FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

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SOUTHWEST DISTRICT
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Jones Edmunds & Associates, Inc.
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Southwest District Tampa

CITRUS COUNTY CENTRAL LANDFILL
GEOMEMBRANE REMEDIATION

CONSTRUCTION QUALITY ASSURANCE PLAN

Prepared for:

CITRUS COUNTY BOARD OF COUNTY COMMISSIONERS
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TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

2.0 RESPONSIBILITY AND AUTHORITY 2-1
2.1 PERMITTING AND DESIGN 2-1
2.2 ORGANIZATION AND PERSONNEL 2-1

3.0 QUALIFICATIONS OF THE CQA TEAM 3-1
3.1 CQA OFFICER 3-1
3.2 CQA INSPECTION PERSONNEL 3-1

4.0 INSPECTION ACTIVITIES 4-1
4.1 GENERAL PRECONSTRUCTION ACTIVITIES 4-1
4.2 GEOMEMBRANE LINER 4-1

5.0 SAMPLING STRATEGIES 5-1
5.1 STATISTICAL SAMPLING METHODS 5-1
5.2 JUDGMENTAL SAMPLING METHODS 5-1

6.0 DOCUMENTATION 6-1
6.1 DAILY REPORTS 6-1
6.2 INSPECTION DATA SHEETS 6-1
6.3 PHOTOGRAPHIC REPORTING DATA SHEETS 6-2
6.4 FINAL DOCUMENTATION 6-2

APPENDICES
APPENDIX A TECHNICAL SPECIFICATIONS
APPENDIX B SAMPLE GEOMEMBRANE MANUFACTURER'S/INSTALLER'S QA/QC PLAN
APPENDIX C CQA AND PROJECT MANAGEMENT FORMS

1.0 INTRODUCTION

This document is intended to serve as the Construction Quality Assurance (CQA) plan for the Geomembrane Remediation to the Citrus County Central Landfill in Lecanto, Florida.

Elements of this CQA plan are based on the U.S. Environmental Protection Agency (EPA) Technical Guidance Document entitled, "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities" (EPA/530-SW-86-031).

2.0 RESPONSIBILITY AND AUTHORITY

2.1 PERMITTING AND DESIGN

Jones, Edmunds & Associates, Inc. (JEA), has been retained by the Citrus County Board of County Commissioners to prepare investigative studies, reports, and construction documents necessary to obtain permits for the Central Landfill Geomembrane Remediation.

2.2 ORGANIZATION AND PERSONNEL

The following organization and personnel have the authority in the performance of this work:

2.2.1 Permitting Agency

The permitting agency is the Florida Department of Environmental Protection (DEP), Southwest District.

The permitting agency is authorized by law to issue a permit for the construction and operation of a solid waste disposal facility. It is the responsibility of the permitting agency to review the facility Owner/Operator's permit application, including the site-specific CQA plan, for compliance with the agency's regulations and to make a decision to issue or deny a permit based on this review. The permitting agency will have the responsibility and authority to review and accept or reject any design revisions or requests for variance that are submitted by the facility Owner/Operator after the permit is issued. The agency also has the responsibility and authority to review all CQA documentation during or after facility construction to confirm that the approved CQA plan was followed and that the facility was constructed as specified.

2.2.2 Facility Owner/Operator

The facility Owner/Operator is the Citrus County Board of County Commissioners with personnel including Susan Metcalfe, Director.

The facility Owner/Operator is responsible for the design, construction, and operation of the solid waste disposal facility. This responsibility includes complying with the requirements of the permitting agency in order to obtain a permit and assuring the permitting agency, by the submission of CQA documentation, that the facility was constructed as specified. The Owner/Operator has the authority to select and dismiss organizations charged with design, CQA, and construction activities. The Owner/Operator also has the authority to accept or reject design plans and specifications, CQA plans, reports and recommendations of the CQA officer, and the materials and workmanship of the Contractor.

2.2.3 Design Engineer

The Design Engineer is Darabi and Associates, Inc., with personnel including: David A. Keough, P.E., Project Manager, and Judy L. DeVita, E.I., Project Engineer.

JEA has the primary responsibility to design a solid waste disposal facility that fulfills the operational requirements of the facility Owner/Operator and the performance requirements of the permitting agency. JEA's activities will not end until the facility is completed; the Project Engineer may be requested to change some component designs if unexpected site conditions are encountered or changes in construction methodology occur that could adversely affect facility performance. CQA provides assurance that these unexpected changes or conditions will be detected, documented, and addressed during construction.

Additional responsibility and authority may be delegated to the Project Engineer by the expressed consent (i.e., a contractual agreement) of the facility Owner/Operator. Additional responsibility and authority includes formulating and implementing a site-specific 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, plans, and specifications is detected by CQA personnel.

2.2.4 CQA Responsibility

JEA's CQA Officer and personnel include: David A. Keough, P.E., CQA Officer, Steven J. Laux, P.E., and Kenneth S. Vogel, P.E.

The overall responsibility of the CQA personnel is to perform those activities specified in the CQA plan (e.g., inspection, sampling, documentation). At a minimum, CQA personnel will include a CQA officer and the necessary supporting CQA inspection personnel. The specific responsibilities and authority of each of these individuals will be defined clearly in the CQA plan and in the associated contractual agreements with the facility Owner/Operator.

Specific responsibilities of the CQA Officer will include:

A. Reviewing design criteria, plans, and specifications for clarity and completeness so that the CQA plan be implemented.

B. Educating CQA inspection personnel on CQA requirements and procedures.

C. Scheduling and coordinating CQA inspection activities.

D. Directing and supporting the CQA inspection personnel in performing observations and tests by:

   1. Submitting blind samples (knowns, duplicates, and blanks) for analysis by the CQA inspection personnel and one or more independent laboratories.

   2. Confirming that regular calibration of testing equipment is properly conducted and recorded.

   3. 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.

4. Confirming that the test data are accurately recorded and maintained (this may involve selecting reported results and backtracking them to the original observation and test data sheets).

5. Verifying that the raw data are properly recorded, validated, reduced, summarized, and interpreted.

E. Providing to the facility Owner/Operator reports on the inspection results including:

1. Review and interpretation of all data sheets and reports.

2. 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.

3. Rejection of defective work and verification that corrective measures are implemented.

F. Verifying that a Contractor's construction quality control plan is in accordance with the site-specific CQA plan.

G. At the Owner/Operator's request, reporting to the Contractor results of all observations and tests as the work progresses and interacting with the Contractor to provide assistance in modifying the materials and work to comply with the specified design.

2.2.5 Responsibility of CQA Inspection Personnel

JEA's CQA Inspection Personnel have not been selected at this time; however, the specific responsibilities of the supporting CQA inspection personnel will include:

A. Performing independent on-site inspection of the work in progress to assess compliance with the facility design criteria, plans, and specifications.

B. Verifying that the equipment used in testing meets the test requirements and that the tests are conducted according to the standardized procedures defined by the CQA plan.

C. Reporting to the CQA Officer results of all inspections including work that is not of acceptable quality or that fails to meet the specified design.

D. Assist the CQA Officer in review and interpretation of all data sheets and reports.

2.2.6 Construction Contractor

The Construction Contractor with their associated personnel have not been designated at this time; however, the following responsibilities pertain:

A. It is the responsibility of the Construction Contractor to construct the geomembrane remediation in strict accordance with design criteria, plans, and specifications, using the necessary construction procedures and techniques. This responsibility may be expanded, as part of the contractual agreement with the facility Owner/Operator, to include formulating and implementing a formal plan for construction quality control.

B. Discussing procedures for the location and protection of construction materials and for the prevention of damage of the materials from inclement weather or other adverse events.

C. Conducting a site walk-around to review construction material and inspection equipment storage locations.

2.2.7 Other Project Responsibilities

Other project responsibilities shall consist of:

- Project Meetings
- Preconstruction CQA Meetings
- Progress Meetings
- Problem or Work Deficiency Meetings

3.0 QUALIFICATIONS OF THE CQA TEAM

The CQA plan will identify the qualifications of the CQA team and describe the expected duties of all team members.

3.1 CQA OFFICER

The CQA Officer is that individual assigned singular responsibility for all aspects of the CQA plan implementation. The CQA Officer is responsible to the facility Owner/Operator and will function independently of the Owner/Operator.

The CQA Officer is a Florida Registered Professional Engineer who possesses adequate formal academic training in engineering and managerial experience to successfully oversee and implement construction quality assurance activities for solid waste disposal facilities. The CQA Officer will be expected to ensure that communication of all CQA-related matters is conveyed to and acted upon by the affected organizations.

3.2 CQA INSPECTION PERSONNEL

The CQA inspection personnel possess adequate formal training and sufficient practical, technical, and administrative experience to execute and record inspection activities successfully. This includes knowledge of specific field practices relating to construction techniques used for solid waste disposal facilities, all codes and regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures, and site safety.

4.0 INSPECTION ACTIVITIES

This section of the CQA plan describes the inspection activities (observations and tests) that will be performed by the CQA personnel during the geomembrane remediation. The presented discussion will address only the construction and installation of the facility components and the manufacture/fabrication of various compounds when pertinent. This section addresses the inspection activities that are necessary to ensure that the facility has been constructed to meet or exceed all design criteria, plans, and specifications. The first subsection addresses general preconstruction activities applicable to all facility compounds. The subsequent subsections discuss each facility component in the areas of preconstruction, construction, and post-construction inspection activities unique to each component. Technical specifications for construction of the geomembrane remediation are provided as Appendix A. Appendices B (Sample Geomembrane Manufacturer's/Installer's QA/QC Plan) and C (CQA and Project Management Forms) contain sample CQA and Project Management Forms. These are included for information only and are indicative of the forms that will be part of the routine management and construction completion report. The blank sample geomembrane manufacturer and installer forms that are included in Appendix C are representative of the types of forms and paperwork that will be required of the geomembrane manufacturer and installer. The Contractor will select the installer and manufacturer in accordance with the project specifications. The inclusion of these manufacturer's and installer's plans and forms in no way constitutes recommendation or pre-approval of these companies.

4.1 GENERAL PRECONSTRUCTION ACTIVITIES

The drawings and specifications will be reviewed prior to construction commencement by the CQA team. All members of the CQA team working on this project have considerable experience in landfill design and construction. Engineering considerations, CQA control procedures, and required results will be discussed.

4.2 GEOMEMBRANE LINER

The geomembrane liner to be installed is to be compatible with the waste liquid constituents that may contact it and be of sufficient strength and thickness to withstand the forces expected to be encountered during construction and operation.

4.2.1 Preconstruction

Preconstruction activities include:

- Inspection of the raw material, manufacturing, fabrication, and product quality control documents.
- Inspection of the transportation, storage, and handling of the geomembrane.
- Evaluation of installation personnel and field QA/QC documentation.

A discussion of submittals/shop drawings and specific testing frequencies and properties is contained in Appendix A (technical specifications) of this report. The technical specifications list in detail all of the parameters that are to be achieved during production, fabrication, and installation aspects of the geomembrane liner.

4.2.2 Construction

During construction, the CQA inspection personnel will collect all roll labels, record placement of the geomembrane rolls on a location map, and document other various aspects of construction that include:

- Conformance to submitted and approved panel layout plans.
- Observation of weather conditions.
- Measurement, inspection, and documentation of the geomembrane liner seaming, destructive and non-destructive testing, repairs, and protective layer placement.

4.2.3 Post Construction

The installed geomembrane liner will be visually inspected prior to waste acceptance.

5.0 SAMPLING STRATEGIES

Sampling strategies shall consist of the following two different methods: statistical sampling and judgmental sampling.

5.1 STATISTICAL SAMPLING METHODS

Statistical sampling methods include sample size, sample locations, frequency of testing, acceptance and rejection criteria, along with plans for implementing corrective measures that may be necessary.

5.2 JUDGMENTAL SAMPLING METHODS

Judgmental sampling methods include any sampling strategy where decisions concerning sample size, selection scheme, and/or locations are based on criteria other than statistical considerations. The objective will be to select a typical sample element or elements to represent a whole process or to identify zones of suspected poor quality.

6.0 DOCUMENTATION

The documents outlined below describe the various elements of CQA inspection, reporting, and final completion documentation. Each of the presented items is essential to document that the completed facility has been constructed to meet or exceed design criteria, plans, and specifications. The various elements are briefly discussed below, and sample documents from previously completed projects are presented in Appendix C.

6.1 DAILY REPORTS

The standard daily report from the CQA inspector will include a work summary with supporting inspection/documentation sheets that are completed daily during construction. Items included are:

- Unique document number.
- Date, project name, location, and other identification.
- Reports on any meetings held and their results.
- Activities and locations of construction under way during the time frame of the daily summary report.
- Equipment and personnel involved in construction activities including subcontractors.
- Descriptions of areas of work being inspected and documented.
- Description of offsite materials received, including any quality verification (vendor certification) documentation.
- Calibrations, or recalibrations, of test equipment, including actions taken as a result of recalibration.
- Decisions made regarding approval of material and/or corrective actions to be taken in instances of substandard quality.
- Signature of the CQA inspector.

6.2 INSPECTION DATA SHEETS

The inspection data sheets record the observations of field and laboratory test data. The formats range from reports, charts, graphs, notes, sketches, and photographs. At a minimum, items included are:

- Unique identifying sheet number for cross-reference 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; procedure used (reference to standard method when appropriate).
- Recorded observation or test data, with all necessary calculations.
- Results of the inspection activity; comparison with specification requirements.
- Personnel involved in the inspection activity.
- Signature of the appropriate testing laboratory personnel.

6.3 PHOTOGRAPHIC REPORTING DATA SHEETS

The CQA inspector will take photographs and maintain a log of photographs throughout the construction period. At a minimum, the photographic information will include the following:

- The date, time, and location where the photograph was taken and weather conditions.
- The size, scale, and orientation of the subject matter photographed.
- Location and description of the work.

These photographs will serve as a pictorial record of work progress, problems, and corrective measures. The photographs and log will be kept in a permanent protective file in chronological order. The file will contain color prints, and negatives will be stored separately.

6.4 FINAL DOCUMENTATION

After the completion of the project, the facility Owner/Operator will submit a final report to the permitting agency which will include a statement of acceptance by the CQA officer, inspection data sheets, independent testing agency reports, identification of major deviations from the approved permit documents, and as-built drawings.

6.4.1 Responsibility and Authority

The final documentation will describe the as-built sequence of construction. The document will be sealed and signed by the CQA officer which will serve as certification that the project is constructed in accordance with the Contract Documents and the DEP permit.

6.4.2 Relationship to Permitting Agencies

Final documentation submitted to the permitting agency as part of the CQA plan documentation does not sanction the CQA plan as a guarantee of facility construction and performance. The purpose of the final documentation is to certify that the CQA plan was implemented as proposed and that the facility was constructed in accordance with the Contract Documents and DEP permit.

APPENDIX A

TECHNICAL SPECIFICATIONS

SECTION 06800
GEOMEMBRANE

PART 1 GENERAL 06800-1
1.01 SUMMARY 06800-1
1.02 RELATED WORK 06800-1
1.03 DEFINITIONS 06800-1
1.04 REFERENCE STANDARDS 06800-2
1.05 SUBMITTALS, SHOP DRAWINGS, AND SAMPLES 06800-3
1.06 QUALITY ASSURANCE AND CONTROL (QA/QC) - GENERAL 06800-5
1.07 GEOMEMBRANE MANUFACTURER'S QA/QC 06800-6
1.08 FIELD SEAMING QA/QC 06800-7

PART 2 PRODUCTS 06800-9
2.01 GEOMEMBRANE MATERIAL 06800-9
2.02 SEAMS 06800-10
2.03 PENETRATIONS AND ACCESSORIES 06800-10

PART 3 EXECUTION 06800-10
3.01 GENERAL 06800-10
3.02 SURFACE PREPARATION 06800-10
3.03 STORAGE AND HANDLING 06800-11
3.04 GEOMEMBRANE INSTALLATION 06800-11
3.05 REPAIRS 06800-12
3.06 SUBMITTALS REQUIRED FOR PROJECT CLOSEOUT 06800-12

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
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SOUTHWEST DISTRICT TAMPA

SECTION 06800
GEOMEMBRANE

PART 1 GENERAL

1.01 SUMMARY

This section covers the work required to furnish and install the high-density polyethylene (HDPE) geomembranes including all necessary labor, equipment, and appurtenances.

1.02 RELATED WORK

A. The Standard and Supplementary Conditions of these specifications are a part of this section as if incorporated herein.

B. Other related specification sections contained herein are listed below:

Section 01300, Schedule, Reports, Records, and Submittals

1.03 DEFINITIONS

A. "Manufacturer" is defined as a person or company that is in the business of processing and manufacturing the polyethylene resin and other components into the extruded, usable form of geomembrane sheet material. This person or company will be responsible for all Quality Assurance/Quality Control (QA/QC) requirements of the resin material testing, factory testing, and the material warranty.

B. "Installer" is defined as a person or company that is in the business of joining the extruded, rolled panels and other related products and permanently installing the material in a manner consistent with the project plans and specifications. This person or company shall be responsible for all QA/QC requirements of "field testing" and is responsible for the complete and proper installation of the geomembrane material and the related products. This person or company must act as a manufacturer's authorized installer.

C. "Technical Representative" is defined as a person who has demonstrated, in the Engineer's opinion, sufficient technical competence and geomembrane material installation supervision, and is a designated representative of the manufacturer. This person shall possess a thorough knowledge and understanding of the project plans and specifications as well as the submitted and approved QA/QC plan.

D. Quality Assurance (QA): A program establishing policies, procedures, standards, training, guidelines, testing, and systems necessary to provide quality in the work to meet the project requirements and accepted industry standards.

E. Quality Control (QC): The specific implementation of the Quality Assurance program, including checking and review of activities.

