying Engineer has obtained, reviewed, and accepted the following:
  - A warranty for the blower/flare station and appurtenances.
  - Certificate of satisfactory operational testing.
  - Operation data for the system components.
  - Maintenance data for the system components.
  - Manufacturer's installation instructions for the system components.
- The CQA Inspection Personnel have observed, documented, and approved the work and tests applicable to this system.
- All work defined under Spec. Section 02733 is completed to the satisfaction of the CQA Inspection Personnel and CQA Officer.
- The as-built drawings are obtained, reviewed, and documented by the CQA Officer.

4.9 SEEDING

The Construction Contractor shall prepare the subsoil, seed, mulch, fertilize and maintain the seeding installation in accordance with Spec. Section 02936. Seed shall be a composite mixture of creeping red fescule, domestic rye grass, red top, smooth bromegrass, tall fescule, and birdsfoot treefoil. Mulch shall consist of straw and cellulose fiber which shall be bound in place with a clear non-staining latex based tackifier or a water-soluble polymer. Fertilizer shall consist of lime and a mixture of nitrogen, phosphate, and potash.

The CQA Inspection Personnel shall the perform the following prior to seeding, as applicable:

- Confirm that fertilizer is delivered in waterproof bags.
- Obtain documentation from the Construction Contractor verifying the seed mixture for landfill and sludge lagoon covers, swales and general grading areas, Spickler stockpiles, and borrow source areas.

- Observe and document the grass seed is delivered in sealed containers. Seed in damaged packaging shall be replaced at the Construction Contractor's expense.

The CQA Personnel shall perform the following during installation:

- The CQA Officer shall observe and document that the topsoil is ready to receive the work.
- For drill seeding, observe and document tilling depth, fertilizer proportions, mulching rates and seeding rates.
- For hydroseeding, observe and document seep application rate; seed, fertilizer, and water mixture; and application and rate of mulching.
- Confirm installation and maintenance of seed protection with erosion fabric.

The CQA Inspection Personnel shall periodically observe and document the maintenance of the grass cover after installation until final acceptance of the Remedial Action Construction. Repairs shall be performed by the Construction Contractor.

4.10 CONCRETE

The Construction Contractor shall place concrete in accordance with Spec. Section 03001. This shall include formwork, concrete reinforcement, and cast-in-place concrete.

The CQA Inspection Personnel shall perform the following, as appropriate:

- Record date, location of pour, quantity, and air temperatures.
- Obtain a copy of the truck ticket for each load.
- Mold three (3) test specimens and perform slump and air entrainment tests in accordance with ACI 30. This shall be performed every 50 cubic yards or less of concrete placed each day.
- Defective concrete, as determined by the CQA Inspection Personnel, shall be modified or replaced.
- Confirm proper curing is performed.

4.11 ELECTRICAL WORK

The Construction Contractor shall install the electrical components in accordance with Spec. Sections 16010, 16111, 16120, 16160, 16180, 16420, 16470, and 16902.

The Certifying Engineer shall review and approve, in writing, shop drawings and product data submitted by the Construction Contractor. The CQA Inspection Personnel shall observe and document that the Local Building Inspector has inspected and approved the electrical installations in accordance with state and local electric codes.

The CQA Inspection Personnel shall observe and document the complete system start-up and pre-operational testing performed by the Construction Contractor. Any system defect shall be repaired or replaced to the satisfaction of the CQA Inspection Personnel at the expense of the Construction Contractor.

The Certifying Engineer shall accept, in writing, the complete control system when the following, at a minimum, applies:

- The Certifying Engineer has obtained, reviewed, and accepted the following from the Construction Contractor:
  - Operation data for the system components.
  - Maintenance data for the system components.
  - Manufacturer's installation instructions for the system components.
- The CQA Inspection Personnel have observed and documented that the work has been completed in accordance with the above referenced specifications.