1.04 REFERENCE STANDARDS

A. Reference standards and recommended practices referred to herein shall be the latest revision of any such document.

B. Standards referenced herein are as listed below:

1.	ASTM D 638	Tensile Properties of Plastics
2.	ASTM D 696	Coefficient of Thermal Expansion of Plastics
3.	ASTM D 1004	Initial Tear Resistance of Plastic Film and Sheeting
4.	ASTM D 1204	Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
5.	ASTM D 1238	Flow Rates of Thermoplastics by Extrusion Plastometer
6.	ASTM D 1505	Density of Plastics by the Density-Gradient Technique
7.	ASTM D 1603	Carbon Black in Olefin Plastics
8.	ASTM D 3895	Carbon Dispersion
9.	ASTM D 4437	Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
10.	ASTM D 4885	Standard Test Method for Determining Performance Strength of Geomembranes by the Wide Strip Tensile Method
11.	ASTM D 5321	Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
12.	ASTM D 5397	Evaluation of Stress Crack Resistance of Polyolefin Geomembrane Using Notched Constant Tensile Load Test
13.	ASTM D 5596	Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
14.	ASTM D 5641	Geomembrane Seam Evaluation by Vacuum Chamber

15.	ASTM D 5820	Pressurized Air Channels Evaluation of Dual Seamed Geomembranes
16.	ASTM D 5994	Measuring Core Thickness of Textured Geomembranes
17.	ASTM D 6365	Standard Practice for the Nondestructive Testing of Geomembrane Seams Using Spark Test
18.	ASTM D 6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
19.	ASTM E 96	Water Vapor Transmission of Materials
20.	GRI GM13	Test Properties, Test Frequency, and Recommended Warrant for High Density

1.05 SUBMITTALS, SHOP DRAWINGS, AND SAMPLES

A. All submittals shall be in accordance with Section 01300, Schedules, Reports, Records, and Submittals, and shall be in sufficient detail to show full compliance with these specifications.

B. The Installer shall submit a copy of the geomembrane liner manufacture and installation QA/QC plan. This information shall include information regarding repair of geomembrane defects. The QA/QC plan and the records of experience as specified herein shall be provided with the executed agreement/documents submitted to the Owner.

C. The Installer shall submit the printed product data for all materials, including material specifications and drawing details. The Installer shall submit the printed installation instructions including a complete description of methods to be used for seaming, splicing, patching, repairs, anchoring, and penetrating the geomembrane. Submittals shall include manufacturer's recommended methods for handling and storage.

D. Installer shall submit all installation drawings and procedures for carrying out the work. Shop drawings shall include a panel layout drawing to show the geomembrane sheet layout including the proposed configuration, size, number, position of all sheets, and the sequence of placements. The submittal shall include the location and direction of all seams.

E. Installer shall submit samples of HDPE geomembrane, penetration materials, anchor strips, anchor bolts, clamps, and other appurtenances.

F. Product data, samples, certifications, and shop drawings shall be submitted by the Installer for review and approval by the Engineer.

G. Testing certification as specified herein shall be submitted to the Engineer.

H. Laboratory test results shall be provided to the Engineer by the Installer no later than 48 hours after receipt of the test results. The Installer shall also provide test results, certifications, and submittals as required to conform to these specifications.

I. During construction, the Installer shall submit installation reports to the Engineer. Reports of installation shall include the following:

1. Material delivery report.
2. Pre-start site inspection.
3. Soil subgrade acceptance.
4. Daily records of construction (text documentation).
5. Daily personnel activity reports.
6. Equipment list, including manufacturer and serial number.
7. Chain-of-custody for destructive samples.
8. Field seam strength test reports and patch testing (destructive).
9. Meeting reports.
10. Problem/solution reports.
11. Seam records.
    a. Name of welder.
    b. Date of weld.
    c. Time of weld.
    d. Location of weld.
    e. Equipment used.
    f. Equipment temperature; start and finish.
    g. Ambient air temperature
12. Nondestructive test records.
13. Certification of completed installation.
14. Maps-updated weekly.

J. The following schedule of submittals identifies, but does not limit, the submittals/shop drawings referenced in this specification section. Refer to the specification paragraph referenced for additional information and/or requirements.

ITEM	SPECIFICATION PARAGRAPH	NUMBER REQUIRED	WHEN REQUIRED
QA/QC Plan	06800-1.5.B	-----	At contract execution
Material specification, installation instructions, handling and storage recommendations	06800-1.5.C	-----	At contract execution or within 10 days
Shop and installation drawings	06800-1.5.D	-----	At contract execution or within 10 days
HDPE material product data, and certifications	06800-1.5.E	-----	At contract execution or within 10 days
Testing certifications and results	06800-1.5.G	-----	Field results within 48 hours of receipt
Documentation of experience	06800-1.6.B, C	-----	Bid/proposal
Subgrade acceptance certificate	06800-1.6.D	As required	Prior to placement of geomembrane
Factory material tests and manufacturer's certification	06800-1.8	1/50,000 SF, unless noted otherwise	Within 60 days of contract execution and 30 days prior to material shipment
Nondestructive field seam, penetrations, and repair test results	06800-1.9.B, C, -1.5.J	All seams	Within 24 hours after testing is performed
Destructive field seam test results	06800-1.9.D, -1.5.J	1/500 LF of seam or 3/seam period (greater) and start up test strips	Within 48 hours of receipt of test results from the approved independent testing lab
Destructive cap (patch) testing	06800-1.9.G, -1.5.J	If required, as needed	Within 48 hours of receipt of test results from the approved independent testing lab
Record documents	06800-3.9.A,B,&C, -1.6H	As required by specification	30 days prior to project closeout

1.06 QUALITY ASSURANCE AND CONTROL (QA/QC) - GENERAL

A. Geomembrane installation shall be performed by an Installer certified, in writing, by the Manufacturer of the geomembrane.

B. <u>Documentation</u>

1. The Manufacturer shall submit documented evidence of proven technical competence, past record of satisfactory performance on similar projects totaling at least 100 million square feet and sufficient capacity to do the volume of work within the required time frame for total project completion within the contract time period. Documentation shall include a typewritten list indicating the name and location of each project which geomembrane was

supplied by the manufacturer; Owner's name, address, and telephone number; square footage of installed geomembrane; type and thickness of geomembrane material installed; seaming method(s) used; and name of installer. This information shall be submitted with the bid or within 10 days of that date.

2. The Installer shall submit documented evidence of proven technical competence, past record of satisfactory performance on five HDPE liner installation jobs and sufficient capacity to do the volume of work within the required time frame for total project completion within the contract time period. Documentation shall include a typewritten list indicating the name and location of each geomembrane installation performed by the Installer; the final construction cost of the geomembrane (if known); Owner's name, address, and telephone number; square footage of installed geomembrane; type and thickness of geomembrane material installed; seaming method(s) used; and resumes of senior installation personnel. This information shall be submitted at Contract execution or within 10 days of that date.

C. The Installer shall, at his expense, provide a geomembrane Manufacturer's Technical Representative at the job site full-time to ensure compliance with the geomembrane Manufacturer's and Installer's submitted and approved QA/QC plan. The geomembrane Manufacturer's Technical Representative shall be present during geomembrane construction and provide technical supervision and assistance at all times during the installation of the geomembrane and as may be required by the Engineer. The Manufacturer's Technical Representative shall have supervised a minimum of 4 million square feet of geomembrane installation. The Manufacturer's Technical Representative shall be responsible for a thorough knowledge and understanding of the project specifications and approved QA/QC plan. The Manufacturer's Technical Representative shall be excluded from routine physical installation of the geomembrane material.

D. Testing and test results shall be performed and certified as specified herein.

E. The finished geomembrane installation shall be inspected by the Installer, the Engineer, and the geomembrane Manufacturer's Technical Representative. The geomembrane Manufacturer's Technical Representative shall provide a letter to the Engineer certifying that, without exception, the geomembrane system has been installed in complete accordance with the project Contract Documents, the approved QA/QC plan, and the Manufacturer's recommendations. All items precluding this certification shall be remedied by and at the expense of the Installer.

1.07 GEOMEMBRANE MANUFACTURER'S QA/QC

A. The manufacturer shall submit factory material test results representative of every 40,000 square feet of geomembrane per batch, and as stated herein, showing conformance with the requirements of these specifications. In the case of a failure, subsequent testing shall be performed at the Installer's expense on all geomembrane material produced from the same batch of compounds to determine if rolls produced from the entire batch are unsatisfactory. Additional testing of individual rolls may

be required at the Installer's expense to identify the noncomplying rolls and/or to qualify individual rolls. All rolls not conforming to the requirements of the Contract Documents will be rejected.

B. The Installer shall submit the manufacturer's certification stating the lot, panel number, and location of each test specimen taken and that the geomembrane material meets the specifications and is suitable for the intended application.

C. There shall be no holes, blisters, or areas of undisbursed resin.

D. The cost of all testing required for the manufacturer's QA/QC program or as specified herein shall be borne by the Installer. Materials failing testing and/or inspection shall be repaired, reinspected, and retested by, and at the expense of, the Installer until compliance is attained.

E. Geomembrane material shall not be shipped to the project site until the results of all manufacturer's QA/QC testing have been submitted and approved by the Engineer.

1.08 FIELD SEAMING QA/QC

A. The cost of all testing, both destructive and nondestructive, required for the field seaming QA/QC program shall be borne by the Installer with the exception of testing on samples submitted to the Engineer as described herein. Seams failing testing and/or inspection shall be repaired, reinspected, and retested by, and at the expense of, the Installer until compliance is attained. All laboratory test reports shall be reviewed and approved for project conformance by a Professional Engineer registered in the state of Florida. All test reports shall be signed and sealed by the Professional Engineer.

B. The Installer shall nondestructively test all field seams over their full length. Continuity testing shall be carried out as the seaming work progresses. The Installer shall complete any required repairs in accordance with the approved QA/QC program. All nondestructive testing shall be observed by the Engineer and the geomembrane Manufacturer's Technical Representative. Documentation of these tests shall be submitted daily to the Engineer's field representative.

1. All extrusion seams, penetrations, and repairs shall be continuously nondestructively tested using vacuum box methods in accordance with ASTM D 5641. Alternatively, a holiday spark test method may be employed on all penetrations, seams, and repairs.

2. Split-wedge seams shall be pressure tested in accordance with ASTM D 5820. The repaired seam will be retested and repaired until the seam passes the pressure test.

C. Sample coupons of field seams shall be taken or made for destructive test purposes for every 500 linear feet of field seaming or 3 times during each seaming period, whichever is greater, and during seaming start up by each crew as directed by the

Engineer. Coupons shall be cut by the Contractor at locations designated by the Engineer as the seaming progresses. The coupons shall measure a minimum 12 inches in width (perpendicular to the seam) plus the width of the seam and 30 inches in length. Each coupon shall be numbered, dated, identified as to the personnel making the seam, and keyed as to the location of the field seam via reference to the panel layout diagrams. Ten 1-inch-wide strips shall be cut from the sample for testing by an independent testing laboratory approved by the Engineer as part of the field seaming QA/QC program in accordance with ASTM D 638 and ASTM D 413. The results of these tests shall be submitted to the Engineer as part of the geomembrane certification requirements. The remaining portion of the coupon shall be submitted to the Engineer for independent (third party) laboratory testing by an independent testing laboratory retained by the Owner, if required. All holes in the geomembrane due to destructive seam sampling shall be immediately repaired by the Installer. The continuity of the new seams in the repaired area shall be nondestructively tested as specified herein.

D. All field seam sample specimens tested by the independent testing agencies retained by both the Installer and the Owner shall be required to pass the minimum material properties specified herein. If any specimen fails, the entire sample from which it was taken shall be considered as a failure and the field seam shall be rejected due to nonconformance with the specifications. Seam shear and peel test requirements are for both wedge and extrusion welds. Seam shear strength shall have a minimum value of 121 pounds per inch (ppi) of width (fusion) and 117 ppi (extrusion). Peel test strength shall have a minimum value of 91 pounds per inch of width (fusion) and 80 ppi (extrusion).

E. The Installer shall comply with the following corrective measures if a seam sample test failure is recorded:

1. Cap each field seam represented by the failed sample and submit 1 new destructive test sample for each seam made during the capping procedure. Failed seam must be completely bounded by new cap.

2. Perform a visual inspection of the geomembrane sheets, seams, anchors, seals, and repairs for defects as the installation progresses and again on completion.

3. Defective and questionable areas (per visual inspection) shall be clearly marked and repaired to the Engineer's satisfaction. Each area showing damage due to scuffing, penetration by foreign objects, or distress from rough subsurface shall, at the expense of the Installer, be replaced or covered with an additional layer of geomembrane material.

F. The Installer shall retain responsibility for the integrity of the geomembrane system until acceptance by the Engineer. The geomembrane will not be accepted by the Engineer until:

1. Installation is completed in accordance with the Contract Documents.

2. Written certification letters, warranty, installation record documents, and record drawings have been received by the Owner.

3. Documentation of completed installation test results, including all reports, is complete.

4. Verification of adequacy of field seams and repairs, including all testing, is complete.

PART 2 PRODUCTS

2.01 GEOMEMBRANE MATERIAL

A. The geomembrane shall be a co-extruded, textured, HDPE and shall consist of products designed and manufactured specifically for the intended purpose which shall have been satisfactorily demonstrated by prior use to be suitable and durable.

B. The geomembrane shall be manufactured completely of virgin poly-ethylene resin.

C. The geomembrane shall be supplied as a factory-fabricated sheet with no factory seams, individually packaged on a heavy cardboard roll which shall have a minimum width of 22 feet or as available from the Manufacturer and approved by the Engineer. The roll length and width shall be maximized to provide the largest manageable sheet for the fewest field seams.

D. The HDPE geomembrane shall have the following physical properties when measured in accordance with the referenced standard.

Table 2 Conformance Testing

Property	Frequency of Testing	Test Method	Value
Geomembrane Thickness * (mils) (minimum)	Every roll	GRI GM 13/ ASTM D 5994	54
Geomembrane Density (g/cubic cm) (minimum)	Every 5th roll	GRI GM 13/ ASTM D 1505	0.94
Carbon Content (%)	Every 5th roll	GRI GM 13/ ASTM D 1603	2.5 ± 0.5
A. Tensile Properties (min) Table and graph of stress versus strain with stress recorded at every 1% strain. Tensile stress and elongation at yield shall be clearly indicated.	Every 5th roll	ASTM D 4885	
B. Tensile Stress at Yield (lbs/inch width) (minimum)			126
C. Elongation at Yield (%)(2.5" Gage Length) (minimum)			12
Oxidation Induction Time (minimum)	Every 5th roll	GRI GM 13/ ASTM D 3895	100
Notched Constant Tensile Load Stress Cracking (NCTL) Test (hr)	Every 5th roll	GRI GM 13/ ASTM D 5397	>400

* Thickness shall be field-verified.

E. Each roll shall be given a prominent, unique, indelible identifying marking indicating the sheet number, date of fabrication, and proper direction of unrolling and/or unfolding to facilitate layout and positioning in the field. This marking shall be on the top of the sheet.

2.02 SEAMS

A. All seams shall be of sufficient strength to withstand all loads applied during handling, installation, and operation and to prevent seam leaks over the life of the geomembrane. Seam shear strength and peel strength shall be as specified herein for split-wedge (fusion) and extrusion-type welds. Seams shall be sealed smooth and provide a film-tearing bond mode of failure when tested for shear and peel.

B. Resin used for extrudate material shall be compatible with the geomembrane material resin.

C. The fusion welding equipment used shall be capable of continuously monitoring and controlling the temperatures and pressures in the zone of contact where the machine is actually fusing the geomembrane material, so as to ensure that changes in environmental conditions will not affect the integrity of the weld.

2.03 PENETRATIONS AND ACCESSORIES

A. All required accessories (i.e., vents, battens, gaskets, sealants, ballast tubes, fasteners, etc.) shall be designed, fabricated, and supplied by the geomembrane installer.

B. Anchor strips shall be continuous for straight runs.

C. Boots are to be fabricated so as to allow excess material to be gathered around the pipe below the stainless steel mechanical clamps in a "socked" fashion or otherwise constructed to allow for 1 foot of landfill settlement before requiring clamp adjustment. Boots' construction technique and details shall be approved by the Engineer.

PART 3 EXECUTION

3.01 GENERAL

All installation procedures shall conform to the requirements of the submitted and approved QA/QC documentation and the requirements of these specifications.

3.02 SURFACE PREPARATION

A. Surfaces to be covered shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind.

B. The prepared surface underlying the geomembrane shall not be allowed to deteriorate after acceptance and shall remain acceptable up to the time of geomembrane placement.

3.03 STORAGE AND HANDLING

A. Geomembrane materials shall be transported, stored, and handled in strict conformance with the fabricator's submitted and approved QA/QC plan.

B. Material is to be stored in an area designated by the Owner until the material is to be deployed for seaming. Geomembrane material shall not be deployed as a measure to protect the completed subgrade from inclement weather.

3.04 GEOMEMBRANE INSTALLATION

A. Geomembrane installation shall not commence until geomembrane shop drawings and QA/QC plans have been approved and the letters of certification and required

documentation, as specified herein, have been received, accepted, and approved by the Engineer.

B. The geomembrane shall be placed over the prepared surfaces in such a manner as to minimize handling. It shall be attached/sealed to all structures in accordance with details shown on the drawings and/or in accordance with details prepared by the geomembrane Manufacturer which have been submitted by the Installer and approved by the Engineer. The geomembrane shall be closely fitted and completely sealed around projections through the geomembrane. Sufficient excess geomembrane material shall be provided to accommodate thermal expansion and contraction and normal settlement; but not excessive to the extent that folds left in the geomembrane material could cause it to crack, break, or pond liquid. All folds shall be repaired or the material realigned to remove any folds.

C. Hardware shall not protrude against the geomembrane so as to cause abrasion or other damage.

D. No equipment used shall damage the geomembrane by handling, trafficking, leaking of hydrocarbons, or other means.

E. No persons in contact with the geomembrane shall smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.

F. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.

G. The Installer shall provide adequate temporary ballasting and/or anchoring to prevent uplift by wind. Selection of ballast (e.g., sand bags, tires, etc.) shall not contain sharp edges (e.g., steel-belted radials) which would damage the geomembrane. Wind-blown geomembrane shall be considered damaged and shall be replaced at the Installer's expense.

H. The geomembrane in high-traffic areas shall be protected by geotextiles, extra geomembrane, or other suitable materials.