5.0 SAMPLING STRATEGIES

5.1 SAMPLING UNITS AND ELEMENTS

Sampling units or sample elements shall be as specified below and in accordance with the standard or specified test method included herein. In earthwork and soil testing, the sampling unit or sample element depends on the type of tests such as compaction test, hydraulic conductivity, etc. in accordance with the specified method. For the geomembrane and the geotextiles, the sampling unit or sample element shall be as provided in Section 4.0 of this Plan.

The methodology and the detailed sampling procedure shall be as specified in ASTM standards or other methods as included herein.

5.2 TYPES OF SAMPLING STRATEGIES

Sampling and testing requirements have been included in Section 4.0 of this Plan. This section briefly discusses sampling requirements of the principal construction items -- earthwork, geomembrane, and the geotextiles.

5.2.1 Earthwork

The sampling strategy for earthwork shall be to evenly distribute sample and in-situ test locations throughout the construction area to provide an even distribution of as-built data. The particular location of any one sample or test shall be left to the discretion of the CQA Inspection Personnel. However, particular care shall be taken to test those areas where compaction shall be technically more difficult to achieve.

5.2.2 Geomembrane

All liner material shall be inspected before it is used in the construction. The seams shall be tested for continuity procedures described in Section 4.6.6. The intent of this rigorous testing program is to confirm that the seams have been properly made, and to reasonably eliminate the seam variable at the end of construction from potential causes of leaks.

5.2.3 Geotextiles

The geotextiles shall be inspected before it is used in the construction. The seam testing for the geotextiles shall be performed as described in Section 4.6.1. The intent of this rigorous testing program is to confirm that the seams have been properly made, and to reasonably eliminate the seam variable at the end of construction from potential causes of failures.

5.3 TREATMENT OF OUTLIERS

Test results shall normally be reviewed and analyzed as soon as they become available. Outliers (test values which appear to deviate substantially from the remainder of the data sample) shall be handled in general accordance with ASTM E-178.

5.4 CORRECTIVE MEASURES IMPLEMENTATION

Any material or workmanship that does not comply with the provisions in the Project Drawings or Specifications shall be rejected, and either replaced or corrected. Provisions for executing corrective actions have been addressed in Section 4.0 of this Plan.

6.0 DOCUMENTATION

6.1 GENERAL

Documentation for this Plan shall include daily recordkeeping, inspection data sheets, problem identification and corrective measures reports, photographic reporting data sheets, acceptance of completed components, final construction documentation, document control and storage of records. These elements are discussed in the following sections.

6.2 DAILY RECORDKEEPING

Standard daily reporting procedures shall be performed by the CQA Personnel including maintenance of field books, preparation of a summary report with supporting data sheets and, when appropriate, problem identification and corrective measures reports.

6.2.1 Field Books

Each member of the CQA Personnel shall maintain a field book. The field book shall be used to record observation notes, inspection activity duration, relevant discussions with on-site personnel, or other information which would not be recorded on specific data sheets.

6.2.2 Inspection Data Sheets

All observations, and field and/or laboratory tests, shall be recorded on notes, charts, sketches, photographs, or any combination of these. Where possible, a checklist shall be used to insure that pertinent factors of a specific observation are not overlooked.

The inspection data sheets shall include the following information, as applicable:

- Unique identifying sheet number for cross-referencing and document control.
- Description or title of the inspection activity.
- Location of the inspection activity or location from which the sample increment was obtained.

- Type of inspection activity and procedure used (reference to standard method when appropriate).
- Recorded observation or test data, with the necessary calculations.
- Results of the inspection activity and a comparison with specification requirements.
- Personnel involved in the inspection activity.
- Signature of the appropriate CQA Inspection Personnel and concurrence by the CQA Officer.

6.2.3 Daily Summary Report

A summary report shall be prepared by the CQA Officer which provides the chronologic framework for identifying and recording other reports. The summary reports shall include the following information, as applicable:

- Unique identifying sheet number for cross-referencing and document control.
- Date, project name, location, and other identification.
- Weather conditions.
- Reports on any meetings held and their results.
- Unit processes, and locations, of construction under way during the time frame of the daily summary report.
- Descriptions of areas or units of work being inspected and documented.
- Calibrations, or recalibrations, of test equipment, including actions taken as a result of recalibration.
- Decisions made regarding approval of units of material or of work and/or corrective actions to be taken in instances of substandard quality.
- Unique identifying sheet numbers of inspection data sheets and/or problem reporting and corrective measures reports used to substantiate the decisions described in the preceding item.
- Quantities and measurements obtained from the Construction Contractor.
- Modifications/deviations from the approved Project Specifications and this CQA Plan.
- Signature of the CQA Officer.