3.05 REPAIRS

A. Repairs to the geomembrane shall be made with the geomembrane material meeting the requirements of the specifications listed herein. All wrinkles shall be smoothed out. All patches shall be round or have rounded corners. Patch size shall be sufficient to cover the defective area plus 6 inches in all directions from the boundary of the defective area.

B. Any necessary repairs to the geomembrane shall be made with the geomembrane material itself. The contact surfaces shall be prepared and the patch applied by extrusion welding methods.

C. Repair methods shall conform to the submitted and approved QA/QC plan, as approved by the Engineer.

3.06 SUBMITTALS REQUIRED FOR PROJECT CLOSEOUT

A. Certifications: Submit certification by the geomembrane Manufacturer and Installer that the geomembrane was installed in substantial accordance with their recommendations and to the Manufacturer's satisfaction. Certification shall be made on the forms attached at the end of this section.

B. Record Drawings: Submit reproducible drawings of record showing changes from the approved installation drawings. The record drawings shall include the identity and location of each repair, cap strip, penetration, and sample taken from the installed geomembrane for testing.

C. Quality Control Records: Submit three original copies of a Quality Control Record Document containing copies of all material and seam test results. Each test shall be identified by date of sampling, date of testing, location of sampling, individual who performed the test, standard test used, departures from standard test methods, and any other pertinent information. These records are submitted in addition to any previously required quality control records.

D. Records of Installation: These include daily records of construction, seaming logs, Installer's and welder's resumes, nondestructive test reports, problem/solution sheets, and other record documents of installation.

HDPE GEOMEMBRANE MANUFACTURER'S CERTIFICATE
OF
ACCEPTABLE INSTALLATION

The HDPE manufacturer _____ for the (Project) _____ _____ hereby certifies that the installation of the geomembrane liner is in accordance with our recommendations, approved QA/QC Plan, and the quality of the work has been to our satisfaction.

Signed: _____

(Representative of Geomembrane Manufacturer)

_____
(Position)

Date: _____

Witness: _____

APPENDIX B

SAMPLE GEOMEMBRANE MANUFACTURER'S/INSTALLER'S QA/QC PLAN

AGRU/AMERICA, INC.

MANUFACTURING QUALITY CONTROL

SALES OFFICE:

AGRU/AMERICA, INC.

600 Rockmead, Suite 103

KINGWOOD, TEXAS 77339

Telephone: (281) 358-4741

Fax: (281) 358-5297

Toll Free: (800) 373-2478

E-Mail: salesmkg@agruamerica.com

Webpage: http//www.agruamerica.com

April 13, 1999

AGRU / AMERICA, INC. - QA/QC

Manufacturing - Quality Assurance - Quality Control

AGRU AMERICA, Inc. extrudes high density polyethylene (HDPE) and linear low density polyethylene (LLDPE) geomembrane at its plant located at 500 Garrison Road, Georgetown, SC 29440. This geomembrane is available as per attached packaging standard - Attachment "A".

Our Quality Assurance Manufacturing Program is dependent on the utilization of an in-house laboratory which is, when necessary, complemented with testing performed by certified outside laboratories such as:

- Geosyntec Laboratories, Boca Raton, Florida
- Telephone (561) 995-0900; Fax (561) 995-0925
- Geotechnics Laboratories, Pittsburgh, Pennsylvania
- Telephone (412) 823-7600; Fax (412) 823-8999
- TRI/Environmental, Inc., Austin, Texas
- Telephone (512) 263-2101; Fax (512) 263-2558

When required, we can also enlist the support of our parent technical laboratory, Agru-Alois Gruber GmbH, Bad Hall, Austria.

Raw Material - Data Sheet

HDPE and LLDPE resin is supplied to our plant in bulk and subjected to the following procedures:

- Prior to shipment, our resin supplier submits a certificate of analysis (Attachment "B") and a resin sample which is tested for melt index compliance. Once approved, the resin is released for shipment to our plant.
- One sample is taken from each rail car section and tested as follows:
  - Melt Index ASTM D-1238 Condition E
- Once the test has been completed and results found to be in compliance with our requirements (.20-.30g/10min), the resin is then unloaded into our silo system.
- At this stage, our supplier has performed one battery of tests and AGRU has performed 5 tests.
- Off specification HDPE resin is returned to the supplier.

Executive Offices: 500 Garrison Road, Georgetown, S.C. 29440 • 843-546-0600 • 800-321-1379 • Fax 843-546-0516
Sales Office: 600 Rockmead, Suite 103, Kingwood, TX 77339 • 281-358-4741 • 800-373-2478 • Fax 281-358-5297
email: salesmkg@agruamerica.com

The Extrusion Process

The resin is conveyed through a vacuum pump system and flexible hoses to a dryer hopper, feeding the resin by gravity into an 8-inch barrel. This barrel is divided into 5 heating zones, each heating zone being computer controlled and constantly monitored.

A screw in the barrel turns at a prescribed and monitored speed. It conveys slowly, plasticating the resin to full plastication, and then the plasticated resin is fed through a manifold into a coat hanger die having a width of approximately 24 feet. The die lips are open to a prescribed distance governed by the thickness of the geomembrane to be extruded.

Exiting the die, the plasticated resin forms a controlled and monitored bead which feeds into a three chrome roll stack in a prescribed pattern. Each chrome roll is set at a prescribed temperature, controlled by water circulation.

Exiting the controlled cooling of the roll stack, the geomembrane starts to travel down the take off haulers towards the winder. On the way down the take off, the liner is trimmed to bring the finished width to the applicable standard. Trimmings are granulated.

The trimmed edge of one side of the geomembrane is marked at every 3.28 ft with meter length, thickness, roll number and Agru America name. This marking also serves as product identification.

The geomembrane is visually inspected for surface defects as it travels down the take off by both the extruder and the winder operators.

The geomembrane is wound on a recycled HDPE core having 6" ID (150mm), 7" OD (175mm) and 22'8" (6.8m) length. Each roll weighs approximately 3,000 pounds (1360 kg) or 4,500 pounds (2045 kg) and is fitted with two nylon slings.

Post Extrusion Quality Control

Once start up conditions are over and commercial extrusion is initiated, post production quality control comes into operation. A series of test procedures are performed at an approximate frequency based upon the weight of the resin extruded at intervals of : each roll, 20,000, 40,000, and 180,000 pounds.

A sample approximately 10" by the full width of the geomembrane is taken from <u>every</u> roll. Based on the above weight frequencies, certain specimens are die cut, tested and the results summarized on the Certificate of Conformity (Attachments C-G) issued by our Quality Control Department. The certificate is signed by the Quality Control Manager. The Quality Control Manager reports directly to the President of the Company.

Rolls failing to comply with either specific project specification and/or our own latest revision to our published data sheets are set aside for granulation.

Certificates of Conformity are provided for the following products:

Smooth Liner - Attachment "C"
Textured Liner - Attachment "D"
Drain Liner - Attachment "E"
Grip Liner - Attachment "F"
Super Grip Net Liner - Attachment "G"

Often a third party Quality Assurance representative is mandated by the owner of a project to oversee our manufacturing QA. We gladly subscribe to this procedure and make all our records available to this person 24 hours a day for the duration of the mandate.

Test Procedures Performed

The following reported items are incorporated in our Certificate of Conformity:

Roll number

(example) **206306 99**

First digit	machine
Second and third digits	week of year
Fourth digit	day of week (Monday=1, Sunday=7)
Last two digits	roll number (first roll of week is 01, etc.)

The two last digits separated from the others indicate the year the roll was produced (Starting in 1999)

Using the above key:

roll # 206306 99 was produced on Liner Machine #2 on Wednesday, February 10, 1999.

Product Description (liner type: Smooth, Microspike™, Drainage, etc.)

Raw material lot and/or batch number and supplier/product identification

Measurements:

Nominal thickness in mils and millimeters
Roll length in feet and meters
Roll width in feet and meters

The following test results are reported in our Certificate of Conformity:

Density by Displacement Attachment "J"	Frequency: 1 test every 180,000lbs Reported: g/cc	ASTM D-792
Melt Flow Index	Frequency: 1 test every 180,000lbs Reported: g/10min 190°C	ASTM D-1238 Condition E
Carbon Black Content Attachment "K"	Frequency: 1 test every 20,000lbs Reported: % carbon black	ASTM D-4218 or D 1603
Carbon Black Dispersion Attachment "L"	Frequency: 1 test every 40,000lbs Reported: category	ASTM D-5596
Environmental Stress Crack Resistance Attachment "S"	Frequency: 1 test every 180,000lbs Reported: Pass or Fail	ASTM D-1693
Notched Constant Tensile Load Stress Crack Resistance (NCTL) Attachment "T"	Frequency: 1 test every 180,000lbs Reported: Pass or Fail	ASTM D-5397 Appendix A
Asperity Height Attachment "U"	Frequency: 1 test per roll Reported: Average Height in mils	GRI GM-12 For Textured Liner

The following test results are also reported on our certificate of Conformity, but are derived from tests **Modified** from the original Standards:

Puncture Resistance Attachment "R"	Frequency: 1 test every 40,000lbs Reported: Resistance in lbs (both)	FTM Stn 101C Meth. 2065 and ASTM D-4833 (Both Modified) [1]
Tear Resistance Attachment "Q"	Frequency: 1 test every 40,000lbs Reported: Resistance in lbs	ASTM D-1004 (Modified)[2]
Tensile Strength Attachment "M"	Frequency: 1 test every 20,000lbs Reported: Strength @ Yield in psi Strength @ Break in psi	ASTM D-638 (Modified)[3]
Elongation Attachment "M"	Frequency: 1 test every 20,000lbs Reported: % Elongation @ Yield % Elongation @ Break	ASTM D-638 (Modified)[3]
Thickness Attachment "H"	Frequency: 1 test per roll Reported: Minimum, Maximum, and Average thickness in inches and millimeters	ASTM D-751, D-5199, or D-5994, depending on liner type (D-5199,D-5994 Modified)[4]
Dimensional Stability Attachment "P"	Frequency: 1 test every 180,000lbs Reported: Average Dimensional Change	ASTM D-1204 (Modified)[5]

Modifications

1 Puncture specimens for both methods are conditioned for a minimum of 1 hour.

2 Tear Resistance specimens are conditioned for a minimum of 1 hour. Average of MD & TD results is reported.

3 For Type IV specimen: @ yield, $L_o = 1.3"$ @ break, $L_o = 2.0"$
For Type I specimen: @ yield, $L_o = 2.0"$ @ break, $L_o = 2.0"$
The specimen type is determined by Liner type:
Type IV: Smooth, Microspike™
Type I: Drainage, Grip, Super Grip Net
Average of MD & TD results is reported.

4 Thickness specimens for both methods are conditioned for a minimum of 1 hour.

5 Average Dimensional Change of MD & TD is reported.

MD = Machine Direction TD = Transverse (Cross) Machine Direction

Additional Test Procedures
(Available if Specified)

Low Temperature Brittleness	ASTM D-746
Hydrostatic Resistance	ASTM D-751
Volatile Loss	ASTM D-1203
Resistance to Soil Burial	ASTM D-3083 using ASTM D-638 Type IV dumbbell at 2"/min.
Water Absorption	ASTM D-570
Coefficient of Thermal Expansion	ASTM D-696
Friction Angle Direct Shear Method	ASTM D-5321-92
Moisture Vapor Transmission Rate	ASTM E-96 100°F - 100% RH
Oxidation Induction Time at 200°C	ASTM D-3895 Al pan
Transmissivity Various gradients & confining pressure	ASTM D-4716
Multi-axial Tensile Strain at Rupture (percent)	GRI GM-4

Accreditation number:
GAI-LAP - 26 - 97

TEL (610) 522-8440

Geosynthetic Institute
475 Kedron, Ave.
Folsom, PA 19033

AGRU / AMERICA Inc.

is granted accreditation

for designated geosynthetic test methods in accordance with the

Geosynthetic Accreditation Institute - Laboratory Accreditation Program (GAI-LAP)

as published in its annual directory.

This accreditation is valid until June 30, 1999.

Robert M. Koerner, Ph.D., P.E.
Director

George R. Koerner, Ph.D., P.E. & CQA
Auditor

© GOES 74

DREXEL UNIVERSITY

Geosynthetic Research Institute
33rd & Lancaster Walk
Rush Building - West Wing
Philadelphia, PA 19104
TEL 215 895-2343
FAX 215 895-1437

Geotextiles Geomembranes Geogrids Geocomposites Geosynthetic Clay Liners Geopipes Geonets

June 22, 1998

Quality Manager
Agru America, Inc.
500 Garrison Road
Georgetown, SC 29440

Re: GAI-LAP Accreditation

The Geosynthetic Institute (GSI) is pleased to acknowledge Agru America, Inc. on its repertoire of Geosynthetic Accreditation Institute's-Laboratory Accreditation Program (GAI-LAP) accredited tests. This letter should serve as notification that Agru America, Inc.'s geosynthetic laboratory located in Georgetown, SC, is currently accredited for the following fifteen test methods until June 30, 1999.

1)	ASTM D 638-94,	Test Method for Tensile Properties of Plastics, [08.01]
2)	ASTM D 751-95,	Test Methods for Coated Fabrics (thickness only), [09.02]
3)	ASTM D 792-91,	Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement, [08.01]
4)	ASTM D 1004-94,	Test Method for Initial Tear Resistance of Plastic Film and Sheeting, [08.01]
5)	ASTM D 1204-94,	Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature, [08.01]
6)	ASTM D 1238-90,	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer, [08.01]
7)	ASTM D 1603-94,	Test Method for Carbon Black in Olefin Plastics, [08.01]
8)	ASTM D 1693-88,	Test Method for Environmental Stress-Cracking of Ethylene Plastics, [08.01]
9)	ASTM D 4218-91,	Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique, [08.02]
10)	ASTM D 4833-88,	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products, [04.08]
11)	ASTM D 5199-91,	Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes, [04.08]
12)	ASTM D 5397-93,	Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes using Notched Constant Tension Load Test, [04.08]
13)	ASTM D 5596-94,	Test Methods for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics, [04.09]
14)	ASTM D 5994-96,	Test Method for Measuring the Core Thickness of Textured Geomembrane, [04.08]
15)	FTM 101C, method 2065,	Puncture Resistance and Elongation Test (1/8 inch radius probe)

A certificate to this affect has been enclosed, signed and sealed. Any questions regarding your accreditation should be directed to myself or Robert Koerner at (610) 522-8440.

Regards,

George R. Koerner

George R. Koerner, Ph.D., P.E & CQA
Research Associate Professor

Attachment "A"

AGRU/AMERICA, INC.

HIGH DENSITY POLYETHYLENE SMOOTH SHEET

Product Data (Minimum Average Roll Values)

Property	Test Method	Values				
Thickness (mils nominal)	ASTM D751	30	40	60	80	100
Melt Flow Index (g/10 minutes)	ASTM D1238 - E	.28	.28	.28	.28	.28
Density (g/cm³ min)	ASTM D792 or D1505	.948	.948	.948	.948	.948
Tensile Strength at Yield (lbs/in. width)	ASTM D638 (Modified)	66	88	132	176	220
Tensile Strength at Break (lbs/in. width)	Type IV Specimen	120	160	240	320	400
Elongation at Yield (%)	Gauge length 2 in. break,	13	13	13	13	13
Elongation at Break (%)	1.3 in. yield, 2 ipm	500	700	700	700	700
Tear Resistance (lbs)	ASTM D1004 - Die C	20	30	45	60	72
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103	-103	-103
Dimensional Stability (% change max)	ASTM D1204, 1 hr @ 212°F	±2	±2	±2	±2	±2
Environmental Stress Crack (hrs)	ASTM D1693	3000	3000	3000	3000	3000
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	36	52	80	105	130
Carbon Black Content (%)	ASTM D1603	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	ASTM D3015	A2	A2	A2	A2	A2

Supply Information (Standard Roll Dimensions)

	Thickness		Width		Length		Area		Weight	
	mil	mm	ft	m	ft	m	ft²	m²	lbs	kg
Long Rolls	30	.75	22.5	6.86	1,312	400	29,520	2,744	4,970	2,254
	40	1.0	22.5	6.86	984	300	22,140	2,058	4,661	2,114
	60	1.5	22.5	6.86	656	200	14,760	1,372	4,639	2,104
	80	2.0	22.5	6.86	492	150	11,070	1,029	4,662	2,114
	100	2.5	22.5	6.86	328	100	7,380	686	3,898	1,768
Medium Rolls	30	.75	22.5	6.86	840	256	18,900	1,756	3,218	1,459
	40	1.0	22.5	6.86	650	198	14,625	1,359	3,113	1,412
	60	1.5	22.5	6.86	420	128	9,450	878	3,006	1,363
	80	2.0	22.5	6.86	320	98	7,200	669	3,067	1,391
	100	2.5	22.5	6.86	250	76	5,625	523	2,995	1,313

NOTES: 1.) All rolls are supplied with two slings. 2.) All rolls are fitted with a 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4.) Standard rolls have a diameter of 29 inches (750 mm). 5.) A 40 foot standard container will hold 9 long rolls and 15 medium rolls. 6.) A 48 foot flatbed will hold 9 long rolls and 15 medium rolls.

HIGH DENSITY POLYETHYLENE MICROSPIKE™ LINER

Product Data (Minimum Average Roll Values)

Property	Test Method	Values				
Thickness (mils nominal)	ASTM D5994	30	40	60	80	100
Melt Flow Index (g/10 minutes)	ASTM D1238-E	.28	.28	.28	.28	.28
Density (g/cm³ min)	ASTM D792 or D1505	.948	.948	.948	.948	.948
Tensile Strength at Yield (lbs/in. width)	ASTM D638 (Modified)	70	90	135	180	225
Tensile Strength at Break (lbs/in. width)	Type IV Specimen	72	96	144	192	240
Elongation at Yield (%)	Gauge length 2 in. break	12	12	12	12	12
Elongation at Break (%)	1.3 in. yield, 2 ipm	400	400	400	400	400
Tear Resistance (lbs)	ASTM D1004 - Die C	23	30	45	60	75
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103	-103	-103
Dimensional Stability (% change max)	ASTM D1204, 1 hr @ 212°F	+/-2	+/-2	+/-2	+/-2	+/-2
Environmental Stress Crack (hrs)	ASTM D1693	3000	3000	3000	3000	3000
Environmental Stress Crack (hrs)	ASTM D5397	200	200	200	200	200
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	45	60	90	120	150
Carbon Black Content (%)	ASTM D1603/D4218	2-3	2-3	2-3	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	1,2	1,2	1,2	1,2	1,2

Supply Information (Standard Roll Dimensions)

Thickness		Width		Length		Area		Weight	
	mm	ft	m	ft	m	ft²	m²	lbs	kg
30	0.75	23.0	7.0	492	150	11,316	1,051	2,430	1,104
40	1.0	23.0	7.0	492	150	11,316	1,051	2,731	1,241
60	1.5	23.0	7.0	410	125	9,430	876	3,283	1,492
80	2.0	23.0	7.0	328	100	7,544	700	3,413	1,551
100	2.5	23.0	7.0	246	75	5,658	525	3,167	1,439

Notes: 1.) All rolls are supplied with two tags. 2.) All rolls are fitted with a 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4. Standard rolls have a diameter of 29 inches (750mm). 5.) A 40-foot standard container will hold 12 rolls. 6.) A 48 foot flatbed will hold 12 rolls.

Information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the user's responsibility to determine the suitability for his own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru America as to the effects of such use or the results to be obtained, nor does Agru America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein contained is to be construed as permission or as a recommendation to infringe any patent.

January 19, 1999

AGRU/AMERICA, INC.

LINEAR LOW DENSITY POLYETHYLENE SMOOTH SHEET

Product Data (Minimum Average Roll Values)

Property	Test Method	Values			
Thickness (mils nominal)	ASTM D751	40	60	80	100
Density (g/cm³ min)	ASTM D792 or D1505	.92	.92	.92	.92
Tensile Strength at Break (lbs/in. width)	ASTM D638 (Modified)Type IV Specimen	160	240	320	400
Elongation at Break (%)	Gauge Length, 2 in. break, 2 ipm	800	800	800	800
Tear Resistance (lbs)	ASTM D1004 - Die C	25	37	48	62
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103	-103
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	55	80	105	130
Carbon Black Content (%)	ASTM D1603	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	ASTM D3015	A2	A2	A2	A2

Supply Information (Standard Roll Dimensions)

	Thickness		Width		Length		Area		Weight	
	mil	mm	ft	m	ft	m	ft²	m²	lbs	kg
Long Rolls	40	1.0	22.5	6.86	984	300	22,140	2,058	4,661	2,114
	60	1.5	22.5	6.86	656	200	14,760	1,372	4,639	2,104
	80	2.0	22.5	6.86	492	150	11,070	1,029	4,662	2,114
	100	2.5	22.5	6.86	328	100	7,380	686	3,898	1,768
Medium Rolls	40	1.0	22.5	6.86	650	198	14,625	1,359	3,113	1,412
	60	1.5	22.5	6.86	420	128	9,450	878	3,006	1,363
	80	2.0	22.5	6.86	320	98	7,200	669	3,067	1,391
	100	2.5	22.5	6.86	250	76	5,625	523	2,995	1,313

NOTES: 1.) All rolls are supplied with two slings. 2.) All rolls are fitted with a 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4.) Standard rolls have a diameter of 29 inches (750 mm). 5.) A 40 foot standard container will hold 9 long rolls and 15 medium rolls. 6.) A 48 foot flatbed will hold 9 long rolls and 15 medium rolls.

formation, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the user's ponsibility to determine the suitability for their own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru/America as to the effects of such use or the results to be obtained, nor does Agru/America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein contained is to be construed as permission or as a recommendation to infringe any patent.

LINEAR LOW DENSITY POLYETHYLENE MICROSPIKE™ LINER

Product Data (Minimum Average Roll Values)

Property	Test Method	Values		
Thickness (mils nominal)	ASTM D5994	40	60	80
Melt Flow Index (g/10 minutes)	ASTM D1238-E	.50	.50	.50
Density (g/cm³ min)	ASTM D792 or D1505	.92	.92	.92
Tensile Strength at Break (lbs/in. width)	ASTM D638 (Modified) Type IV Specimen	112	168	224
Elongation at Break (%)	Gauge length 2 in. break 1.3 in. yield, 2 ipm	400	400	400
Tear Resistance (lbs)	ASTM D1004 - Die C	25	36	50
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103
Dimensional Stability (% change max)	ASTM D1204, 1 hr @ 212°F	+/-2	+/-2	+/-2
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	75	90	140
Carbon Black Content (%)	ASTM D1603/D4218	2-3	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	1,2	1,2	1,2

Supply Information (Standard Roll Dimensions)

Thickness		Width		Length		Area		Weight	
mil	mm	ft	m	ft	m	ft²	m²	lbs	kg
40	1.0	23.0	7.0	492	150	11,316	1,051	2,731	1,241
60	1.5	23.0	7.0	410	125	9,430	876	3,283	1,492
80	2.0	23.0	7.0	328	100	7,544	700	3,413	1,551

Notes: 1.) All rolls are supplied with two slings. 2.) All rolls are fitted with a 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4. Standard rolls have a diameter of 29 inches (750mm). 5.) A 40-foot standard container will hold 12 rolls. 6.) A 48 foot flatbed will hold 12 rolls.

All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the user's responsibility to determine the suitability for his own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru America as to the effects of such use or the results to be obtained, nor does Agru America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein contained is to be construed as permission or as a recommendation to infringe any patent.

February 16, 1999

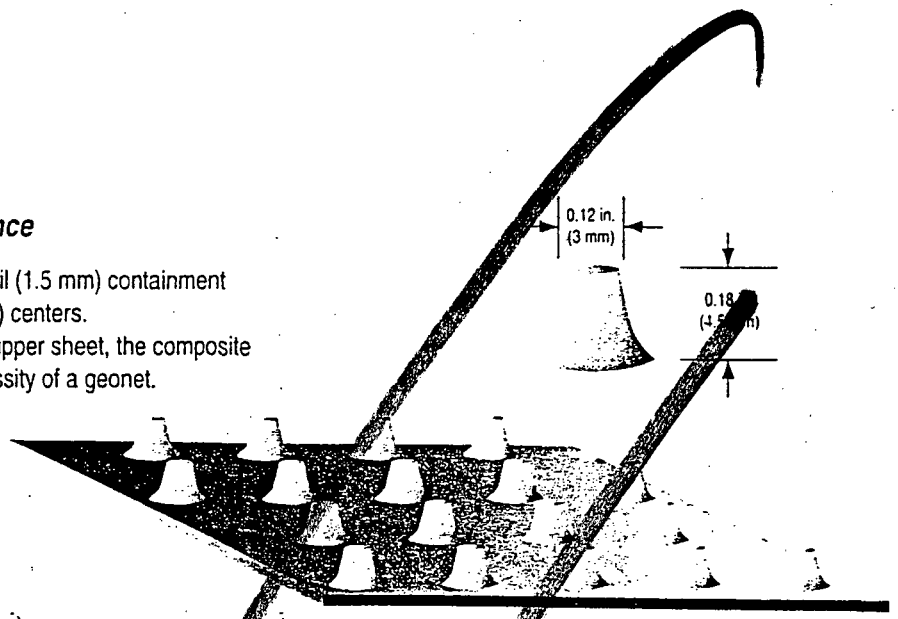
AGRU/AMERICA, INC.

A/A DRAIN LINER®

Designed for Drainage and Anchor Performance

Extruded homogeneously to provide a minimum 60 mil (1.5 mm) containment liner with solid stud drainage structures at 0.8 inch (20 mm) centers.

When used in conjunction with a smooth or textured upper sheet, the composite provides an effective double liner system without the necessity of a geonet.



Features/Benefits

- Excellent interfacial friction with soils
- Excellent hydraulic transmissivity

Product Data (Minimum Average Roll Values)

Property	Test Method	Values		
Thickness (mils nominal)	ASTM D751	60	80	100
Melt Flow Index (g/10 minutes)	ASTM D1238 - E	.28	.28	.28
Density (g/cm³ min)	ASTM D792 or D1505	.948	.948	.948
Tensile Strength at Yield (lbs/in. width)	ASTM D638 (Modified)	120	160	200
Tensile Strength at Break (lbs/in. width)	Type I Specimen	132	176	220
Elongation at Yield (%)	Gauge Length 2 in. break,	13	13	13
Elongation at Break (%)	1.3 in. yield, 2 ipm	200	200	200
Tear Resistance (lbs)	ASTM D1004 - Die C	50	67	83
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103
Dimensional Stability (% change max)	ASTM D1204, 1 hr @ 212°F	± 2	± 2	± 2
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	95	126	158
Carbon Black Content (%)	ASTM D1603	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	ASTM D3015	A2	A2	A2

Supply Information (Standard Roll Dimensions) 465 studs/ft² = 5,000 studs/m²

Thickness		Width		Length		Area		Weight	
mil	mm	ft	m	ft	m	ft²	m²	lbs	kg
60	1.5	22.5	6.86	263	80	5,917	550	2,295	1,041
80	2.0	22.5	6.86	230	70	5,175	480	2,489	1,129
100	2.5	22.5	6.86	197	60	4,433	412	2,637	1,196

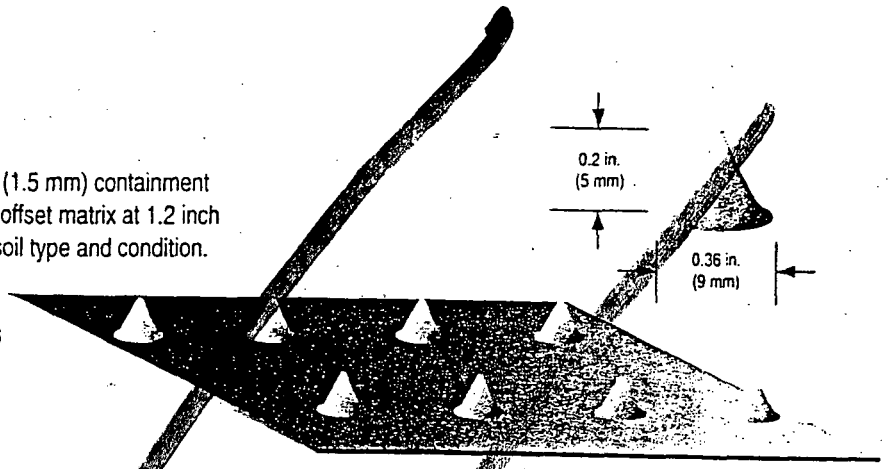
NOTES: 1.) All rolls are supplied with two slings. 2.) All rolls are fitted with a 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4.) Standard rolls have a diameter of 29 inches (750 mm). 5.) A 40 foot standard container will hold 9 rolls. 6.) A 48 foot flatbed will hold 14 rolls.

AGRU/AMERICA, INC.

A/A GRIP LINER®

Anchor Structure

Extruded homogeneously to provide a minimum 60 mil (1.5 mm) containment liner with textured surface and spiked structure on a special offset matrix at 1.2 inch (30 mm) centers, maximizing shear load capacity for every soil type and condition.



Features/Benefits

- Superior interfacial friction with all soil types and conditions
- Allows steepest possible slopes

Product Data (Minimum Average Roll Values)

Property	Test Method	Values		
Thickness (mils nominal)	ASTM D751	60	80	100
Melt Flow Index (g/10 minutes)	ASTM D1238 - E	.28	.28	.28
Density (g/cm³ min)	ASTM D792 or D1505	.948	.948	.948
Tensile Strength at Yield (lbs/in. width)	ASTM D638 (Modified)	96	128	160
Tensile Strength at Break (lbs/in. width)	Type I Specimen	96	128	160
Elongation at Yield (%)	Gauge length 2 in. break,	13	13	13
Elongation at Break (%)	1.3 in. yield, 2 ipm	200	200	200
Tear Resistance (lbs)	ASTM D1004 - Die C	50	67	83
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103
Dimensional Stability (% change max)	ASTM D1204, 1 hr @ 212°F	±2	±2	±2
Environmental Stress Crack (hrs)	ASTM D1693	1500	1500	1500
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	95	126	158
Carbon Black Content (%)	ASTM D1603	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	ASTM D3015	A2	A2	A2

Supply Information (Standard Roll Dimensions) 90 spikes/ft² = 1,000 spikes/m²

Thickness		Width		Length		Area		Weight	
mil	mm	ft	m	ft	m	ft²	m²	lbs	kg
60	1.5	22.5	6.86	263	80	5,917	550	2,148	974
80	2.0	22.5	6.86	230	70	5,175	480	2,261	1,025
100	2.5	22.5	6.86	197	60	4,433	412	2,368	1,074

NOTES: 1.) All rolls are supplied with two slings. 2.) All rolls are fitted with a 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4.) Standard rolls have a diameter of 29 inches (750 mm). 5.) A 40 foot standard container will hold 9 rolls. 6.) A 48 foot flatbed will hold 14 rolls.

Attachment "A"

AGRU/AMERICA, INC.

SUPER GRIPNET® LINER

Drainage + Anchor Structure Liner

Extruded homogeneously to provide a minimum 60 mil (1.5 mm) containment liner with drainage and anchor structure capability.
These multi-structural products enhance steep composite slope designs with maximum interfacial shear resistance and superior drainage capacity.

Features/Benefits
- Superior interfacial friction with all soil types and conditions
- Allows steepest possible slopes

Product Data (Minimum Average Roll Values)

US. Patent - No. 5.258.217

Property	Test Method	Values		
Thickness (mils nominal)	ASTM D751	60	80	100
Melt Flow Index (g/10 minutes)	ASTM D1238 - E	.28	.28	.28
Density (g/cm³ min)	ASTM D792 or D1505	.948	.948	.948
Tensile Strength at Yield (lbs/in. width)	ASTM D638 (Modified)	114	152	190
Tensile Strength at Break (lbs/in. width)	Type I Specimen	126	168	210
Elongation at Yield (%)	Gauge length 2 in. break,	13	13	13
Elongation at Break (%)	1.3 in. yield, 2 ipm	200	200	200
Tear Resistance (lbs)	ASTM D1004 - Die C	40	53	67
Low Temperature Impact (°F max)	ASTM D746	-103	-103	-103
Dimensional Stability (% change max)	ASTM D1204, 1 hr @ 212°F	± 2	± 2	± 2
Environmental Stress Crack (hrs)	ASTM D1693	1500	1500	1500
Puncture Resistance (lbs)	FTMS 101 - C, Method 2065	75	100	125
Carbon Black Content (%)	ASTM D1603	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion	ASTM D3015	A2	A2	A2

Supply Information (Standard Roll Dimensions)

Thickness		Width		Length		Area		Weight	
mil	mm	ft	m	ft	m	ft²	m²	lbs	kg
60	1.5	22.5	6.86	197	60	4,433	412	2,060	934
80	2.0	22.5	6.86	165	50	3,713	343	1,973	895
100	2.5	22.5	6.86	165	50	3,713	343	2,418	1,096

NOTES: 1.) All rolls are supplied with two slings. 2.) All rolls are fitted with 6 inch ID HDPE core. 3.) Special roll lengths are available on request. 4.) Standard rolls have a diameter of 29 inches (750 mm). 5.) A 40 foot standard container will hold 9 rolls. 6.) A 48 foot flatbed will hold 14 rolls.

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Attachment "B"

Chevron

U.S. Chemical

March 15, 1999

Grant Palmer
Agru-America Inc
500 Garison Rd
Georgetown, SC 29440

CERTIFICATE OF ANALYSIS

Product:	9638	Lot Number:	J011070
Chevron Order #:	203828 - 6000	Destination:	Georgetown
Package:	CHVX898067	Weight (lbs):	197,700
Customer Order #:	1342	Ship Date:	1/15/99

Following is the data on the subject material as determined by the Quality Control Department:

Property	Value	Units
Melt Index	0.26	gms/10 min
HLMI	20.8	gms/10 min
Density	0.9366	gms/cc
OIT	141.0	

The data set forth herein has been carefully compiled by Chevron Chemical Company. However, there is no warranty of any kind, either expressed or implied, applicable to its use and the user assumes all risk and liability in connection therewith.

Sincerely,

Gary MacMurtrie

Gary MacMurtrie
Supervisor
Quality Control

Customer Fax: 843-546-0516

For inquiry, contact Customer Service at the following number:

Film, Coating, Pipe Applications: 1-800-231-3826
Molding Applications: 1-800-231-3828

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot # **Liner Type:SMOOTH HDPE**

Measurement ASTM D-751/5199 (Modified)		METRIC	ENGLISH
	MIN:	mm	mil
	MAX:	mm	mil
	AVE:	mm	mil

Thickness	**1.5mm**	**60mil**
Length	m	feet
Width	m	feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.940min	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g - g /10 min			
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Yield	psi	2200	
	Average Strength @ Break	psi	4000	
Elongation ASTM D - 638 (Modified) (2 inches / minute) Lo = 1.3" Yield	Average Elongation @ Yield	%	13	
Lo = 2.0" Break	Average Elongation @ Break	%	700	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional Change	%	±1	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs	45	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	80	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D - 1693	Minimum Hrs w / o Failures	hrs	3,000	
Notched Constant Tensile Load ASTM D -5397	pass / fail @ 30%	hrs	200	

CUSTOMER:

P.O.#:

DESTINATION:

Form SM60AA.FRM

Date:.....

Signature.....

Quality Control Department

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #:

Liner Type: SMOOTH LLDPE

Measurement ASTM D-751/5994 (Modified)	METRIC	ENGLISH
MIN:	mm	mil
MAX:	mm	mil
AVE:	mm	mil

Thickness..... 1.0 mm 40 mil
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.92	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10		
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Break	psi	4000	
Elongation ASTM D-638 (Modified) (2 inches/minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Break	%	800	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional Change	%	± 2	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs	25	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	55	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3,000	

CUSTOMER:

P.O.#:

DESTINATION

Date:.....

Signature:.....