6.2.4 Problem Identification and Corrective Measures Reports

A problem is defined herein as material or workmanship that does not meet the design requirements, Project Drawings and Specifications, and actions that do not comply with this Plan. All such problems shall be brought to the attention of the responsible project personnel and the CQA Officer for resolution and follow-up, respectively. The CQA Officer shall confirm that the cause of the problem is determined and that appropriate corrective action is taken by the responsible project personnel to resolve the problem. The results of such actions shall be documented and confirmed by the CQA Personnel using the Problem Identification and Corrective Measures Report form, as applicable:

Problem Identification and Corrective Measures Reports shall be cross-referenced to specific inspection data sheets where the problem was identified. They shall include the following, as applicable:

- Unique identifying sheet number for cross-referencing and document control.
- Detailed description of the problem.
- Location of the problem.
- Probable cause.
- How and when the problem was located (referenced to inspection data sheets).
- Estimation of how long the problem has existed.
- Suggested corrective measure.
- Documentation of correction (reference to inspection data sheets).
- Modifications and/or deviation from the approved Project Specifications and Drawings, and this CQA Plan.
- Final results.
- Signature of the appropriate CQA Inspection Personnel and concurrence by the CQA Officer.

Copies of the report shall be sent to the Certifying Engineer and the Respondents for their comments and acceptance. These reports shall not be submitted to the Permitting Agencies at that time unless they have been specifically requested. However, a summary

of the data sheets and reports shall be required by the Permitting Agencies upon completion of construction.

6.3 PHOTOGRAPHIC REPORTING DATA SHEETS

Photographic reporting data sheets shall be used to document construction progress, critical activities, construction problems, and remedial actions. Photographs shall be taken using 35mm color print film. Prior to the start of construction, a list of minimum required photographic subjects shall be prepared by the CQA Officer to aid in obtaining the desired photographic documentation.

Photographic data sheets shall be cross-referenced or appended in the Final Documentation Report and in the Inspection Data Sheets, and/or Problem Identification and Corrective Measures Reports, if applicable. As a minimum, these documents shall include the following information, as applicable:

- A unique identifying number of data sheets and photographs for cross-referencing and document control.
- The date, time, and location where the photograph was taken.
- Description of the Work.

These photographs shall serve as a pictorial record of work progress, problems, and corrective measures. They shall be kept in a permanent protective file in the order in which they were taken. The file shall contain color prints; negatives shall be stored in order in a separate file.

6.4 ACCEPTANCE OF COMPLETED COMPONENTS

All daily inspection summary reports, inspection data sheets, and problem identification and corrective measures reports shall be reviewed by the CQA Officer. The documentation shall be evaluated and analyzed for internal consistency and for consistency with similar work. Timely review of these documents shall permit errors, inconsistencies, and other problems to be detected and corrected as they occur, when corrective measures are the easiest.

This information shall be assembled and summarized into periodic acceptance reports. The reports shall indicate that the materials and construction processes comply with the specified design. These reports shall be included in project records, submitted to Certifying Engineer, and, if requested, submitted to the Permitting Agencies.