Quality Control Department

Form 40MSDSLL.FRM

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #: **Liner Type: MICROSPIKE™ HDPE**

Measurement ASTM D-751/5994 (Modified)		METRIC	ENGLISH
	MIN:	mm	mil
	MAX:	mm	mil
Asperity GRI GM12: mil	AVE:	mm	mil

Thickness..... 1.5 mm 60 mil
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.940min.	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10		
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Yield	psi	2250	
	Average Strength @ Break	psi	2400	
Elongation ASTM D-638 (Modified) (2 inches/minute) Lo = 1.3" Yield	Average Elongation @ Yield	%	12	
Lo = 2.0" Break	Average Elongation @ Break	%	400	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional change	%	± 2	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs.	45	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	90	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3,000	
Notched Constant Tensile Load ASTM D-5397	pass / fail @ 30%	hrs	200	

CUSTOMER:

P.O.#:

DESTINATION

Date:.....

Signature.....

Quality Control Department

Form 60MSDS.FRM

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #: **Liner Type: MICROSPIKE™lldpe**

Measurement ASTM D-751/5994 (Modified)		METRIC	ENGLISH
	MIN:	mm	mil
	MAX:	mm	mil
Asperity GRI GM12: mil	AVE:	mm	mil

Thickness..... **1.0 mm** **40 mil**
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.92	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10		
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Break	psi	2800	
Elongation ASTM D-638 (Modified) (2 inches/minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Break	%	400	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional Change	%	± 2	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs	25	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	75	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3,000	

CUSTOMER:

P.O.#:

DESTINATION

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Date:.....

Signature:.....

Quality Control Department

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #: **Liner Type: MICROSPIKE™lldpe**

Measurement ASTM D-751/5994 (Modified)		METRIC	ENGLISH
	MIN:	mm	mil
	MAX:	mm	mil
Asperity GRI GM12: mil	AVE:	mm	mil

Thickness..... **1.5 mm** **60 mil**
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.92	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10		
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Break	psi	2800	
Elongation ASTM D-638 (Modified) (2 inches/minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Break	%	400	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional Change	%	± 2	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs	36	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	90	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3,000	

CUSTOMER:

P.O.#:

DESTINATION

Form 40MSDSLL.FRM

Date:.....

Signature:.....

Quality Control Department

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #: **Liner Type: MICROSPIKE™ HDPE**

Measurement ASTM D-751/5994 (Modified)		METRIC	ENGLISH
	MIN:	mm	mil
	MAX:	mm	mil
Asperity GRI GM12: mil	AVE:	mm	mil

Thickness..... 1.5 mm 60 mil
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10		
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Yield	psi	2250	
	Average Strength @ Break	psi	2400	
Elongation ASTM D-638 (Modified) (2 inches/minute) Lo = 1.3" Yield	Average Elongation @ Yield	%	12	
Lo = 2.0" Break	Average Elongation @ Break	%	400	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional change	%	± 2	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs.	45	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	90	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3,000	
Notched Constant Tensile Load ASTM D-5397	pass / fail @ 30%	hrs	200	

CUSTOMER:

P.O.#:

DESTINATION

Form 60MSDS.FRM

Date:.....

Signature.....

Quality Control Department

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #: **Liner Type: DRAIN LINER**

		METRIC	ENGLISH
Measurement ASTM D-751/5199	MIN:	mm	mil
	MAX:	mm	mil
	AVE:	mm	mil

Thickness..... 1.5mm, 60 mil
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10 min	.28	
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (Modified) (2 inches / minute)	Average Strength @ Yield	psi	2,000	
	Average Strength @ Break	psi	2,200	
Elongation ASTM D-638 (Modified) (2 inches/minute) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	psi	13	
	Average Elongation @ Break	psi	200	
Dimensional Stability ASTM D-1204 (Modified)	Average Dimensional Change	%	±1	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	lbs	50	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	lbs	95	
Puncture Resistance ASTM D-4833 (Modified)	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	1,500	
Notched Constant Tensile Load ASTM D-5397	pass / fail @ 30%	hrs	200	

CUSTOMER:

P.O.#:

DESTINATION

Form DR60AA.FRM

Date:.....

Signature.....
Quality Control Department

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #:

Liner Type: GRIP LINER

		METRIC	ENGLISH
Measurement ASTM D-751/5199	MIN:	mm	mil
	MAX:	mm	mil
	AVE:	mm	mil

Thickness..... **1.5mm, 60 mil**
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10 min	.28	
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (2 inches / minute)	Yield M.D.	psi	1,600	
	YieldT.D.	psi	1,600	
	BreakM.D.	psi	1,600	
	BreakT.D.	psi	1,600	
Elongation ASTM D-638 Modified (2 inches/minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	
	YieldT.D.	%	13	
	BreakM.D.	%	200	
	BreakT.D.	%	200	
Dimensional Stability ASTM D-1204	M.D.	%	±1	
	T.D.	%	±1	
Tear Resistance ASTM D-1004	M.D.	lbs	50	
	T.D.	lbs	50	
Puncture Resistance FTMS 101 Method 2065	Load	lbs	95	
Puncture Resistance ASTM D-4833	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3000	
Notched Constant Tensile Load ASTM D-5397	pass / fail @ 30%	hrs	200	

CUSTOMER:

P.O.#:

DESTINATION

Date:.....

Signature.....
Quality Control Department

FormGR60AA.FRM

AGRU / AMERICA, INC.

CERTIFICATE OF CONFORMITY

ROLL # Lot #: **Liner Type: SUPER GRIPNET LINER**

		METRIC	ENGLISH
Measurement ASTM D-751/5199	MIN:	mm	mil
	MAX:	mm	mil
	AVE:	mm	mil

Thickness..... **1.5mm, 60 mil**
Length..... m; feet
Width..... m; feet

			A/A'S DATA SHEET	TEST RESULTS
Specific Gravity ASTM D-792	Density	g/cc	.948	
MFI ASTM D-1238 COND. E GRADE:	Melt Flow Index 190°C /2160 g	g/10 min	.28	
Carbon Black Content ASTM D-1603/4218	Range	%	2-3	
Carbon Black Dispersion ASTM D-5596	Category		1,2	
Tensile Strength ASTM D-638 (2 inches / minute)	Yield M.D.	psi	1,900	
	YieldT.D.	psi	1,900	
	BreakM.D.	psi	2,100	
	BreakT.D.	psi	2,100	
Elongation ASTM D-638 Modified (2 inches/minute) Lo = 1.3" Yield Lo = 2.0" Break	Yield M.D	%.	13	
	YieldT.D.	%	13	
	BreakM.D.	%	200	
	BreakT.D.	%	200	
Dimensional Stability ASTM D-1204	M.D.	%	±1	
	T.D.	%	±1	
Tear Resistance ASTM D-1004	M.D.	lbs	40	
	T.D.	lbs	40	
Puncture Resistance FTMS 101 Method 2065	Load	lbs	75	
Puncture Resistance ASTM D-4833	Load	lbs		
ESCR ASTM D-1693	Minimum Hrs w/o Failures	hrs	3000	
Notched Constant Tensile Load ASTM D-5397	pass / fail @ 30%	hrs	200	

CUSTOMER:

P.O.#:

DESTINATION

Date:.....

Signature.....
Quality Control Department

FormSG60AA.FRM

AGRU / AMERICA, INC.

LINER MEASUREMENT FORM

THIS CHART FOR PRODUCTION USE ONLY

#1	#2			#1	#2		
10	1			29	20		
11	2			30	21		
12	3			31	22		
13	4			32	23		
14	5			33	24		
15	6			34	25		
16	7			35	26		
17	8			36	27		
18	9			37	28		
19	10			38	29		
20	11			39	30		
21	12			40	31		
22	13			41	32		
23	14			42	33		
24	15			43	34		
25	16			44	35		
26	17			45	36		
27	18			46	37		
28	19				38		

PLACE ROLL IDENTIFICATION STICKER HERE

LOT # : _____ MATERIAL : _____

TOLERANCE : _____

MEASUREMENTS ASTM D 751 / ASTM D 5199 / ASTM D 5994

1. _____ mm # 6. _____ mm

2. _____ mm # 7. _____ mm

3. _____ mm # 8. _____ mm

4. _____ mm # 9. _____ mm

5. _____ mm #10. _____ mm

MINIMUM THICKNESS: _____ mm _____ mil

MAXIMUM THICKNESS: _____ mm _____ mil

AVERAGE THICKNESS: _____ mm _____ mil

Test Conditions Temperature: Humidity:

ASTM STANDARD	GAGE ACCURACY	PRESSER FOOT / TIP DIMENSIONS	DEADWEIGHT OR PSI APPLIED	SPECIMEN DIMENSIONS	DWELL TIME (SEC)
D751	.00005"	foot 0.375±0.004"diameter	6.0±0.1oz	variable	5
D5199	.00005"	foot 0.250"diameter	.29±0.003psi	3" diameter	10
D5994	.00005"	tip diam. 0.031±0.004" angle of tip 60°±2°	2.0±.2oz	3" diameter	10

DATE : _____ OPERATORS : _____

AGRU / AMERICA, INC.

DENSITY TEST ASTM D 792-91

DATE	TESTED BY	LOT #	ROLL #	WEIGHT / AIR (g)	WEIGHT / LIQUID (g)	DENSITY (g / cm³)
Test Conditions	Temperature:		Humidity:	Average:		

DATE	TESTED BY	LOT #	ROLL #	WEIGHT / AIR (g)	WEIGHT / LIQUID (g)	DENSITY (g / cm³)
Test Conditions	Temperature:		Humidity:	Average:		

DATE	TESTED BY	LOT #	ROLL #	WEIGHT / AIR (g)	WEIGHT / LIQUID (g)	DENSITY (g / cm³)
Test Conditions	Temperature:		Humidity:	Average:		

DATE	TESTED BY	LOT #	ROLL #	WEIGHT / AIR (g)	WEIGHT / LIQUID (g)	DENSITY (g / cm³)
Test Conditions	Temperature:		Humidity:	Average:		

DATE	TESTED BY	LOT #	ROLL #	WEIGHT / AIR (g)	WEIGHT / LIQUID (g)	DENSITY (g / cm³)
Test Conditions	Temperature:		Humidity:	Average:		

AGRU / AMERICA, INC.

CARBON BLACK CONTENT ASTM D 1603-94 OR ASTM D 4218-96

LOT # : _____ ROLL # : _____ MATERIAL : _____

BOAT / DISH #: _____

BOAT TARE _____ g SAMPLE _____ g

BOAT + SAMPLE _____ g CARBON _____ g

BOAT + CARBON _____ g % CARBON

BOAT / DISH #: _____

BOAT TARE _____ g SAMPLE _____ g

BOAT + SAMPLE _____ g CARBON _____ g

BOAT + CARBON _____ g % CARBON

COMMENTS : Test Conditons Temperature: Humidity:

Method used (circle) 1603-94 4218-96

DATE: _____

Average

TESTED BY: _____

CHECKED BY: _____

AGRU / AMERICA, INC.

CARBON BLACK DISPERSION ASTM D 5596-94

LOT #:	
ROLL #	
MATERIAL:	
SPECIMEN	CATEGORY
Lowest Rating	**Average**
Comments: **Test Conditons** **Temperature:** **Humidity:**	

DATE:_____ **TESTED BY:**_____

CHECKED BY:_____

Attachment "M"

AGRU AMERICA QUALITY CONTROL DEPARTMENT
500 GARRISON ROAD GEORGETOWN, SC 29440
TEL: 843 546-0600 FAX: 843 546-0516
04/09/1999

Sample ID: 212607 99TL.mss

Test Date : 03/28/1999
Method : 5 Head Tensile 638 Modified.msm
Operator : Trey

Sample Information:

Name	Value
Direction of Force	LONGITUDINAL
Liner Type	SMOOTH
Lot Number	JO11089
Method type	ASTM D 638 NSF 54 Specifications
Production Date	3-27-99
Relative Humidity	50%
Resin Type	HDPE
Roll Number	212607
Temperature	70°F
Thickness	60mil (1.5mm)

Specimen Results:

Specimen #	Thickness in	Stength @ Yield psi	Elong. @ Yield %	Strength @ Break psi	Elong. @ Break %		
1	0.0615	2447	17.43	4678	814.7		
2	0.0628	2491	18.17	4459	757.1		
3	0.0598	2565	17.81	4730	793.2		
4	0.0609	2481	18.29	4488	759.2		
5	0.0595	2464	16.88	4683	790.0		
Mean	**0.0609**	**2489**	**17.72**	**4608**	**782.8**		
Std Dev	0.0013	45	0.58	124	24.4		
COV	2.1938	2	3.26	3	3.1		

Specimen Comments:

Specimen #	Comments
1	
2	
3	
4	
5	

AGRU AMERICA QUALITY CONTROL DEPARTMENT
500 GARRISON ROAD GEORGETOWN, SC 29440
TEL: 843 546-0600 FAX: 843 546-0516
04/09/1999

Sample ID: 212626 99TW.mss

Test Date : 03/28/1999
Method : 5 Head Tensile 638 Modified.msm
Operator : Trey

Sample Information:

Name	Value
Direction of Force	TRANSVERSAL
Liner Type	SMOOTH
Lot Number	JO11089
Method type	ASTM D 638 NSF 54 Specifications
Production Date	3-27-99
Relative Humidity	50%
Resin Type	HDPE
Roll Number	212626
Temperature	70°F
Thickness	80mil (2.0mm)

Specimen Results:

Specimen #	Thickness in	Stength @ Yield psi	Elong. @ Yield %	Strength @ Break psi	Elong. @ Break %		
1	0.0832	2477	16.48	4839	907.4		
2	0.0833	2541	16.41	5120	947.3		
3	0.0802	2485	17.20	5048	947.8		
4	0.0806	2648	17.34	5269	965.3		
5	0.0810	2534	17.54	5177	976.7		
Mean	**0.0817**	**2537**	**16.99**	**5091**	**948.9**		
Std Dev	0.0015	68	0.52	162	26.3		
COV	1.8114	3	3.05	3	2.8		

Specimen Comments:

Specimen #	Comments
1	
2	
3	
4	
5	

AGRU / AMERICA, INC.

DIMENSIONAL STABILITY TEST ASTM D-1204-94

LOT # :_____

ROLL# :_____ MATERIAL :_____

TESTING CONDITIONS

Conditioned at _____ degrees F (+ or - 3.6 degrees) and _____ % relative humidity for _____ hours.

Exposed at_____degrees C for _____hours.

Reconditioned at _____degrees F and _____% relative humidity for_____hours.

Specimen #	Direction	Before (mm)	After (mm)	Change (%)
1. (mid)	XY			
	AB			
2. (end)	XY			
	AB			
Average	XY (MD)			
	AB (TD)			

Comments:

DATE:_____ TESTED BY:_____

CHECKED BY:_____

AGRU AMERICA QUALITY CONTROL DEPARTMENT
500 GARRISON ROAD GEORGETOWN, SC 29440
TEL: 843 546-0600 FAX: 843 546-0516
04/09/1999

Sample ID: **212607 99RW.mss**

Test Date : 03/28/1999
Method : 5 Head Tear 1004 Modified.msm
Operator : Trey

Sample Information:

Name	Value
Direction of Force	TRANSVERSAL
Liner Type	SMOOTH
Lot Number	JO11089
Production Date	3-27-99
Relative Humidity	50%
Resin type	HDPE
Roll Number	212607
Temperature	70°F
Thickness	60mil (1.5mm)

Specimen Results:

Specimen #	Thickness in	Max. Tear Resistance lbf	Tear Resistance Max. Load lbf/in				
1	0.0616	47.783	775.7				
2	0.0619	48.301	780.3				
3	0.0622	48.450	778.9				
4	0.0627	48.916	780.2				
5	0.0617	47.472	769.4				
6	0.0612	47.243	771.9				
7	0.0615	47.410	770.9				
8	0.0600	46.575	776.2				
9	0.0589	46.013	781.2				
10	0.0601	46.829	779.2				
Mean	**0.0612**	**47.499**	**776.4**				
Std Dev	0.0012	0.896	4.3				
COV	1.9012	1.886	0.6				

Specimen Comments:

Specimen #	Comments
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

AGRU AMERICA QUALITY CONTROL DEPARTMENT
500 GARRISON ROAD GEORGETOWN, SC 29440
TEL: 843 546-0600 FAX: 843 546-0516
04/09/1999

Sample ID: **212626 99RL.mss**

Test Date : 03/28/1999
Method : 5 Head Tear 1004 Modified.msm
Operator : Trey

Sample Information:

Name	Value
Direction of Force	LONGITUDINAL
Liner Type	SMOOTH
Lot Number	JO11089
Production Date	3-27-99
Relative Humidity	50%
Resin type	HDPE
Roll Number	212626
Temperature	70°F
Thickness	80mil (2.0mm)

Specimen Results:

Specimen #	Thickness in	Max. Tear Resistance lbf	Tear Resistance Max. Load lbf/in				
1	0.0849	70.784	833.7				
2	0.0817	67.071	820.9				
3	0.0822	67.602	822.4				
4	0.0838	69.481	829.1				
5	0.0816	65.421	801.7				
6	0.0799	66.799	836.0				
7	0.0794	65.034	819.1				
8	0.0807	66.893	828.9				
9	0.0818	67.611	826.5				
10	0.0824	67.966	824.8				
Mean	**0.0818**	**67.466**	**824.3**				
Std Dev	0.0016	1.712	9.6				
COV	2.0260	2.538	1.2				

Specimen Comments:

Specimen #	Comments
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Attachment "R"

AGRU AMERICA QUALITY CONTROL DEPT.
500 GARRISON ROAD GEORGETOWN, SC 29440
TEL.(843) 546-0600 FAX (843) 546-0516

Puncture Resistance Test
Fed Test Std No 101C, Method 2065
1/2" Probe with 1/8" end radius

Test type: Compression
Operator name: JAMIE
Sample Identification: 210546P
Interface Type: 4200

Instron Corporation
Series IX Automated Materials Testing System 7.49.00
Test Date: Wednesday, March 10, 1999

Sample Rate (pts/secs): 20.0000
Crosshead Speed: 20.0000 in/min
2nd Crosshead Speed: 0.0000 in/min

Full Scale Load Range: 2000.000 lbf

Humidity (%): 55
Temperature: 72 F

LINER TYPE/THICKNESSA/A LINER 1.5mm (60mil)

MATERIAL / LOT NO. CHEVRON 9638 / J011115

ROLL NO. / PROD DATE210546/ 3-12-99

CUSTOMER/ PROJECT

Sample comments:

	Load at Max.Load (lbs)	Load/Thick at Max.Load (lbs/in)	Displcment at Max.Load (in)	Displcment at Auto. Break (in)	Thickness (in)
1	100.200	1616.129	0.511	0.827	0.062
2	99.010	1612.541	0.527	0.843	0.061
3	102.600	1662.885	0.542	0.876	0.062
4	99.650	1649.834	0.538	0.838	0.060
5	96.320	1563.636	0.478	0.778	0.062
Mean	99.556	1621.005	0.519	0.833	0.061
S.D.	2.262	38.638	0.026	0.035	6.1E-4
C.V.	2.272	2.384	4.978	4.258	0.993
Minimum	96.320	1563.636	0.478	0.778	0.060
Maximum	102.600	1662.885	0.542	0.876	0.062

AGRU / AMERICA, INC.