6.5 FINAL CONSTRUCTION DOCUMENTATION REPORT

Upon completion of the Project, the Certifying Engineer on behalf of the Respondents shall submit an as-built drawing set and a final summary documentation report to the Permitting Agencies. This as-built drawing set shall include, at a minimum, the following information:

- A plan sheet documenting the subbase grades. Documentation of grades shall include spot evaluations taken on a maximum 100-foot grid for the landfills and a maximum 50-foot grid for the sludge lagoon after grading has been performed to establish uniform slopes.
- A plan view drawing for each 1-foot thickness of clay placed showing the locations of the various soil testing performed at each test location on the landfills. Multiple plan views may be presented on a single engineering plan sheet if legibility is not compromised.
- A plan view drawing of the uppermost lift of clay shall document the final clay grades on a maximum 100-foot grid for the landfills.
- A plan sheet documenting the constructed final cap grades prior to topsoil placement on a maximum 100-foot grid for landfills and a maximum 50-foot grid for the sludge lagoon. Approved final cap grades shall be shown for the same area in a clear and legible manner.
- A plan sheet documenting the final surfaces following topsoil placement. Documentation grades shall include spot elevations taken on a maximum 100-foot grid for the landfills and a maximum of 50-foot grid for the sludge lagoon. The approved final grades shall also be shown in a clear and legible manner. This plan sheet shall also show the locations of the manholes. lift stations. risers, head wells, gas venting systems, surface water drainage control structures and other appurtenances.
- Daily field test reports.
- Problem identification and corrective measures.
- Deviations from design material and construction from the Project Specifications (with justifying documentation).
- Personnel and their respective responsibilities shall be clearly defined, understood, and accepted by the parties involved in the Project. Signatures of

the Respondents, Design Engineer, Certifying Engineer, CQA Officer, and Construction Contractor shall be included as confirmation that each party understood and accepted the areas of responsibility and lines of authority and performed their function(s) in accordance with the CQA Plan.

- Cross-sections through the closed area which are constructed parallel and perpendicular to the base line of the facility at maximum 200-foot intervals. A minimum of four (4) cross-sections shall be submitted, two (2) of which shall be in each direction. Each of these cross-sections shall show the surficial and subsurface features encountered including gas vents, leachate lines, and other landfill structures and shall be tied into the grades of adjacent previously filled areas. At a minimum, each cross-section shall show subbase grades, base grades, final refuse grades, final cap system configuration and grades, and final topsoil grades.

The report shall include, at a minimum, the following information:

- A detailed narrative chronologically describing the closure of the area. Particular emphasis shall be placed on any deviations from the approved Project Drawings.

- A cover letter under the seal of a registered Professional Engineer rendering an opinion as to whether the area has been closed in substantial conformance with the approved Project Drawings. Any deviations from the approved plan shall be noted and explained.

- An analysis and discussion of the soil testing work performed. The raw data from the soil testing performed shall be included in an appendix.

- The results of the required topsoil testing along with the rates and types of fertilizer and seed applied. Liming requirements shall also be included along with the actual rate of application.

- A series of properly labeled 35 mm color prints which document the major aspects of facility closure. This shall include panoramic views of the closed area as well as close-up photos of the construction process and completed engineering structures such as gas vents, cleanout ports, manholes, leachate storage tank access, leachate loadout areas and other pertinent structures.

The Final Construction Documentation Report submitted to the Permitting Agencies as part of this Plan does not sanction the CQA Plan as a guarantee of remedial action Construction and performance. Rather, the primary purpose of the final documentation is to improve confidence in the constructed remedial action through written evidence that the CQA Plan was implemented as proposed and that the construction proceeded in accordance with design criteria, and Project Drawings and Specifications.

6.6 DOCUMENT CONTROL

A control scheme shall be used to organize and index the CQA documents. This scheme shall allow easy access to the CQA documents and shall enable a reviewer to identify and retrieve original data sheets for any completed work or closure component.

6.7 STORAGE OF RECORDS

The CQA Officer shall be responsible for the facility CQA documents. This shall include the CQA Officer's copy of the design criteria, Project Drawings and Specifications, the CQA Plan, and the originals of the data sheets and reports. Duplicate records shall be kept at another location to avoid loss of this information if the originals are destroyed.

Once the closure construction is complete, the original document shall be stored in the Final Evidence File in a manner that shall allow for easy access while still protecting it from any damage. An additional copy shall also be kept at the Respondents' facility. A final copy shall be kept by the Permitting Agencies in a publicly acknowledged repository. The documentation shall be maintained through operating and Post Closure periods (i.e. 30 years after construction is completed).