ENVIRONMENTAL STRESS CRACK RESISTANCE
ASTM D 1693-88

Material : _____

Lot # : _____

Reagent : IGEPAL Strength : 10 %

ASTM D-1693	Specimen Thickness	Notch Depth	Bath Temp.
Test Conditon 'B'	_____	*0.3 to 0.4 mm*	*50°C*

Duration _____ hrs Failure Rate _____ %

ROLL NUMBER: _____

LOCATION: _____

START DATE: _____

PASS DATE: _____

REMOVED ON: _____

COMMENTS: Test Conditons Temperature: Humidity:

DATE : _____ TESTED BY : _____

CHECKED BY : _____

AGRU / AMERICA, INC.

NOTCHED CONSTANT TENSILE LOAD ASTM D 5397-93 APPENDIX A

LOT # :_____ MATERIAL :_____ DATE :_____

ROLL # :_____ LINER TYPE :_____ THICKNESS :_____

FORMULA FOR APPLIED LOAD :

Load = str@yld x 30%* x thickness x 80% x width

where :

str@yld = Tensile strength @ yield (Transverse Direction) from ASTM D-638 in psi

thickness = Thickness of sample at notch point in inches

width = Width of sample in inches (.125" constant)

Therefore, for each sample, **load = str@yld x thickness x .0300----->(.3 x .8 x .125)**

*** This number may change due to customer specifications. Formula will be changed also.**

Strength @ yield for this roll : _____ psi % of yield tested : _____ %

SAMPLE # 1 NOTCH DEPTH:_____ THICKNESS : _____in LOAD = str@yld x thickness x .03 LOAD = _____ x _____ x .03 LOAD = _____lbs STATION # : PASS @ _____ HRS PASS / FAIL FAILURE @ _____ HRS	SAMPLE # 2 NOTCH DEPTH:_____ THICKNESS : _____in LOAD = str@yld x thickness x .03 LOAD = _____ x _____ x .03 LOAD = _____lbs STATION # : PASS @ _____ HRS PASS / FAIL FAILURE @ _____ HRS	SAMPLE # 3 NOTCH DEPTH:_____ THICKNESS : _____in LOAD = str@yld x thickness x .03 LOAD = _____ x _____ x .03 LOAD = _____lbs STATION # : PASS @ _____ HRS PASS / FAIL FAILURE @ _____ HRS
SAMPLE # 4 NOTCH DEPTH:_____ THICKNESS : _____in LOAD = str@yld x thickness x .03 LOAD = _____ x _____ x .03 LOAD = _____lbs STATION # : PASS @ _____ HRS PASS / FAIL FAILURE @ _____ HRS	SAMPLE # 5 NOTCH DEPTH:_____ THICKNESS : _____in LOAD = str@yld x thickness x .03 LOAD = _____ x _____ x .03 LOAD = _____lbs STATION # : PASS @ _____ HRS PASS / FAIL FAILURE @ _____ HRS	COMMENTS :_____ _____ _____ _____ _____ _____ TESTED BY :_____ CHECKED BY :_____ Test Conditons Temperature: Humidity:

COMANCO ENVIRONMENTAL CORPORATION

QUALITY

ASSURANCE

MANUAL

THIS QUALITY ASSURANCE MANUAL IS INTENTED TO COMPLEMENT THE SPECIFICATIONS FOR THIS PROJECT.

COMANCO

1. GEOMEMBRANE TRANSPORTATION, DELIVERY AND STORAGE

1.01 The responsibility for the transportation of geomembrane rolls or panels shall be designated by the owner. The geomembrane rolls or panels shall be packaged and shipped by appropriate means so that no damage is caused.

1.02 DELIVERY

At the time of delivery, before and after the unloading of the material, the owner, the owner's representative, and/or liner installer shall conduct a visual inspection of the geomembrane rolls or panels for imperfections and/or damage. Any damage occurring during unloading shall be documented by third-party inspector or installer at the time of unloading.

1.03 ON-SITE STORAGE

The geomembrane rolls or panels shall be stored so as to be protected from damage, and stored as close to the job operation as possible. The geomembrane material shall be stored on an unyielding base free of sharp objects or protrusions to minimize risk of damage.

2. EARTHWORK

2.01 The owner, owner's representative, or general and/or earthwork contractor shall be responsible for the preparation of the subgrade. Prior to liner installation, the exposed subgrade shall be smooth, clear of all foreign and organic material, angular or sharp objects, roots, or debris of any kind. The subgrade shall be compacted in accordance with design specifications, but in no circumstance shall the subgrade be compacted below the minimum required to provide a firm, unyielding foundation with no sharp changes or abrupt breaks in the grade.

2.02 VEGETATION CONTROL

The general contractor, if necessary, shall sterilize the liner installation area using an effective soil sterilizing agent specifically formulated for the vegetation present in the area. The sterilizing agent shall not be harmful to the liner, and shall be applied according to the manufacturer recommendations.

2.03 ANCHOR TRENCH EXCAVATION

The anchor trench shall be excavated to the line, grade and width shown on the construction drawings prior to the placement of the liner system. If the liner system is located in a clay that is susceptible to dessication, the anchor trench shall be excavated in a manner so as to minimize the dessication of the anchor trench soils.

3. METHOD OF PLACEMENT

3.01 PANEL LAYOUT

COMANCO will supply the proposed panel layout drawing prior to the commencement of the liner deployment. The drawings will indicate, in general manner, the panel configuration and the location of the panel seams for the project. The proposed panel layout may, and probably will be adjusted to properly suit field conditions.

3.02 IDENTIFICATION

An identifier (either numeric or alpha-numeric) shall be given to each panel used for the installation, which is consistent with the layout drawings. This identifier shall be related to a material manufacturer roll number which identifies the resin type, batch number, date of manufacture, and other relevant material properties.

4. START-UP TESTING PROCEDURES

4.01 Double wedge fusion welder and extrusion welder start-up testing shall be conducted on the geomembrane liner to verify that seaming conditions are satisfactory.

4.02 The test seam samples shall be of sufficient size to properly test the sample. Specimens measuring one (1) inch wide shall be cut from the test seam. A tensiometer shall be used to test these specimens for shear and peel. If a test seam fails to meet field seam specifications, the seaming apparatus and/or seamer shall not be accepted, and shall not be used for seaming until the deficiencies are corrected and a successful test seam is achieved.

4.03 The samples shall be tested for shear strength and peel strength in accordance with ASTM D4437 and NSF standards.

4.04 Grip separation rate is approximately two (2) inches per minute, and both shear strength and peel strength tests shall be conducted on five (5) replicate specimens. Four out of the five specimens should exhibit the appropriate values with respect to shear strength and peel strength. Approved field seaming processes are DOUBLE WEDGE FUSION WELDING and EXTRUSION WELDING.

5. NON-DESTRUCTIVE SEAM TESTING

The installer shall non-destructively test all field seams over their full length.

5.01 AIR PRESSURE TESTING PROCEDURES (FOR DOUBLE FUSION SEAM ONLY)

5.01.01 Seal both ends of the seam to be tested, and insert needle into the air channel created by the double wedge fusion weld.

5.01.02 Inflate the air channel to a pressure between 25 and 30 psi, and close the valve. Maintain pressure and sustain for approximately five (5) minutes.

5.01.03 If loss of pressure exceeds four (4) psi, or the pressure does not stabilize, locate the area of the leak and repair. Retest the repaired area using the Vacuum Box Testing Method.

5.01.04 At the end of the five (5) minute period, cut the seam at the far end of the test area to allow air to escape, and remove needle.

5.02 VACUUM BOX TESTING METHOD PROCEDURES

5.02.01 Acceptable equipment for the Vacuum Box Testing Method include:

A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, and a vacuum gauge. A vacuum pump equipped with a pressure controller. A rubber pressure-vacuum hose with fittings and connections (if necessary). A plastic bucket and applicator. A soapy solution.

5.02.02 For double fusion seams, the excess sheet overlap shall be trimmed.

5.02.03 Clean the vacuum box viewing window, gasket surfaces and check for leaks.

5.02.04 Wet a strip of geomembrane approximately the size of the box with the soapy solution, and place the box over the wetted area and compress.

5.02.05 Commence with the vacuum process ensuring an air-tight seal is created, and for a period of approximately fifteen (15) seconds, examine the seam through the viewing window for the presence of a stream of moving soap bubbles indicating a leak.

5.02.06 If bubbles do not appear after fifteen (15) seconds, cease the vacuum process, move the box over the adjoining area with a minimum of three (3) inches overlap and repeat the process. All areas where leaks were detected shall be marked, repaired, and retested.

6. TESTING AND SAMPLING PROCEDURES

6.01 DESTRUCTIVE TESTING

Destructive test samples shall be randomly selected in accordance with site specific requirements in a manner consistent with actual field conditions.

6.02 SAMPLING PROCEDURE

Sampling times and locations shall be randomly selected as the seaming progresses. All holes in the geomembrane resulting from obtaining the seam samples shall be repaired. All patches shall be vacuum tested.

6.03 SIZE AND DISPOSITION OF SAMPLES

The samples shall ideally be twelve (12) inches wide by twenty-four (24) inches long with the seam centered lengthwise. Actual sample sizes may vary.

6.04 FIELD LABORATORY TESTING

Five (5) specimens shall be tested for seam strength and five (5) specimens shall be tested for peel strength. To be acceptable, four (4) out of the five (5) specimens must pass.

6.05 INDEPENDENT LABORATORY TESTING

Upon request and at the expense of the Owner or Purchaser, the installer shall package and ship the seam samples to an independent laboratory for the determination of shear and peel strengths. The test method and procedures to be used by the independent laboratory shall be the same as used in the field testing, where the seam samples are one (1) inch wide and the grip separation rate is two (2) inches per minute (ipm). Four (4) out of the five (5) specimens per sample must pass.

6.06 PROCEDURES FOR DESTRUCTIVE TESTING

The following procedures shall apply whenever a sample fails the field destructive test:

6.06.01 The installer shall reconstruct the seam between the failed location and any passed test location.

6.06.02 The installer can retrace the welding path to an intermediate location (at a minimum of ten feet from the location of the failed test) at the discretion of the inspector, and take a sample for an additional field test. If this test passes, then the seam shall be reconstructed between the location and the original failed location. The process is to be repeated if the test fails.

6.06.03 Over the length of the seam failure, the contractor shall either cut out the old seam, reposition the panel and reseam, or add a cap strip.

6.06.04 After reseaming or placement of the cap strip, additional destructive field testing shall be taken within the reseamed area. The reseamed sample shall be tested, and if the results are not acceptable, this process shall be repeated until the reseamed length is judged satisfactory.

6.06.05 In the event that a sample fails a laboratory destructive test, the above procedures shall also be followed.

7. REPAIR PROCEDURES

7.01 DEFECTS AND REPAIRS

All seam and non-seam areas of the geomembrane shall be inspected for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

7.02 EVALUATION

Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate. Each location that fails the non-destructive testing shall be repaired.

7.03 REPAIR PROCEDURES

7.03.01 Defective seams shall be reseamed. Small holes shall be repaired by extrusion welding. Tears shall be repaired by patching. When the tear is on a slope, an area of stress, and/or has a sharp end, it must be rounded prior to patching. Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches. Surfaces of HDPE which are to be patched shall be abraded and cleaned prior to the repair.

7.03.02 Patches shall be round or oval in shape, made of the same geomembrane and extend a minimum of six (6) inches beyond the edge of defects. All patches shall have their top edge beveled with an angular grinder prior to placement on the geomembrane.

7.04 VERIFICATION OF REPAIRS

Each repair shall be non-destructively tested. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.

8. WARRANTY

A written warranty for the material may be obtained from the geomembrane material manufacturer. A written warranty for the workmanship may be obtained from the installation contractor. Samples of these warranties are available upon request.

- - END OF MANUAL - -

APPENDIX C

CQA AND PROJECT MANAGEMENT FORMS

9.
Paper Flow Forms

9.1
Product Quality Report

This report documents the raw material manufacturer's test results for the physical properties of the inco resin. Each incoming shipment to Poly•Flex is accompanied by such a report. A copy of this report is sen the engineer/client with the finished product.

PRODUCT QUALITY REPORT

FAX NO. 214-988-8331
POLY•FLEX, INC.
INC.
GRAND PRAIRIE, TEXAS 75051
ATTN: SALES ASSISTANT

UNION CARBIDE CHEMICALS
AND PLASTICS COMPANY.

POLYOLEFINS DIVISION
P.O. BOX 184
PORT LAVACA, TEXAS 77979

FEBRUARY 12, 1991

PRODUCT NAME	DMHD-1825 BK	
BLEND NUMBERS	431914	431915
QUANTITY, LBS.	91,700	91,700
CONTAINER	BAIX60051	BAIX60051
CUSTOMER ORDER NO.	4770	
CCC ORDER NO.	447466	
SHIPPING DATE	02/12	

SHIPPED TO: GRAND PRAIRIE, TX

THE FOLLOWING TEST DATA WAS OBTAINED:

	431914	431915
MELT INDEX	0.12	0.14
MFI III	15.0	16.0
DENSITY	0.9478	0.9482
CARBON BLACK	2.3	2.4
IND TIME 200 C MIN	114.0	121.0
ANALYSIS NO.	660925	1820925

Dylan Thomas
QUALITY CONTROL DEPARTMENT
SEADRIFT PLANT LABORATORY

9.2
Railcar Resin Report

Used by Poly•Flex's in-house laboratory to document results of tests performed on incoming raw material. These results are checked against Poly•Flex's raw material specifications and the Product Quality Report issued by the material manufacturer.

POLY-FLEX, INC.

RAILCAR RESIN REPORT

VENDOR: _____ RAILCAR NO: _____

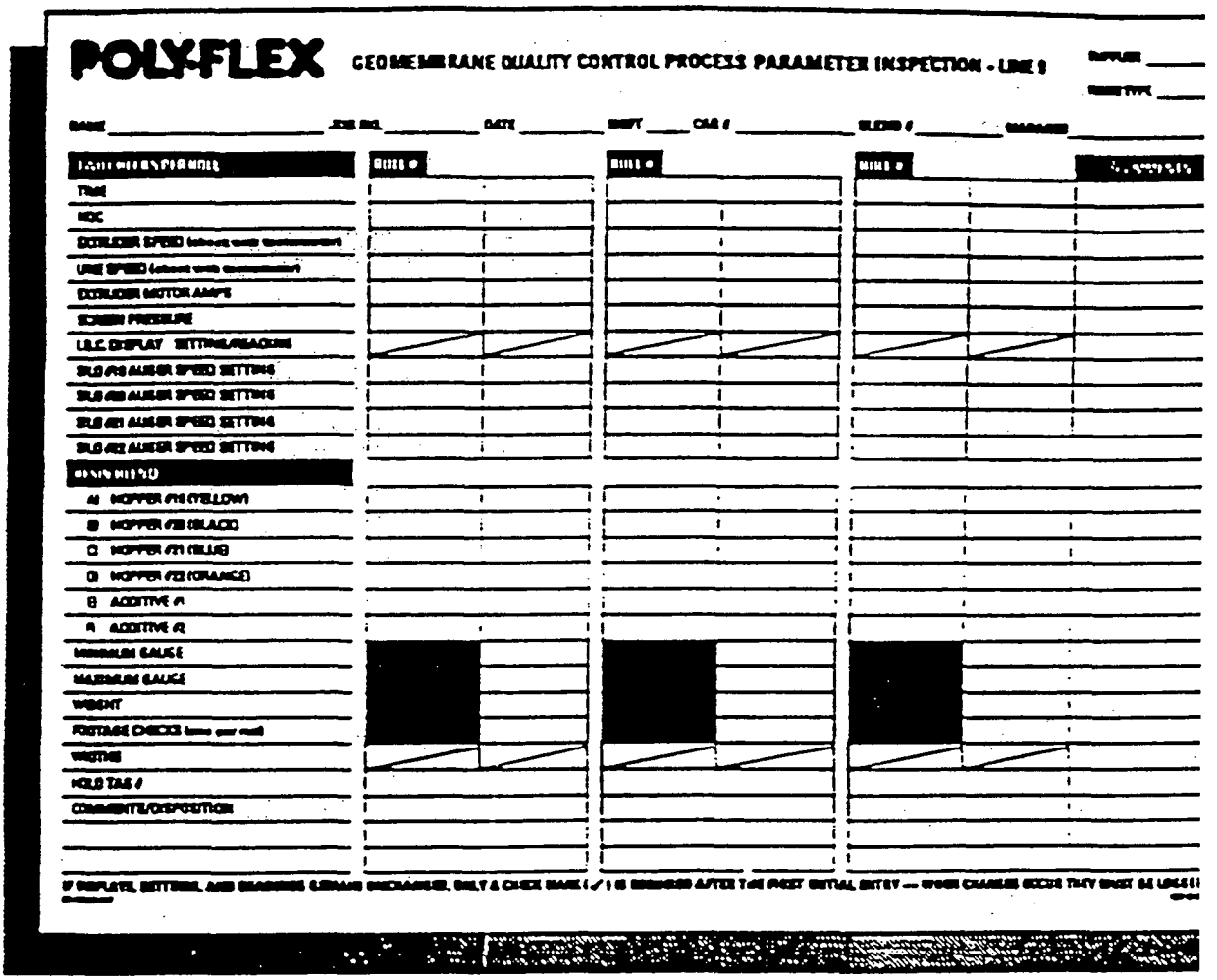
BLEND NO/TYPE	MELT INDEX	DENSITY	CARBON BLACK	O.I.T.
	D 1238/E g/10 min	D 1505 g/cc	D 1603 %	D 3895 200° C min.
/				
/				
/				
/				

Quality Control Department
Poly-Flex, Inc.

Date:

9.3
Geomembrane Quality Control Process Parameter Inspection

Statistical Process Control is conducted and extruder readings are logged. Readings are taken twice per and are recorded on a per-roll basis. Production history is constantly updated, and the enriched databa integral to the ongoing refinement of production efforts.



POLY-FLEX GEOMEMBRANE QUALITY CONTROL PROCESS PARAMETER INSPECTION - LINE 9

Time						
MDC						
EXTRUDER SPEED						
LINE SPEED						
EXTRUDER MOTOR AMPS						
SCREEN PRESSURE						
L.E.C. DISPLAY SETTING/READING						
SILO #19 AUGER SPEED SETTING						
SILO #20 AUGER SPEED SETTING						
SILO #21 AUGER SPEED SETTING						
SILO #22 AUGER SPEED SETTING						
A HOPPER #19 (YELLOW)						
B HOPPER #20 (BLACK)						
C HOPPER #21 (BLUE)						
D HOPPER #22 (ORANGE)						
B ADDITIVE #1						
A ADDITIVE #2						
MINIMUM GAUGE						
MAXIMUM GAUGE						
WEIGHT						
FOOTAGE CHECKS						
WIDTHS						
HOLD TAG #						
COMMENTS/DISPOSITION						

9.4
Quality Control Report - During Production

Sent to the engineer/client as Poly•Flex's standard quality control report. Documents the property values of the specific rolls shipped to a project.

QUALITY CONTROL REPORT - DURING PRODUCTION

POLY-FLEX, INC.

[illegible] West Marshall Drive
Grand Prairie, TX [illegible] USA
214-[illegible]
FAX 214-[illegible]

page _____ of _____

Project Name _____ Customer _____ mil Poly-Flex

Project Number _____ Sheet Number _____

Report Date _____ Trip Number _____

Certified by: _____ Roll Number _____ _____ _____

_____ Sheet Number _____ _____ _____

Property	Test Method			
Sheet Thickness, mil	ASTM D 1593			
Melt Index, g/10	ASTM D 1238			
Sheet Density, g/cc	ASTM D 1505			
Tensile Properties	ASTM D 638			
Strength at Yield, lbs./in.				
Strength at Break, lbs./in.				
Elongation at Yield, %				
Elongation at Break, %				
Secant Modulus (2.5%), psi				
Tear Strength, lbs.	ASTM D 1004			
Puncture Resistance, lbs.	FTMS 101C 2065			
	FTMS 101C 2031			
Carbon Black Content, %	ASTM D 1603			
Carbon Black Dispersion	ASTM D 3015			
Dimensional Stability, %	ASTM D 1204			

The standard test results for Tensile Properties, tear strength, and dimensional stability are based on [illegible] dimensions.

[illegible]

Quality Control & Quality Assurance

POLY-FLEX, INC.

9.5
Quality Control Report - Long Term Testing

Follow-up documentation of results from long-term tests. Submitted to the engineer/client upon request, at the completion of all specified tests.

QUALITY CONTROL REPORT - LONG TERM

POLY-FLEX, INC.

2000 West Marshall Drive
Grand Prairie, TX 75051 USA
214-647-4374 800-527-3332
FAX 214-988-6331

page _____ of _____

Product Name _____ Geomembrane _____ mil Poly-Flex

Product Number _____ Sheet Number _____

Batch Date _____ Trip Number _____

Certified by: _____ Roll Number _____ _____ _____

_____ Sheet Number _____ _____ _____

LOT TESTING	YIELD % ELONG.	ELONG. @ YIELD % ELONG.	ASTM D 3083 SOIL BURIAL BREAK % ELONG.	ELONG. @ BREAK % ELONG.	RECAPT SECT. % ELONG.	ASTM D 746 COLD TEMP TEMP = -70° C TESTED PASSED	ASTM D 1693 ESCR TIME = 2000 HR TESTED PASSED
DATE _____							
LOT _____							
BLEND							

Remarks

FLSI

POLYETHYLENE GEOMEMBRANES

material delivery report

date .....

job no. .....

p.o. no. .....

project .....

driver .....

truck no. .....

conditions of materials damaged

item	roll no.	panel no.	problem description

comments .....

.....

.....

how was material off-loaded? .....

how is material stored? .....

signed _____

certificate of acceptance

POLYETHYLENE GEOMEMBRANES

project name

date

poly-flex job no.

project location

details of work completed and measured

I, the undersigned, duly authorized representative of

do hereby take over and accept the work described above from the date hereof, subject to the exceptions detailed below, and confirm that the work has been completed in accordance with the specifications and the terms and conditions of the contract. There is no apparent damage to the plastic lining, nor is there any interference within or without the surrounding works.

I have evaluated and measured the work together with the Poly-Flex representative, and agree that the measurements shown above are true and correct, and that the installation has met our approval.

exceptions

authorized representative

name	signature	title	date

poly-flex representative

name	signature	title	date

POLYETHYLENE GEOMEMBRANES

pre-start site inspection

date .....

job no. .....

project name .....

	name	representing	position
persons present			

description of site conditions

___ photos enclosed ___ to follow

description of remedial site preparation work

date & conditions of startup

billing terms for additional inspection

further inspection required ___ yes ___ no date

further comments

prepared by

name signature title

POLYETHYLENE GEOMEMBRANES

certificate of acceptance of soil subgrade

project name .....

project no. .....

location .....

installation contractor representative .....

area to be accepted .....

.....

.....

I, the undersigned, duly authorized representative of the installer, do hereby accept the soil subgrade surface conditions and shall be responsible for maintaining its integrity and suitability in accordance with these specifications from this date to completion of this installation. I do not accept any responsibility for the conditions or character of the subsurface soil, or any effects the soil might have on the liner system.

signature	title	date

POLYETHYLENE GEOMEMBRANES

geomembrane seam sample

project name .....

project no. .....

project location .....

seamer's name ..... welding machine no. ..... make .....

sample data: date seamed ..... date sampled .....

sample size

.....

sample i.d.

A B C

seam location .....

remarks .....

thickness	20	30	40	60	80	100
	___	___	___	___	___	___

seam tests: shear ___ ASTM D3083 (modified by NSF App A)

peel ___ ASTM D413 (modified by NSF App A)

requested by ..... date .....

FLSI

POLYETHYLENE GEOMEMBRANES

meeting report

date

time

project name

project no.

purpose

	name	company
present 1		
2		
3		
4		
5		
6		
7		
8		

comments

items discussed

prepared by

date

c.c. to

FLSI

POLYETHYLENE GEOMEMBRANES

problem solution data sheet

data sheet no. .....

project no. .....

project name .....

project location .....

problem .....

implication .....

solutions .....

actions .....

prepared by ..... date .....

c.c. to .....

result .....

POLYETHYLENE GEOMEMBRANES

daily personnel activity

project no. ..... date .....

project name ..... project location .....

personnel	installer manager	deployment supervisor	quality control inspector	master seamer	welder	grinder	seam tester	laborer
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Attachment

chain of custody record

POLYETHYLENE GEOMEMBRANES

liquid |___

Poly-Flex (HDPE) |___

Dura-Flex (VLDPE-A) |___

soil |___

project no.

project name

project location

field record

sample type

container type

sample i.d.	sampled by	date

released to courier by field personnel

received by courier

Poly-Flex laboratory record

lab no.

received by	date	condition

released to lab courier

received by lab

contract laboratory record

laboratory name

received by	date	disposition

released to lab courier

received by lab

FLSI

POLYETHYLENE GEOMEMBRANES

geomembrane vacuum test record

project no. ..... project name .....

project location .....

vacuum box no. ..... make ..... model .....

seam interval tested	tester's name	test failure location	test failure no.	repair date	retest approval

inspected by ..... date .....

POLYETHYLENE GEOMEMBRANES

geomembrane field seam strength test sheet

project no. ..... project name .....

project location .....

field information

weather ..... sample no. .....

temperature ..... seam no. .....

time of day seamed ..... welding apparatus .....

date seamed ..... welder .....

testing information

location of testing ..... testing date .....

tested by ..... temp. during testing .....

sample width ..... in. grip separation rate ..... in./min.

seam strength — shear

specimen test	1	2	3	4	5
thickness mil					
strength at break lb./in.					
break description					
comment (pass/fail)					

seam adhesion strength — peel

strength at break lb./in.	1	2	3	4	5
break description					
comment (pass/fail)					

FLSI

POLYETHYLENE GEOMEMBRANES

daily field report
construction management services

project no. ..... date .....

project name ..... weather .....

project location ..... contract days remaining .....

contractor's equipment .....

contractor's personnel .....

observations

___ photo ___ meeting ___ change order ___ problem sheet ___ conversation

time arrived ..... time departed .....

signature

FLSI

geomembrane seaming record

POLYETHYLENE GEOMEMBRANES

project no. .... project name ....

project location ....

time	seamer's name	welding machine	seam i.d.	length	temperature		weather
					sheet	welding machine	

inspected by .... date ....

FLSI

POLYETHYLENE GEOMEMBRANES

equipment list

project no. ..... project name .....

project location .....

type	manufacturer	serial no.	status	date in use

FLSI

photography log

POLYETHYLENE GEOMEMBRANES

slides ____

prints ____

project no. ____ project name ____

project location ____ slide series no. (or print negative series no.) ____

photography date(s) ____

photographed by ____

comments ____

frame number	project number	date(s)	description
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Note: see daily field report (attachment 12) for expanded description and references

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PROJECT IDENTIFICATION _____ PAGE OF

OWNER/CLIENT _____ PROJECT NO _____ PROJECT MANAGER _____

DESIGN A/E _____ PROJECT NO _____ PROJECT MANAGER _____

CONSTRUCTION A/E _____ PROJECT NO _____ PROJECT MANAGER _____

CONTRACTOR _____ PROJECT NO _____ PROJECT MANAGER _____

SHOP DRAWING / SUBMITTAL LOG AND CONTROL SHEET

SUB-MITTAL NO	DATE REC'D OFFICE / DATE / BY	DESCRIPTION	SUBCONTRACTOR / REF SPEC SECTION/DWG	CON-TRACTOR TRANS NO	NO COPIES REC'D	TO A/E REVIEWER / DATE / BY	REVIEWER / NAME / OFFICE	DATE REC'D / DATE / OFFICE	DATE REC'D / DATE / OFFICE	P M CHECK / DATE / BY	ACTION: NO EXCEPTIONS TAKEN	ACTION: MAKE CORRECTIONS NOTED	ACTION: AMEND & RESUBMIT	ACTION: REJECTED-SEE REMARKS	TRANS TO CON-TRACTOR / DATE / BY	NO COPIES REC'D	TRANS VIA	REMARKS
ORIG																		
RESUB A																		
RESUB B																		
ORIG																		
RESUB A																		
RESUB B																		
ORIG																		
RESUB A																		
RESUB B																		

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

730 North Waldo Road • Gainesville, Florida 32601 • (904) 377-5821 / FAX (904) 377-3164

3510 Northdale Boulevard, Suite B-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 968-6164

QA/TESTING PLAN

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

SECTION	PART	CONTR. RESP.	ENGR. RESP.	OWNER RESP.	ITEM	REF. STD.	TEST	COMMENTS

= Responsible to Coordinate X = Test to be Run by

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3910 Northside Boulevard, Suite B-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 964-6196

AGENDA - PRE-CONSTRUCTION CONFERENCE

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

PRE-CONSTRUCTION CONFERENCE

I. INTRODUCTION

- A. Verbal
- B. Attendee Sign In Sheet

II. CONTRACT DOCUMENTS

- A. Notice of Award _____
- B. Contract Agreement Executed _____
- C. Bonds Posted _____
- D. Insurance Certificate _____
- E. Certifications and Affidavits _____
- F. Addenda Verified _____
- G. Contract Drawings Verified _____
- H. Other Requirements _____

III. CONSTRUCTION MANAGEMENT PLAN REVIEW

IV. CONTRACTOR PRESENTATION

- A. Division 0 and 1 Pre-Construction Requirements
- B. Construction Schedule
- C. Monetary Draw-down Schedule
- D. Temporary Facilities
- E. Mobilization and Project Start

V. CONTRACT DATES

- A. Notice to Proceed _____
- B. Contract Completion _____

VI. OTHER

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3910 Northdale Boulevard, Suite B-208 • Tampa, Florida 33624 • (813) 960-3040 / FAX (813) 964-8

ATTENDEE SIGN IN SHEET

PURPOSE OF MEETING: _____ DATE: _____

LOCATION OF MEETING: _____ TIME: _____

AGENCY: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

NAME	REPRESENTING	PHONE NUMBER

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

MINUTES - PRE-CONSTRUCTION CONFERENCE

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

PRE-CONSTRUCTION CONFERENCE

I. INTRODUCTION
- A. Verbal
- B. Attendee Sign In Sheet

II. CONTRACT DOCUMENTS
- A. Notice of Award _____
- B. Contract Agreement Executed _____
- C. Bonds Posted _____
- D. Insurance Certificates _____
- E. Certifications & Affidavits _____
- F. Addenda Verified _____
- G. Contract Drawings Verified _____
- H. Other Requirements _____

III. CONSTRUCTION MANAGEMENT PLAN REVIEW

IV. CONTRACTOR PRESENTATION
- A. Division 0 and 1 Pre-Construction Requirements
- B. Construction Schedule
- C. Monetary Draw-down Schedule
- D. Temporary Facilities
- E. Mobilization & Project Start

V. CONTRACT DATES
- A. Notice to Proceed _____
- B. Contract Completion _____

VI. OTHER

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
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AGENDA - PROGRESS MEETING

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

I. INTRODUCTIONS
   A. Verbal
   B. Attendee Sign In Sheet

II. REQUESTS FOR INFORMATION (RFI)

III. PROPOSED CONTRACT MODIFICATIONS (PCM)

IV. SUBMITTALS/SHOP DRAWING STATUS

V. JOB PROGRESS REPORT

VI. PROGRESS PROJECTION REPORT

VII. SAFETY REPORT

VIII. PERIODIC PAYMENT REQUEST

IX. OTHER CONCERNS AND ISSUES

X. SCHEDULE DATE/TIME/PLACE FOR NEXT PROGRESS MEETING

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

MINUTES - PROGRESS MEETING

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

I. INTRODUCTIONS
   A. Verbal
   B. Attendee Sign In Sheet

II. REQUESTS FOR INFORMATION (RFI)

III. PROPOSED CONTRACT MODIFICATION (PCM)

IV. SUBMITTALS/SHOP DRAWING STATUS

V. JOB PROGRESS REPORT

VI. PROGRESS PROJECTION REPORT

VII. SAFETY REPORT

VIII. PERIODIC PAYMENT REQUEST

IX. OTHER CONCERNS AND ISSUES

X. SCHEDULE DATE/TIME/PLACE FOR NEXT PROGRESS MEETING

Jones Edmunds & Associates, Inc. JEA
CONSULTING ENGINEERS AND SCIENTISTS

Ship to the Following Address:

☐ 730 North Waldo Road • Gainesville, Florida 32601
(904) 377-5821

☐ 3910 Northdale Boulevard, Suite B-208 • Tampa, Florida 33624
(813) 960-3040 or (800) 535-5766

LETTER OF TRANSMITTAL

DATE:	JOB NO.:
ATTENTION:	
REGARDING:	

TO: _____

GENTLEMEN:

WE ARE SENDING YOU ☐ Attached ☐ Under Separate Cover via _____ the Following Items

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of Letter ☐ Change Order ☐ _____

COPIES	DATE	NO.	DESCRIPTION

THESE ARE TRANSMITTED AS CHECKED BELOW:

☐ For Approval ☐ Approved as Submitted ☐ Resubmit ____ Copies for Approval

☐ For Your Use ☐ Approved as Noted ☐ Submit ____ Copies for Distribution

☐ As Requested ☐ Returned for Corrections ☐ Return ____ Corrected Prints

☐ For Review and Comment ☐ Prints Returned After Loaned to U

☐ For Bids Due _____ 19_____ ☐ _____

REMARKS:

COPY TO: _____ SIGNED: _____

If enclosures are not as noted, kindly notify us at once.

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA
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3916 Northdale Boulevard, Suite 8-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 964-6166

REQUEST FOR INFORMATION (RFI)

NO.: _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

TO: _____ DATE: _____

RE: CONTRACT DOCUMENT REFERENCE(S): _____

FROM: _____

DESCRIPTION OF RFI:

☐ INFORMATION, ☐ CLARIFICATION, ☐ INTERPRETATION

is Requested for the Items Described Below or in the Attached:

_____

RESPONSE REQUESTED BY: _____ Date _____ Signature

TO: _____ DATE: _____

FROM: _____

RESPONSE TO RFI NO. _____

Our Response to your Request for ☐ INFORMATION, ☐ CLARIFICATION, ☐ INTERPRETATION

is Described Below or in the Attached: _____

XC: _____

_____ Signature

ATTACHMENT: _____

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

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3610 Northside Boulevard, Suite B-208 • Tampa, Florida 33624 • (813) 960-3040 / FAX (813) 968-6166

REQUEST FOR DESIGN REVIEW (RDR) NO.: _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

TO: _____

FROM: _____

Review of the following is requested:

( ) SHOP DRAWING NO.: _____

( ) REQUEST FOR INFORMATION NO.: _____

( ) OTHER: _____

Please provide response by: _____
DATE

If modification to contract drawings and or specifications are required, please provide the following:

_____ JUSTIFICATION FOR MODIFICATIONS

_____ COPIES OF TYPED SPECIFICATION REVISIONS

_____ PRINTS OF REVISED DRAWINGS

TO: _____ DATE: _____

FROM: _____

RESPONSE: _____

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

SUBMITTAL/SHOP DRAWING REVIEW STAMP

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

SUBMITTAL REVIEW

REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AND COMPLIANCE WITH INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS, QUANTITIES OR INSTALLATION REQUIREMENTS.