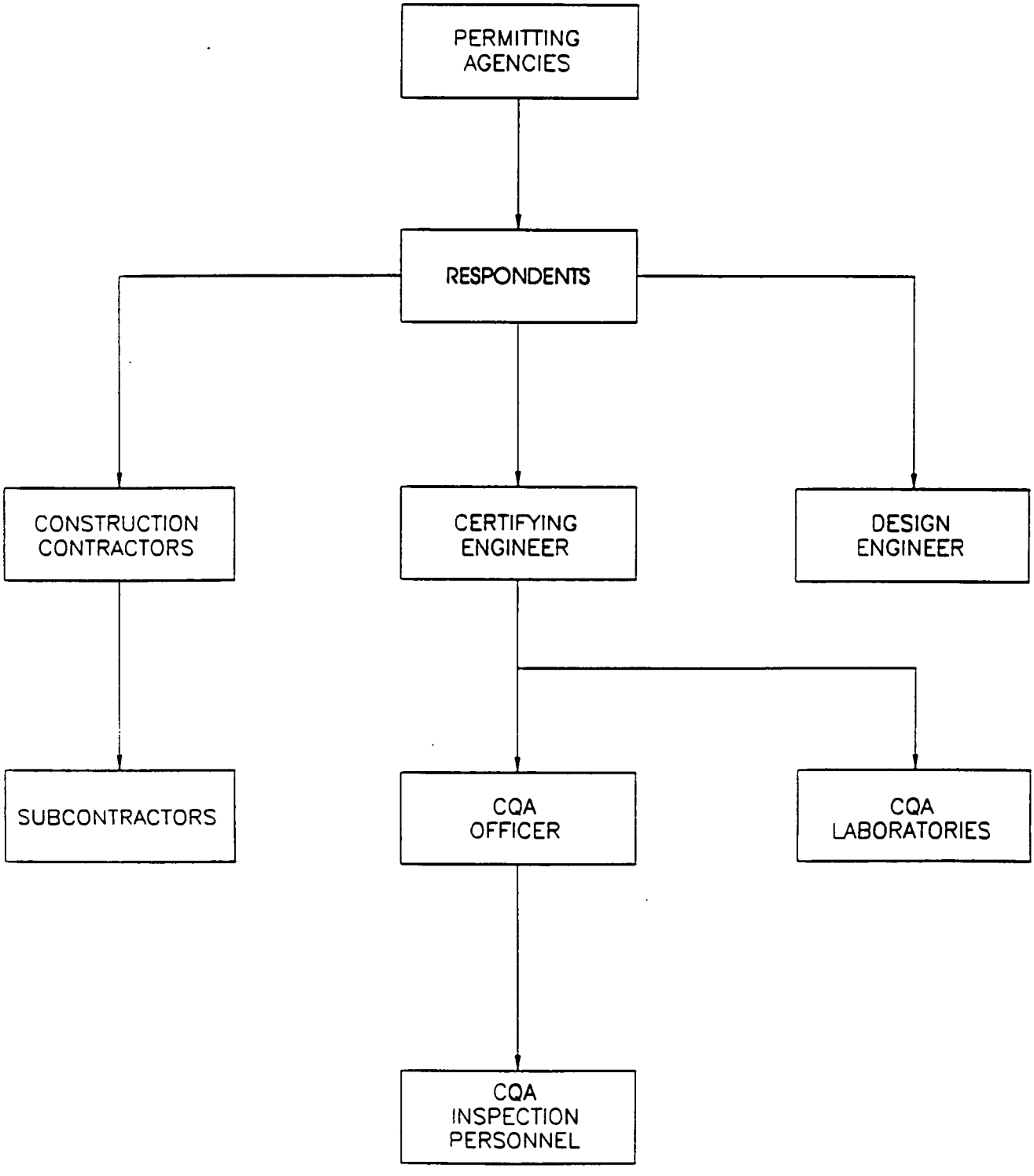
FIGURE

1 - Organization Chart

FIGURE 1

SPICKLER LANDFILLL SITE

CQA ORGANIZATION STRUCTURE



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