☐ NO EXCEPTIONS TAKEN ☐ MAKE CORRECTIONS NOTED

☐ AMEND AND RESUBMIT ☐ REJECTED-SEE REMARKS

BY_____ DATE_____ SUBMITTAL NO._____

JONES, EDMUNDS & ASSOCIATES, INC.

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

720 [illegible] • [illegible] • [illegible] / FAX [illegible]
3010 [illegible] • [illegible] • [illegible] / FAX [illegible]

NOTICE OF NONCOMPLIANCE (NON)

NO.: _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

TO: _____ DATE: _____

_____ TIME: _____

_____

NONCOMPLIANCE OBSERVATION: _____

DETAILS OF OBSERVATION: _____

REFERENCE TO CONTRACT DOCUMENTS: _____

Your response to this notice is required by the close of business on the day following the date of issuance

Receipt of the above notice of noncompliance is hereby acknowledged by:

_____

THIS THE _____ DAY OF

_____ .

BY:

TITLE: _____ _____

CONTRACTOR'S REPRESENTATIVE

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

730 North Wilde • Gainesville, Florida 32601 • (904) 377-5821 / FAX (904) 377-3166
3910 Hartsdale Boulevard, Suite 8-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 968-6164

CONSTRUCTION CONTRACT FIELD ORDER (CFO)

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

THE CONTRACTOR IS HEREBY DIRECTED TO ACCOMPLISH THE FOLLOWING WORK:

_____

_____

_____

_____

REASON: _____

_____

SPECIFICATION REFERENCES: _____

DRAWING REFERENCE: _____

This WORK shall be performed within the confines of the contract unless the Contractor believes this work entitles him to a contract modification, and so notifies the Engineer, in writing, within seven (7) days after the date of this Field Order.

RESIDENT PROJECT REPRESENTATIVE

BY: _____

TITLE: _____

Receipt of the above Field Order is hereby acknowledged by

_____

this the _____ day of _____

_____, 19 _____

_____

By _____

Title _____

CONTRACTOR'S REPRESENTATIVE

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

730 North Waldo • Gainesville, Florida 32601 • (904) 377-5821 / FAX (904) 377-3166
3910 Northside Boulevard, Suite B-206 • Tampa, Florida, 33624 • (813) 880-3040 / FAX (813) 948-6184

CONTRACT QUANTITY REPORT (CQR)

PAGE ____ OF ____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

CONTRACT ITEM NUMBER: _____ DESCRIPTION: _____

DATE:	LOCATION / MEASUREMENTS / COMPUTATION	QUANTITY:
	TOTAL FOR THIS SHEET	
	TOTAL FROM PREVIOUS SHEET	
	TOTAL TO DATE	

VERIFIED BY: _____

PERIODIC PAYMENT REQUEST (PPR)

PROJECT:

JEA PROJECT NO: _____ OWNER NO: _____

REQUEST NO:

PERIOD COVERING: THROUGH

DATE SUBMITTED: _____

CONTRACTOR: (NAME/ADDRESS)

OWNER:

ENGINEER/ARCH:

CHANGE ORDER STATUS

Change Orders approved in previous months by Owner TOTAL		ADDITIONS	DEDUCTIONS
Approved this Month			
Number	Date Approved		
	TOTALS		
Net change by Change Orders			

1. ORIGINAL CONTRACT SUM $ _____
2. Net change by Change Orders $ _____
3. CONTRACT SUM TO DATE (Line 1 + 2) $ _____
4. TOTAL COMPLETED & STORED TO DATE (Column G on 16B) $ _____
5. RETAINAGE:
   a. ___% of Completed Work (Column D + E on 16B) $ _____
   b. ___% of Stored Work (Column F on 16B) $ _____
   Total Retainage (line 5a + 5b or Total in Column I of 16b) $ _____
6. TOTAL EARNED LESS RETAINAGE: (Line 4 less Line 5 Total) $ _____
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate) $ _____
8. CURRENT PAYMENT DUE $ _____
9. BALANCE TO FINISH, PLUS RETAINAGE: (Line 3 less Line 6 Total) $ _____

CONTRACTOR'S APPLICATION FOR PAYMENT

As authorized agent for the Contractor, I, the undersigned, hereby certify that to the best of my knowledge and belief, this is true and correct statement of work performed and materials delivered. I further certify that the Contractor has good title for all materials delivered under this Partial Estimate and there are no vendor's liens, mechanic's liens, or other liens or rights to liens against this job, and that all previous Partial Payments received under this Contract have been applied to discharge in full all of the Contractor's obligations reflected in prior Partial Payment requests, and that hourly wages paid to all employees on this project for the period of this estimate are in accordance with the wage scale determination contained in the Contract Documents.

CONTRACTOR:

By: _____ Date: _____

State of:

Subscribed and sworn to before me this day of ,19

Notary Public:

My Commission expires:

ENGINEER'S CERTIFICATION

In accordance with the Contract Documents, based on on-site observations and the data comprising the above application, the Engineer certifies to the Owner that to the best of the Engineer's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT RECOMMENDED.

AMOUNT RECOMMENDED $ _____

(Attach explanation if amount recommended differs from the amount applied for.)

By: _____ Date: _____

OWNER APPROVAL

Title: _____ By: _____ Date: _____

NOTE: TYPE INFORMATION; DO NOT HAND WRITE

JEA DOCUMENT NO. 16A (USE WITH DOC. NO. 16B)

SCHEDULE OF VALUES FORM

Jones Edmunds & Associates, Inc. JEA
CONSULTING ENGINEERS AND SCIENTISTS

PROJECT:
JEA PROJECT NO:
REQUEST NO:
DATE SUBMITTED:
PERIOD COVERING: THROUGH

In tabulations below, amounts are stated to the nearest dollar and whole percent. Do not hand write.
Entries are to be typewritten. Use Column I on Contracts where variable retainage for line items may apply.

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G÷C)	BALANCE TO FINISH (C-G)	RETAINAGE
			FROM PREVIOUS APPLICATION (D+E)	THIS PERIOD					

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

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3610 Hendricks Boulevard, Suite 8-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 968-6166

PROPOSED CONTRACT MODIFICATION (PCM) NO.: _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

TO: _____ DATE: _____

Please submit your proposal for an equitable adjustment in the contract amount and/or performance time in accordance with the following:

CONTRACT DOCUMENT REFERENCE(S): _____

DESCRIPTION OF MODIFICATION: _____

REASON FOR MODIFICATION: _____

WORK DIRECTIVE:

( ) Proceed with the work immediately.

( ) Do not proceed with the work until a change order is issued.

Your response is requested by _____.

XC: _____

Signature _____

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

CONTRACT CHANGE ORDER

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

USE FORMAT ACCEPTABLE TO OWNER OR AS SPECIFIED

IN THE CONTRACT DOCUMENTS

Jones Edmunds & Associates, Inc. JEA

PROJECT IDENTIFICATION _____ PAGE ___ OF ____

OWNER/CLIENT _____ PROJECT NO _____ PROJECT MANAGER _____

DESIGN A/E _____ PROJECT NO _____ PROJECT MANAGER _____

CONSTRUCTION A/E _____ PROJECT NO _____ PROJECT MANAGER _____

CONTRACTOR _____ PROJECT NO _____ PROJECT MANAGER _____

CHANGE ORDER/STATUS REPORT

CHECK ORDER NUMBER	NUMBER OF PCN INITIATING CHANGE	DATE	STATUS THIS REPORT/ REMARKS	DATE APPROVED				ACTION DATE		CHANGE IN PRICE				CHANGE IN TIME				REASON FOR CHANGE					
		INITIATED		BY CONTRACTOR	BY A/E	BY OWNER/CLIENT	BY OTHER AGENCY	ORDER ISSUED	CANCELLED	ORIGINAL CONTRACT AMOUNT	AMOUNT ADD	AMOUNT DEDUCT	REVISED CONTRACT AMOUNT	ORIGINAL CONTRACT DATE/TIME	TIME ADD	TIME DEDUCT	REVISED COMPLETION DATE	DESIGN MODIFICATION	CONTRACTORS REQUEST	DIFFERENT/SITE CONDITIONS	CORRECTION OF DEFECTIVE WORK	OTHER REQUEST	CONTRACT COMPLETION

Jones Edmunds & Associates, Inc.
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JEA
730 North Wilson • Gainesville, Florida 32601 • (904) 377-5421 / FAX (904) 377-3166
3910 Northdale Boulevard, Suite B-208 • Tampa, Florida, 33624 • (813) 960-9048 / FAX (813) 964-4166

MONTHLY PROGRESS REPORT

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

FORMAT, CONTENT AND DISTRIBUTION AS

REQUESTED BY OWNER

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

730 North Wilder • Gainesville, Florida 32601 • (904) 377-5821 / FAX (904) 377-3196
3910 Northwest Boulevard, Suite B-208 • Tampa, Florida 33624 • (813) 960-3040 / FAX (813) 968-6166

CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

DESCRIPTION OF WORK: _____

CONTRACT DOCUMENT REFERENCE: _____

The work performed under this Contract has been reviewed and found to be substantially complete. The date of substantial completion of the project or portion thereof designated above is hereby established as also the date of commencement of applicable warranties required by the contract documents.

The date of substantial completion of a project or specified part of a project is the date accepted by the Owner, that the construction is sufficiently completed, in accordance with the contract documents, so that the project or specified part can be utilized for the intended purpose.

A list of items to be completed or corrected, prepared by the Contractor and verified and amended by the Construction Engineer and the Owner is attached. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all work in accordance with the contract documents.

The Contractor will complete or correct the work on the list of items attached hereto within _____ days from the Date of Substantial Completion.

_____	_____	_____
CONTRACTOR	*BY*	*DATE*
_____	_____	_____
RESIDENT ENGINEER	*BY*	*DATE*
_____	_____	_____
OWNER	*BY*	*DATE*

pc: Design Engineer - Construction Engineer - Contractor - Owner -

Other _____

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

720 North Wilde • Gainesville, Florida 32601 • (904) 377-5621 / FAX (904) 377-3166
3910 Northdale Boulevard, Suite B-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 968-6186

CERTIFICATE OF GUARANTEE

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

DESCRIPTION OF WORK: _____

CONTRACT DOCUMENT REFERENCE: _____

The work under the Contract, except as expressly excluded, and all of its subcontracts, severally and collectively, whether herein stipulated in each case or not, shall be guaranteed against faulty workmanship and/or material as specified below from date of acceptance of the work. The provisions of the guarantee and/or guarantees shall be incumbent on all parties of the work, including the Contractor, each subcontractor, all material supply houses and all manufacturers whose products and/or equipment are incorporated into the facilities.

Neither the Certificate of Substantial Completion, Final Certificate of Payment, nor any provisions in the Contract Documents, nor partial or entire use or occupancy of the premises by the Owner shall constitute an acceptance of work, materials, or equipment not performed or installed in accordance with the Contract Documents, or relieve the Contractor or his Sureties of liability in respect to any warranties or responsibility for faulty materials or workmanship.

The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one (1) year from the date of Substantial Completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system resulting from such defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other work that may be necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Maintenance Bond shall remain in full force and effect through the guarantee period.

_____	_____	_____
CONTRACTOR	*BY*	*DATE*
_____	_____	_____
RESIDENT ENGINEER	*BY*	*DATE*
_____	_____	_____
OWNER	*BY*	*DATE*

pc: Design Engineer - Construction Engineer - Contractor - Owner -

Other _____

JONES, EDMUNDS & ASSOCIATES, INC.

CONSULTING ENGINEERS AND SCIENTISTS

730 North Waldo Road • Gainesville, Florida • (904) 377-5821 / FAX (904) 377-3166 3910 Northdale Boulevard, Suite B-208 • Tampa, Florida 33624 • (813) 960-3040 /FAX (813) 968-8186

LIST OF ITEMS TO BE COMPLETED OR CORRECTED - "PUNCH LIST"

DATE: _____ PAGE: 1 OF 3

PROJECT IDENTIFICATION: _____

OWNER: _____

DESIGN ENGINEER: _____

CONTRACTOR: _____

CONSTRUCTION ENGINEER: _____

DESCRIPTION OF WORK: _____

CONTRACT DOCUMENT REFERENCE: _____

_____

CONTRACTOR BY DATE

_____

RESIDENT ENGINEER BY DATE

_____

OWNER BY DATE

XC: DESIGN ENGINEER - CONSTRUCTION ENGINEER - CONTRACTOR - OWNER

OTHER: _____

24.

LIST OF ITEMS TO BE COMPLETED OR CORRECTED - "PUNCH LIST"

ITEM	DATE COMPLETED	CONFIRMED BY

LIST OF ITEMS TO BE COMPLETED OR CORRECTED - "PUNCH LIST"

ITEM	DATE COMPLETED	CONFIRMED BY

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

730 North Waldo • Gainesville, Florida 32601 • (904) 377-5821 / FAX (904) 377-3166
3010 Northdale Boulevard, Suite 8-208 • Tampa, Florida, 33624 • (813) 960-3040 / FAX (813) 968-4166

PROJECT CLOSEOUT REPORT (PCR)

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT IDENTIFICATION: _____

SUBSTANTIAL COMPLETION DATE: _____ CONTRACT COMPLETION DATE: _____

ITEM - DESCRIPTION	CONTRACT DOCUMENT REFERENCE	DATE REC'D	DATE REVIEWED BY	ACTION

Jones Edmunds & Associates, Inc.
CONSULTING ENGINEERS AND SCIENTISTS
JEA

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3910 Northdale Boulevard, Suite B-208 • Tampa, Florida 33624 • (813) 960-3040 / FAX (813) 968-6186

SHOP DRAWING/SUBMITTAL CONTROL FORM

PROJECT IDENTIFICATION: _____

PROJECT NUMBER: _____

OWNER/CLIENT: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT MANAGER: _____

CONTRACTOR INFORMATION

SUBMITTAL DATE: _____ SUBMITTAL NUMBER: _____ NO. OF COPIES SENT: _____

☐ ORIGINAL SUBMITTAL ☐ RESUBMITTAL ☐ SUPPLEMENT ☐ INFORMATION ONLY

NOTE: If other than original then include: Date of Original _____ Submittal No. of Original _____

A. SPECIFICATION SECTION AND SUB-SECTION NUMBER: _____

B. DESCRIPTION: _____

C. MANUFACTURED BY: _____

D. INSTALLATION BY: _____

E. CRITICAL DATE ☐ NO ☐ YES WHEN: _____

NOTE: Engineer shall receive at least 30 days for review (reference General Requirements of the Documents)

ENGINEER INFORMATION

NO. OF COPIES RECEIVED _____ NO. OF COPIES RETURNED _____

ACTIVITY	DATE	PERSON	COMMENT
RECEIVED			
TO REVIEWER			
TO ADMINISTRATOR			
RETURNED			

STATUS: ☐ NO EXCEPTIONS TAKEN ☐ MAKE CORRECTIONS AS NOTED ☐ AMEND AND RESUBMIT ☐ REJECTED SEE REMARKS

COMMENTS: _____

Jones Edmunds & Associates, Inc. JEA
CONSULTING ENGINEERS AND SCIENTISTS
730 North Waldo Road • Gainesville, Florida 32601 • (904) 377-5821 / FAX (904) 377-3166 3910 Northdale Boulevard, Suite B-208 • Tampa, Florida 33624 • (813) 960-3049 / FAX (813) 968-8166

ENGINEER'S CERTIFICATE OF FINAL COMPLETION

PROJECT IDENTIFICATION: _____

PROJECT NUMBER: _____

OWNER/CLIENT: _____ PROJECT MANAGER: _____

DESIGN A/E: _____ PROJECT MANAGER: _____

CONSTRUCTION A/E: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT MANAGER: _____

CONTRACT INFORMATION

AGREEMENT EXECUTED: _____ NOTICE TO PROCEED: _____

	ORIGINAL	REVISED
SUBSTANTIAL COMPLETION:		
FINAL COMPLETION:		
CONTRACT AMOUNT:		

ENGINEER'S AFFIDAVIT

Jones, Edmunds & Associates, Inc. (JEA), the Engineer hereby certifies that it has provided certain professional services as set forth in its agreement with _____ _____. Dated: _____

JEA further certifies that, based upon its observations and available data, the construction of the above referenced project is to the best of its knowledge and belief, acceptably complete in accordance with the intent of the Contract Documents, as revised and amended to reflect design changes, and the construction conditions, as recorded, subject to the provisions of the Standard General Conditions of the Construction Contract.

JEA has forwarded to the owner the contractor's final Application for Payment in accordance with the Standard General Conditions of the Construction Contract.

Engineer of Record	Manager of Construction Services
(Signature)	(Signature)
Date	Date

CONTRACTOR'S AFFIDAVIT OF CONTRACT COMPLETION

PROJECT:

CONTRACTOR:

CONTRACT FOR:

CONTRACT DATE:

CONTRACTOR'S AFFIDAVIT

I solemnly swear and affirm: That the work under the above named contract and all amendments thereto have been completed in accordance with the requirements of said contract; that all costs incurred for equipment, materials, labor, and services against the project have been paid; that no liens have been attached against the project; that no suits are pending by reason of work on the project under the contract; that all Workmen's Compensation claims are covered by Workmen's Compensation insurance as required by law; that all public liability claims are adequately covered by insurance, and that the Contractor shall save, protect, defend, indemnify, and hold the Owners harmless form and against any and all claims which arise as a direct or indirect result of any transaction, event or occurrence related to performance of the work contemplated under said contract.

CONTRACTOR:

_____ SEAL

Title: _____

Date: _____

STATE OF
COUNTY OF

Personally appeared before me this _____ day of _____ 199__
known (or made known) to me to be _____

_____
(Owner)(Partner)(Corporate Officer - Title)

Contractor(s), who, being by me duly sworn, subscribed to the foregoing affidavit in my presence.

_____
(Notary Public)
(type name):

My Commission Expires _____